Public Works

Hillsborough County Florida

Stormwater Management Technical Manual

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HILLSBOROUGH COUNTY

STORMWATER MANAGEMENT TECHNICAL MANUAL

APPROVED

APPROVED: Michael J. Williams

Digitally signed by Michael J. Williams
Date: 2026.11.06 12:11:16 -05'00'

Michael Williams, PE
County Engineer

Date

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Effective Date

PREFACE

The Hillsborough County Stormwater Management Technical Manual (Manual) contains current information for designing and submitting construction plans for all proposed stormwater management facilities (SMF) and stormwater conveyance systems in unincorporated Hillsborough County (County). This manual is a compilation of existing regulations, policy statements, and engineering requirements. The manual facilitates the planning and design of projects in accordance with County standards and requirements.

This manual includes design criteria that applicants must follow when submitting plans for approval by the County. This Manual clearly distinguishes required design criteria and standards from recommended or suggested procedures.

The County will revise and update this Manual as technical criteria and County polices change to meet new needs and evolving technology. The County's procedure for making revisions includes issuing technical bulletins, approving public comments, and updating the manual during the bi-annual update cycle in odd-numbered years. The County requests that users submit manual feedback using the online "Comment on Public Utilities/Public Works Technical Publications" form on the County's website.

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Section 1.0 INTRODUCTION

The County requires all projects to comply with this Manual, the Land Development Code (LDC), applicable County and State regulations, and additional County design manuals related to stormwater design and maintenance (See Section 1.7). The County has adopted this Manual by reference in its Ordinances and LDC for the following locations:

- County Ordinances
  - Part A, Chapter 24, Article IV
- County Land Development Code
  - Article II
  - Part 3.06, 5.01, 5.02, 6.02, 6.03, 6.06, 8.01, 8.02…
- Environmental Protection Commission of Hillsborough County (EPCHC)
  - Chapter 1-5 Water Quality Standards
  - Chapter 1-11 Wetlands

This Manual provides standards and design criteria that supplement the limited scope of the County Ordinances and LDC sections listed above. Together, County law and this Manual enable the effective design of SMF's and stormwater conveyance systems for all County projects.

1.1 PURPOSE

This Manual guides users in designing all stormwater components for County projects. It aligns with the requirements of the Hillsborough County Capital Improvement Program (CIP) and the One Water Element of the County's Comprehensive Plan. This Manual incorporates the latest regulations and criteria applicable to SMF and stormwater conveyance system designs in Hillsborough County. Hillsborough County uses this Manual for permitting, study, review and design purposes.

1.2 OBJECTIVES

This Manual establishes design criteria to enable users to accomplish the following objectives:

- Protect human life, health and welfare.
- Minimize private and public property damage resulting from erosion, sedimentation, changes in seepage slopes (i.e. phreatic surfaces) and flooding in and adjacent to proposed stormwater management systems.
- Provide a technically efficient and cost-effective design for all SMF and stormwater conveyance systems.
- Maintain or improve groundwater, stormwater runoff, and receiving waterbody quantity and quality characteristics.
- Maintain or reduce water quantity discharges at project outfall locations.
- Maintain historical drainage patterns.

1.3 ORGANIZATION OF THE MANUAL

This Manual provides criteria, recommended methodologies, design procedures, tables, and graphs, to guide users. The Manual organizes this information as follows:

- Relationship Between County Ordinances, Regulations and Policies (Section 1.0 & Section 2.0)
- Review, Stormwater Criteria and Standards for Design (Section 3.0 thru Section 13.0)
- Design Procedures & Design Aids (Appendix A thru Appendix F)

1.4 ROLE OF HILLSBOROUGH COUNTY IN STORMWATER MANAGEMENT

Hillsborough County maintains and updates the Hillsborough County Comprehensive Plan document. The Hillsborough County Watershed Management Master Plans (WMMP) studies simulate the response of the county's drainage conveyance system to rainfall from various storm events. The National Pollutant Discharge Elimination System (NPDES) permit partially governs the operation and maintenance activities for all County SMF and stormwater conveyance system designs assets. County staff implements the aforementioned initiatives as follows:

1.4.1 Review of Permits and Rezonings: Staff reviews all permit applications and rezonings to ensure that all County criteria related to SMF and stormwater conveyance system designs are met and adjacent properties are not adversely impacted. The EPCHC regulates wetland protection and environmental concerns.

1.4.2 Overseeing County Flood Damage Control Ordinance

a) Staff reviews all proposed developments and rezonings to ensure compliance with Federal Emergency Management Agency (FEMA) requirements related to flood zones. The County requires applicants to file Flood Insurance Rate Map amendments as part of the design process when a proposed design alters an existing flood zone designation. County staff also assists the public in determining the proper flood zone designation for residential properties.

b) County staff will inform the applicant whether a 100-year flood elevation exists for a specific site. If no such elevation exists and the property lies within Flood Zone A, the applicant must determine and propose an acceptable 100-year flood elevation.

1.4.3 Development, Review and Inspection of Plans, Designs and Construction for Public SMF and stormwater conveyance systems:

a) County Staff evaluates larger projects during the preliminary design, final design, and construction phases to ensure compliance with stormwater design requirements.

b) County staff also reviews smaller projects and all roadway projects for SMF and stormwater conveyance systems design compliance.

c) All design calculations, design reports, and construction plans must be signed and sealed by the appropriate Florida licensed Professional Engineer (P.E.) responsible for the work within their respective disciplines.

1.4.4 Citizen Reported Stormwater Management Problems

a) Hillsborough County evaluates citizen-reported stormwater management problems and recommends corrective actions.

b) Citizens can report stormwater pollution and management problems directly to the County through the online reporting system.

1.4.5 Impacts of Mining, Land Excavation and Landfill Activities

a) Mining, land excavations and landfill activities must have adequate SMF and stormwater conveyance system design.

b) County staff evaluates land excavation applications and conducts site inspections to confirm compliance with SMF and stormwater conveyance system design and plans.

1.4.6 Implementation of a Ditch Maintenance Program: The Hillsborough County Transportation Maintenance Division's Service Units must clear County-maintained ditches to protect the public right-of-way from flooding. The Florida Department of Environmental Protection (FDEP), the EPCHC, and the Southwest Florida Water Management District (SWFWMD) are agencies that may require permits for these ditch maintenance activities.

1.4.7 Scheduling of Future CIP Projects: The County provides information on future CIP projects, including stormwater-related improvements, can be found on the County's website.

1.4.8 Data Collection: The County regularly utilizes data from federal, state, and local government agencies to help facilitate stormwater analysis initiatives. County staff acquires this information as needed to develop the most accurate and representative design documentation.

1.4.9 Existing Baseline Information: County staff provides watershed data, including water quantity and water quality designations related to stormwater management. This information is available for download through the County's File Transfer Protocol site.

1.4.10 Interagency Regulation:

a) Both private and public stormwater management activities must comply with a variety of regulations and permitting requirements beyond the County's criteria. Federal, state, and local jurisdiction agencies specify stormwater management design criteria, which may differ from Hillsborough County requirements.

b) If a conflict exists between the requirements of this Manual and those of other regulatory agencies, the most restrictive requirements must apply.

c) Applicants must obtain all appropriate permits or approvals from the necessary agencies before beginning construction on a site.

d) Applicants must submit a Notice of Intent (NOI) to the FDEP for stormwater runoff associated with construction activity involving one acre or greater of land disturbance per the NPDES Construction Generic Permit (CGP). FDEP requires stormwater pollution prevention measures, possible monitoring activities, and inspections. Applicants must prepare a stormwater pollution prevention plan (SWPPP) for all required sites, including proposed erosion control measures and other best management practices (BMPs). See Section 13.0 of this Manual for more information.

1.4.11 Warning and Disclaimer of Liability: The regulations presented in this Manual provide a reasonable level of flood protection based on sound and accepted engineering practices. Flooding may occur or flood heights may be increased, due to man-made or natural causes. This Manual does not guarantee that areas or properties designed and constructed according to these regulations will be free from flooding or flood damages. Hillsborough County, its officers, and employees are not liable for any flood damages that result from reliance on this Manual or any lawfully made administrative decision. The Engineer of Record (EOR) is responsible for any adverse impacts that result from their design.

1.4.12 Violation and Enforcement: If any land is being used or proposed for use in violation of this Manual, in addition to other remedies provided by law, institute injunction, abatement, or any appropriate action to prevent, enjoin, or abate unlawful use. If the County staff finds that any provision of this Manual, the Hillsborough County LDC or related ordinances has been violated, they will suspend or hold in abeyance all development and building permits issued to the violator or for the site in violation. The County may withhold permits for the violator or for development on the site until the violation is corrected to their satisfaction. They may also present their findings to the State Board of Professional Regulation and/or to the Hillsborough County Code Enforcement Board.

1.4.13 Abandonment & Alteration of Stormwater Management Facilities

a) Stormwater management facilities cannot be abandoned or reduced in capacity, unless a facility is appropriately permitted or formally approved by the County for such a modification. Proper maintenance (including pertinent activities identified in Section 13.0 of this Manual) of any and all stormwater management facilities must be continuously provided by the facility owner. Any intentional or unintentional reduction in attenuation capacity, increase in discharge capacity, or reduction in treatment capacity of a constructed SMF violates this Manual.

b) Any alterations to the design of a permitted SMF requires an Environmental Resource Permit (ERP) modification.

1.5 STATEWIDE ENVIRONMENTAL RESOURCE PERMITTING

Hillsborough County requires that all development and re-development projects comply with the State of Florida's Environmental Resource Permitting Rules per Chapter 62-330, Florida Administrative Code (F.A.C.), which the SWFWMD, an ancillary of the FDEP, enforces locally.

In June 2024, the Statewide Stormwater Rule updated the water quality performance criteria for SMF systems, replacing the previous "presumptive" with a pollutant loading analysis. This criteria is established by Chapter 62-330, F.A.C., and available for review on the FDEP's website.

1.6 DESIGN EXCEPTIONS AND DESIGN DEVIATION MEMORANDUMS

If a proposed design conflicts with any criteria in this Manual, the user must refer to Section 1.3.5 of the Hillsborough County Transportation Design Manual (HCTDM) for guidance on preparing a Design Exceptions or Design Deviation Memorandum (DDM). The County Engineer holds final approval for all Design Exceptions and Design Deviation Memorandums, as well as the final interpretation of any criteria in this Manual.

1.7 REFERENCES

This Manual supplements and/or substitutes existing engineering standards, requirements, and guidelines in the following engineering manuals:

- Florida Department of Transportation (FDOT) Drainage Manual
- FDOT Drainage Design Guide (DDG)
- FDOT Design Manual (FDM)
- SWFWMD Handbooks Vol. I & II
- FDOT Standard Specifications for Road and Bridge Construction (Specifications)
- FDOT Standard Plans for Road Construction (Standard Plans)
- FDOT Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (also referred to as Florida Greenbook)
- Federal Highway Administration (FHWA) Hydraulic Design Series No. 5 (HDS-5), Hydraulic Design of Highway Culverts

County Public Work manuals that interface with stormwater design include the following engineering manuals:

- Hillsborough County Transportation Design Manual (HCTDM)
- Hillsborough County Transportation Technical Manual for Subdivision and Site Development Projects (TTM)
- Hillsborough County Green Infrastructure Manual

County regulations and policies related to stormwater design include the following codes and orders:

- Hillsborough County Land Development Code
- Hillsborough County Ordinance
- Building and Construction Code
- Hillsborough County Comprehensive Plan
- Hillsborough County Development Review Procedures Manual
- Rules of Environmental Protection Commission of Hillsborough County

Note: All manual references assume latest edition.

Section 2.0 COUNTY REGULATIONS AND POLICIES RELATED TO STORMWATER MANAGEMENT

This section briefly describes prominent County regulations and policies related to stormwater. Users should refer to the specific regulation or policy to obtain further information and verify the latest requirements.

2.1 SUBDIVISION REGULATIONS (LDC, SECTIONS 5.01.00 AND 6.02.00)

The purpose of the LDC's Subdivision Regulations regarding stormwater, is to establish procedures and standards that ensure subdivision development and design consider environmental flooding factors. The standards and design criteria in this Manual are supplement the limited criteria listed in these LDC sections.

2.2 NATURAL RESOURCES AND LANDSCAPING REGULATIONS (LDC, SECTIONS 4.01.00 AND 6.06.00)

The LDC regulates land alteration by establishing standards and guidelines to protect soil and water resources, maintain surface water flow patterns, and preserve environmentally sensitive areas. Landscaping requirements include specific provisions for land use compatibility and stormwater detention and retention ponds.

2.3 FLOOD DAMAGE CONTROL REGULATIONS (LDC, SECTION 3.06.00)

The purpose of the LDC's Flood Damage Control Regulations is to establish minimum requirements that protect the public from development in flood hazard areas. These regulations apply to all developments located wholly within or partially within a flood hazard area, including subdivision of land, filling, grading, and other site improvements. The ordinance restricts or prohibits property uses that could cause excessive water accumulation or erosion, increase flood heights or velocities, flood adjacent properties, or alter natural floodplains and floodways.

2.4 LAND EXCAVATION REGULATIONS (LDC, SECTION 8.01.00)

The County requires land excavation permits. County staff evaluates stormwater-related excavation activities to address dewatering impacts on adjacent areas and to protect environmentally sensitive lands.

2.5 SITE DEVELOPMENT REGULATIONS (LDC, SECTIONS 5.02.00 AND 6.03.00)

County staff must review and approve proposed SMFs and stormwater conveyance system designs for projects that are not otherwise subject to the Hillsborough County Subdivision Regulations. The criteria in this Manual is supplement the criteria and standards in the Site Development Regulations.

2.6 ZONING CODE (LDC, ARTICLE II)

The LDC's Zoning Code governs all buildings, structures, lands and waters within unincorporated Hillsborough County. Although the Zoning Code does not directly address stormwater, temporary uses, occupancies, or activities that could cause adverse impacts require permit that include appropriate stormwater management measures. In addition, stormwater design criteria may become an issue within Planned Development Districts.

2.7 PHOSPHATE MINING REGULATIONS (LDC, 8.02.00)

This section of the LDC regulates activities associated with phosphate mining and processing to ensure that resource development complies with County requirements. The LDC establishes stormwater design criteria for phosphate mining within the County's Phosphate Mining Operating Permit application. Applicants must submit supporting documentation, including stormwater design calculations, with their applicant's Mining and Reclamation permit application as required by this section of the LDC.

2.8 BUILDING AND CONSTRUCTION CODE

The Building Code does not directly regulate stormwater design, except for requirements regarding "finished floor" elevations (FFE) in FEMA flood zones and for adjacent roadways.

2.9 FUTURE OF HILLSBOROUGH, COMPREHENSIVE PLAN – FUTURE LAND USE ELEMENT

The County's Comprehensive Plan guides future land development. The plan's policies address growth issues and inform planning and development in unincorporated Hillsborough County. The Future Land Use Element defines water bodies and environmentally sensitive areas and uses this information to determine land use densities.

2.10 FUTURE OF HILLSBOROUGH, COMPREHENSIVE PLAN – STORMWATER MANAGEMENT ELEMENT

This section of the County's Comprehensive Plan analyzes hydrologic changes caused by stormwater management activities, evaluates stormwater quantity and quality control strategies, identifies flooding problems, and assesses the cost of stormwater management facilities to both public and private sectors.

2.11 RULES OF THE ENVIRONMENTAL PROTECTION COMMISSION OF HILLSBOROUGH COUNTY – WATER POLLUTION (CHAPTER 1-5)

The EPCHC establishes water quality criteria for various fresh and saltwater activities and uses. The agency also sets minimum standards for earthen dams. According to these standards, "drainage facilities must be provided to maintain the water level on the outside of the dam within design limitations."

2.12 RULES OF THE ENVIRONMENTAL PROTECTION COMMISSION OF HILLSBOROUGH COUNTY – WETLANDS (CHAPTER 1-11)

The EPCHC regulates County policy for wetland identification, delineation and mitigation. EPCHC's review of proposed development within wetlands address surface water considerations. Wetlands provide value by receiving, storing and discharging surface water runoff, thereby contributing to the hydrological stability of water courses, lakes, or bays; control flooding and erosion; and enhancing water quality.

2.13 HILLSBOROUGH COUNTY STORMWATER QUALITY MANAGEMENT ORDINANCE

This Ordinance grants the County authority to regulate point discharges to all receiving water in Hillsborough County. The Environmental Protection Agency (EPA) requires the County to establish legal authority to regulate illicit discharges to the Municipal Separate Storm Sewer Systems (MS4s) under the NPDES Stormwater Program.

Section 3.0 BASIS OF REVIEW

3.1 GENERAL

3.1.1 Projects must meet applicable design criteria identified in the following sections to receive County approval of a project's stormwater management design. Other regulatory agencies may impose additional permitting requirements and design criteria that Engineers must incorporate into their SMF and stormwater conveyance system designs.

3.1.2 This section guides users to specific sections of this Manual that address treatment, attenuation, and floodplain criteria. This chapter does not provide a comprehensive overview of all sections that may apply to a given project. Users should review the entire Manual to better understand its contents and determine which sections apply based on project scope.

3.1.3 Projects must limit post-development stormwater runoff rates, so they do not exceed pre-development runoff rate for the design storm event while also meeting applicable statewide water quality and quantity standards.

3.1.4 The County must approve a master plan before phased development begins. Users must use the SMF and stormwater conveyance system design parameters established in the approved master plan for future phase submittals. Each phase must include an adequate SMF design that addresses floodplain, treatment and attenuation criteria for the subject site.

3.2 ARTERIAL, COLLECTOR AND LOCAL ROADS

3.2.1 All projects involving roadway components must adhere to the roadway drainage criteria specified in this Manual. The County references FDOT drainage criteria in developing its standards and provides explicit citations to pertinent documents and locations throughout this Manual.

- For roadway projects that necessitate stormwater management facility and floodplain design, see Section 5.0 of this Manual.
- For roadway culvert, bridge design, and storm sewer criteria, see Section 8.0 and Section 9.0.
- For roadway underdrain design criteria, see Section 10.0.
- For roadside conveyance design criteria (open and closed systems), see Section 12.0.

3.3 NEW DEVELOPMENT

3.3.1 New Development projects are subject to the design criteria found in Section 5.0 of this Manual.

3.4 REDEVELOPMENT

Redevelopment projects constitute all non-residential and non-agricultural redevelopment and expansions of existing non-residential and non-agricultural development. Redevelopment project types are subject to design criteria as detailed in Section 5.1.5 of this Manual.

3.4.1 Redevelopment projects with a cumulative alteration area $\leq$ 1,000 sq ft are exempt from the requirements of this Manual.

3.4.2 Redevelopment projects are further defined in this Manual as follows:

a) Major Redevelopment: projects meeting any of the following:

i. Alteration area > 5,000 sq ft; or

ii. For sites > 50,000 sq ft – alteration area > 10% of site; or

iii. Pervious area alteration > 50% of remaining pervious area.

b) Minor Redevelopment: projects meeting any of the following:

i. Alteration area $\leq$ 5,000 sq ft; or

ii. For sites > 50,000 sq ft – alteration area $\leq$ 10% of site; or

iii. Pervious area alteration $\leq$ 50% of remaining pervious area.

Section 4.0 STORMWATER MODELING REVIEW REQUIREMENTS

4.1 PURPOSE AND APPLICABILITY

4.1.1 This section establishes the minimum stormwater impact evaluation and modeling requirements for projects submitted to Public Works Department/Stormwater Modeling Team for review. These requirements apply to private development and redevelopment projects and to County-sponsored projects, including CIP projects, regardless of whether the engineering analysis is prepared by County staff, a consultant under contract to the County, or another authorized representative. These requirements also apply to revisions to County watershed models, proposed condition models, clipped model requests, alternative modeling software requests, County model questions, FEMA floodplain base flood elevation requests, and peak/volume-sensitive discharge capacity clarification requests.

4.1.2 The purpose of these requirements is to ensure that stormwater impact evaluations and submitted models are complete, reproducible, technically defensible, and suitable for evaluating potential upstream, downstream, onsite, offsite, floodplain, and regional drainage system impacts. Any project that alters, or has the potential to alter, the hydraulic or hydrologic characteristics of an area shall evaluate potential flood and drainage impacts in accordance with this section unless exempt from such evaluation under applicable Hillsborough County codes, ordinances, or other adopted criteria.

4.1.3 For County-sponsored projects, the responsible County project manager and EOR shall ensure that the project complies with the applicable requirements of this section. County ownership, funding, or designation as a CIP project does not, by itself, exempt a project from demonstrating that the proposed improvements will not cause adverse flood or drainage impacts.

4.1.4 Unless otherwise provided by Section 4.2 or an exception is approved by the Public Works Department/Stormwater Modeling Team in accordance with this section, stormwater modeling submitted for County review shall use the full, current County-approved HCSWMM5 watershed model applicable to the project location.

4.2 ALTERNATIVE IMPACT ANALYSIS FOR MINOR PROJECTS

4.2.1 For certain minor projects, the County may approve an alternative technical impact analysis in lieu of hydrologic and hydraulic (H&H) modeling when the nature and extent of the proposed improvements are such that potential adverse flood and drainage impacts can be adequately evaluated without modification and simulation of the County-approved watershed model.

4.2.2 Use of an alternative impact analysis does not exempt a project from demonstrating that the proposed improvements will not cause adverse upstream, downstream, onsite, offsite, floodplain, or regional drainage system impacts. The alternative analysis provides an alternative means of demonstrating compliance when the County determines that H&H modeling is not necessary to adequately evaluate potential project impacts.

4.2.3 Eligibility for an alternative impact analysis must be based on the hydraulic and hydrologic significance of the proposed improvements and must not be based solely on project cost, project ownership, construction area, or designation as a County CIP project. Examples of projects that may be suitable for consideration include in-kind repair or replacement of drainage infrastructure,

limited roadway, sidewalk, or utility improvements, localized grading, and similar work where drainage divides, storage, conveyance, discharge conditions, and hydraulic controls are not materially altered. Inclusion in these examples does not constitute approval of an alternative analysis methodology.

4.2.4 An alternative impact analysis may be considered when the EOR demonstrates, as applicable, that the proposed project:

a) Does not materially alter contributing drainage areas, watershed boundaries, drainage divides, or existing drainage patterns;

b) Does not create a new outfall or materially alter the location, direction, rate, volume, or timing of discharge to the receiving drainage system;

c) Does not materially reduce existing conveyance capacity or obstruct an existing drainage path, channel, ditch, culvert, floodplain conveyance area, or other hydraulic connection;

d) Does not materially reduce existing stormwater or floodplain storage unless equivalent or greater compensating storage is provided;

e) Does not materially modify a hydraulic control, tailwater condition, control structure, cross-drain, bridge, culvert, weir, stormwater management facility, or other feature that controls regional or offsite water levels or flows;

f) Is not expected to materially affect flood elevations, floodplain limits, floodplain storage, peak flows, discharge rates, tailwater conditions, or the timing of flows within the County drainage system; and

g) Is sufficiently limited in hydraulic and hydrologic effect that the absence of full watershed modeling will not prevent the County from determining whether the project will result in adverse impacts.

4.2.5 The EOR must submit sufficient documentation to demonstrate that an alternative impact analysis is appropriate. The documentation must include, as applicable:

a) A description of the proposed improvements and the limits of construction;

b) Existing and proposed drainage maps, construction plans, grading information, survey information, and other documentation necessary to identify changes in drainage patterns, elevations, storage, conveyance, and discharge conditions;

c) Identification of the receiving drainage system, applicable floodplain, and relevant upstream and downstream drainage features;

d) Quantitative calculations or other technical analyses necessary to compare existing and proposed conditions. Depending on the project, such analyses may include drainage-area comparisons, conveyance-capacity calculations, culvert or structure capacity calculations, stage-storage comparisons, floodplain storage calculations, discharge calculations, hydraulic grade evaluations, or other engineering analyses appropriate to the proposed improvements;

e) A comparison of existing and proposed conditions demonstrating that the project is not

expected to increase flood stages, adversely alter flows or drainage patterns, reduce required storage or conveyance, or otherwise cause adverse impacts;

f) Identification and justification of all assumptions used in the analysis; and

g) A signed and sealed conclusion by the EOR stating that, based on the information and analyses provided, the proposed project is not expected to cause adverse upstream, downstream, onsite, offsite, floodplain, or regional drainage system impacts.

4.2.6 Approval to rely on an alternative impact analysis must be obtained from the Public Works Department/Stormwater Modeling Team before the alternative analysis is used as the basis for the project no-adverse-impact determination. The County may require additional calculations, supporting information, limited modeling, or full H&H modeling if the alternative analysis does not provide sufficient information to evaluate potential impacts or if project conditions indicate that regional system interactions may be significant.

4.2.7 Approval of an alternative impact analysis for one project must not establish that the same methodology is appropriate for another project.

4.3 MODELING BASIS

4.3.1 When H&H modeling is required, stormwater models submitted to Hillsborough County for review must utilize the full, current County-approved watershed model in HCSWMM5 format applicable to the project location, unless an exception is approved by the County in accordance with Section 4.11.

4.3.2 The submitted model must maintain the complete upstream and downstream network contained in the County-approved watershed model to ensure that hydraulic and hydrologic interactions within the regional drainage system are properly represented. Use of the full watershed model preserves the dynamic behavior of the regional system, including upstream inflows, downstream backwater conditions, floodplain storage, attenuation, control structure operation, and interconnected drainage features that may influence project impacts.

4.3.3 Model modifications must be limited to those necessary to represent existing condition revisions, proposed project improvements, or other County-approved changes. Regional model parameters unrelated to the project must not be modified unless specifically authorized by the County.

4.3.4 The use of a clipped model or alternative modeling software must not be permitted unless approved in accordance with Section 4.11. The County retains sole discretion to determine whether a clipped model or alternative modeling approach is appropriate for a given project.

4.4 MODEL VERSION CONTROL

4.4.1 The EOR must obtain the latest County-approved HCSWMM5 model from the Public Works Department/Stormwater Modeling Team, or through Development Services Department/Development Review as applicable, before beginning stormwater modeling.

4.4.2 Models submitted for review must be based on the latest County-approved model version available at the time of submittal, unless otherwise approved by the County.

4.4.3 The submittal must identify the County model name, watershed or basin name, model version, date received, and all County-provided files used as the modeling basis.

4.4.4 If the County-approved model is updated after the project team begins modeling but before approval, the County may require the analysis to be updated using the revised model when the update may affect project review, flood stages, flows, tailwater conditions, floodplain limits, or discharge capacity determinations.

4.4.5 The EOR must document all changes made to the County-approved model, including hydrologic, hydraulic, boundary condition, storage, conveyance, control structure, land use, terrain, and floodplain revisions.

4.5 MODELING FRAMEWORK FOR PROJECT EVALUATION

Stormwater modeling used to evaluate project impacts must follow a consistent analytical framework so that comparisons between existing and proposed conditions are based on equivalent assumptions, boundary conditions, model extent, and modeling structure. Unless otherwise approved by the County, project evaluations shall use the following model sequence:

4.5.1 County-Approved Watershed Model / Baseline Model

a) The most current County-approved watershed model applicable to the project location shall serve as the baseline reference model.

4.5.2 Revised Existing Conditions Model (RECM), When Applicable

a) If updates are necessary to reflect current physical conditions or to correct documented errors or omissions relevant to the project area, a RECM must be developed in accordance with Section 4.6.

b) The RECM represents existing drainage system conditions immediately before implementation of the proposed project.

4.5.3 Proposed Conditions Model (PCM)

a) The PCM must be developed by modifying the RECM, or the County-approved baseline model if a RECM is not required, to incorporate the proposed project improvements.

b) Project modifications may include, but are not limited to, revised subcatchments, stormwater management facilities, conveyance systems, control structures, grading, storage areas, outfalls, tailwater conditions, and other infrastructure necessary to represent the proposed design.

c) Unless otherwise approved by the County, project impact evaluations must be based on direct comparison between the RECM and the PCM. If a RECM is not required, project impact evaluations must be based on direct comparison between the County-approved baseline model and the PCM.

d) The modeling framework must maintain consistency between scenarios, including:

i. Identical storm events and rainfall distributions;

ii. Boundary conditions;

iii. Regional watershed representation;

iv. Modeling parameters outside the approved project modification limits; and

v. Reporting locations for comparison of stages, flows, floodplain impacts, and discharge rates.

e) This approach ensures that modeled differences are attributable to the proposed project improvements or approved existing condition revisions and not to unrelated model changes.

4.6 REVISED EXISTING CONDITIONS MODEL

4.6.1 In certain cases, the County-approved watershed model may not fully represent current field conditions due to development, infrastructure modifications, drainage pattern changes, new survey information, as-built information, or identification of errors or omissions since the model was originally developed. When such conditions are present and are relevant to the project evaluation, the EOR may be required to develop a RECM.

4.6.2 A RECM updates the County-approved watershed model to reflect current physical drainage conditions before evaluating the proposed project. Revisions may include incorporation of infrastructure or watershed changes that have occurred since development of the County model, correction of documented modeling errors, or addition of drainage features that materially influence the hydraulic or hydrologic response of the system.

4.6.3 Examples of conditions that may warrant development of a RECM include:

a) Stormwater infrastructure constructed after the County watershed model was developed;

b) Changes in drainage patterns due to roadway, utility, or development projects;

c) New survey, as-built, GIS, terrain, or field information that materially affects model geometry, elevations, storage, or connectivity;

d) Identification of errors or omissions in the existing model that influence conditions within the project area; and

e) Missing or incorrectly represented storage areas, conveyance elements, boundary conditions, or hydraulic structures that materially affect system performance.

4.6.4 When preparing a RECM, the following requirements must apply:

a) The revisions must be limited to elements necessary to accurately represent existing conditions relevant to the project analysis.

b) All modifications to the County model must be clearly documented, including a description of the change, the reason for the revision, and supporting data.

c) The EOR must provide comparison tables of peak stages, peak flows, floodplain impacts, and discharge rates comparing the County-approved baseline model to the RECM.

d) The EOR must explain any differences between the County-approved baseline model results and the RECM results.

e) Supporting documentation must be provided as applicable, including signed and sealed survey, as-built plans, construction plans, GIS files, digital terrain data, field observations, calculations, photographs, and other information demonstrating that the revisions accurately represent current conditions.

f) If times of concentration are revised, the supporting calculation workbook must be provided.

g) If Curve Numbers or land use assumptions are revised, detailed calculations and supporting land use documentation must be provided.

h) If the model revision is based on land use changes or constructed improvements, the applicable as-built plans or other documentation must be provided in digital PDF format.

i) At a minimum, the 100-year/24-hour and 25-year/24-hour design storm events must be simulated. Additional storm events may be required by the County.

j) If calibration was performed, the calibration model input files, output files, observed data, calibration assumptions, and calibration results must be provided.

4.6.5 The County must review and determine the acceptability of the RECM before it is used to evaluate proposed project conditions. The EOR must include a signed and sealed model certification identifying the year and version of the watershed model used for the revised model. The County may require additional documentation or model modifications if the proposed revisions are determined to be inconsistent with observed conditions, available data, or regional drainage system behavior.

4.7 PROPOSED CONDITIONS MODEL

4.7.1 Except where an alternative impact analysis is approved in accordance with Section 4.2, a PCM must be submitted when H&H modeling is required to evaluate proposed development, redevelopment, infrastructure improvements, stormwater management facilities, drainage modifications, floodplain impacts, or other project-related changes.

4.7.2 The PCM must be based on the full, current County-approved HCSWMM5 model, or on an accepted RECM when applicable, unless a clipped model or alternative modeling software exception is approved by the County in accordance with Section 4.11.

4.7.3 At a minimum, the PCM must simulate the 100-year/24-hour and 25-year/24-hour design storm events. Additional storm events may be required by the County depending on project conditions, regulatory criteria, receiving system sensitivity, floodplain considerations, or potential upstream and downstream impacts.

4.7.4 The proposed conditions drainage report must summarize the proposed improvements, modeling methodology, assumptions, upstream and downstream impacts, floodplain impacts, tailwater assumptions, boundary conditions, discharge rates, peak stages, peak flows, and conclusions. The report shall identify any deviations from the County-approved model and provide technical justification for each deviation.

4.7.5 The PCM submittal must include signed and sealed construction plans and a signed and sealed drainage report in digital PDF format. The EOR must include a signed and sealed model certification identifying the year and version of the watershed model used for the drainage design and confirming whether peak flow and volume-sensitive data were evaluated and incorporated into the design process.

4.8 MODEL SUBMITTAL REQUIREMENTS

Stormwater model submittals must include sufficient documentation to allow the County to

reproduce, review, and verify the analysis. At a minimum, model submittals must include the following items, as applicable.

4.8.1 Technical Report

a) Signed and sealed stormwater modeling report in PDF format.

b) Description of the project, modeling purpose, modeling methodology, design storm events, rainfall distributions, boundary conditions, and modeling assumptions.

c) Identification of the County-approved watershed model used as the modeling basis, including model name, watershed or basin name, version, date received, and County-provided files.

d) Description of all model modifications made to represent revised existing conditions or proposed conditions.

e) Discussion of upstream impacts, downstream impacts, onsite impacts, offsite impacts, floodplain impacts, tailwater assumptions, boundary conditions, and deviations from the County-approved model.

f) Summary of results, conclusions, and confirmation that the analysis complies with applicable County stormwater management criteria.

g) A plan-view figure showing the model network and subcatchment delineations over current aerial imagery. All applicable model nodes, links, and subcatchments must be clearly identified and labeled.

h) Page numbers and clear section headings.

i) Signed and sealed model certification by the EOR identifying the watershed model year and version used in the drainage design and confirming whether peak flow and volume-sensitive data were evaluated and incorporated into the design process.

4.8.2 Native Model Files

a) Native model input files, including the HCSWMM5/SWMM .INP file and all supporting files required to run the model.

b) Model output files for each required design storm event.

c) All supporting data files used by the model.

d) Calibration model files, output files, and observed data, if calibration was performed.

e) For alternative modeling software, all native model files, supporting files, output files, model version information, and instructions necessary for the County to reproduce the analysis.

4.8.3 Summary Tables

The submittal must include summary tables comparing the County-approved baseline model, RECM if applicable, and PCM. Tables must include, as applicable:

a) Peak stages at key nodes and points of interest.

b) Peak flows at key links, outfalls, control structures, and points of interest.

c) Discharge rates at project outfalls and receiving system locations.

d) Floodplain impacts, including changes in floodplain elevation, extent, and storage where applicable.

e) Identification of nodes, links, structures, outfalls, or floodplain areas where increases occur.

f) Comparison of results for each required design storm event.

4.8.4 Supporting Calculations

The submittal must include supporting calculations used to develop the model, including as applicable:

a) Time of concentration calculations.

b) Curve Number calculations.

c) Basin and subbasin parameter tables.

d) Stage-storage tables.

e) Stage-discharge tables.

f) Tailwater calculations.

g) Control structure calculations.

h) Hydrologic and hydraulic calculations supporting model inputs.

4.8.5 Plans, Survey, GIS, and Terrain Data

The submittal must include supporting information necessary to verify model geometry, elevations, drainage patterns, and proposed improvements, including as applicable:

a) Signed and sealed construction plans.

b) Signed and sealed survey.

c) As-built plans.

d) Grading plans.

e) GIS files.

f) Digital terrain data, with TIN or DEM format preferred.

g) Model location map.

h) Drainage basin delineation map.

i) Schematic of model modifications.

4.8.6 GIS Data Requirements

When GIS files are required, the following data must be provided as applicable:

a) Revised basin delineations with attributes including, but not limited to, basin ID, area in acres, time of concentration, and Curve Number.

b) Revised stormwater junctions with attributes including, but not limited to, junction ID, invert elevation, initial condition, predicted 100-year/24-hour peak water level, and predicted 25-year/24-hour peak water level.

c) Revised stormwater conduits with attributes including, but not limited to, conduit ID, upstream junction, downstream junction, conduit type, size, upstream invert elevation, downstream invert elevation, length, Manning's roughness coefficient, predicted 100-year/24-hour peak flow, and predicted 25-year/24-hour peak flow.

d) Revised weirs with attributes including, but not limited to, weir ID, upstream junction, downstream junction, weir type, weir elevation, weir length, weir coefficient, predicted 100-year/24-hour peak flow, and predicted 25-year/24-hour peak flow.

e) Revised 100-year/24-hour floodplain delineation.

f) Revised digital topography.

Unless otherwise specified by the County, elevations must be reported in feet, NAVD 88, and flows shall be reported in cubic feet per second.

4.8.7 Model Change Log

The submittal must include a concise model change log identifying each modification from the County-approved model. The change log must include, at a minimum:

a) Model element ID.

b) Type of element revised.

c) Original value or condition.

d) Revised value or condition.

e) Reason for revision.

f) Supporting documentation or calculation reference.

g) Identification of whether the change applies to the RECM, PCM, or both.

The County may request additional model information as necessary to verify results and evaluate system impacts.

4.9 CLIPPED MODEL SUBMITTALS

4.9.1 Submittal of a clipped model may be permitted only where the EOR demonstrates that removal of portions of the regional watershed model will not reduce the dynamic representation of the system relevant to the project site.

4.9.2 A clipped model may be considered where:

a) The clipped model boundaries occur at hydraulic control points where upstream or downstream conditions are unaffected by the proposed project.

b) The removed portions of the model do not influence stage, flow, tailwater, floodplain, or storage conditions within the project reach.

c) Appropriate boundary conditions can be established without altering the hydraulic response of the system.

d) The clipped model retains sufficient upstream and downstream extent to capture backwater, attenuation, floodplain, and storage effects that may influence project conditions; and

e) The clipped model results can be compared to the full County-approved model at appropriate boundary and reporting locations.

4.9.3 Clipped model exception requests must include written justification, model boundary documentation, comparison of peak stages and flows to the full County-approved model where applicable, and sufficient input and output files for County review.

4.9.4 The clipped model must be in HCSWMM5 format unless alternative modeling software is specifically approved by the County. The County may require use of the full watershed model if it determines that the clipped model does not adequately represent regional system dynamics.

4.10 ALTERNATIVE MODELING SOFTWARE

4.10.1 Alternative hydrologic or hydraulic modeling software may be accepted on a case-by-case basis when the EOR demonstrates that:

a) The proposed software is more appropriate for the specific site conditions, such as situations involving complex hydraulic structures, detailed two-dimensional hydraulics, groundwater interactions, coastal or tidal boundary conditions, or other processes not adequately represented in the County watershed model framework;

b) The proposed software is actively supported and appropriate for the intended analysis;

c) The modeling approach provides results that can be reasonably compared with or integrated into the County watershed modeling framework; and

d) The model submittal includes sufficient files, documentation, assumptions, and results for the County to reproduce and review the analysis.

4.10.2 Approval to use alternative modeling software must be obtained in accordance with Section 4.11 before model development and submittal unless otherwise authorized by the County. If alternative software is approved, the submittal must comply with the applicable requirements of Section 4.8 and any additional requirements specified by the County.

4.11 EXCEPTIONS TO USE OF THE FULL COUNTY HCSWMM5 MODEL

4.11.1 This section applies to requests to use a clipped model, alternative modeling software, or both. Approval of an alternative impact analysis under Section 4.2 is a separate determination and is not an exception request under this section.

a) To initiate an exception request for a private development project, the EOR must submit a memorandum to DSD/Development Review justifying the use of a clipped model, alternative modeling software, or both. For County-sponsored projects, the exception request must be coordinated through the responsible County project manager with the Public Works Department/Stormwater Modeling Team.

b) DSD/Development Review will coordinate private development exception requests with the Public Works Department/Stormwater Modeling Team.

c) Characteristics that will be considered in the exception request review include, but are not limited to:

i. Site outflow conditions, including whether the site is free outfall or tailwater-dependent;

ii. Site inflows;

iii. Upstream and downstream hydraulic connectivity;

iv. Dynamic interconnectivity of offsite areas and flows;

v. Floodplain storage and conveyance interactions;

vi. Sensitivity of project results to boundary conditions;

vii. Proposed alternative modeling software and version;

viii. Ability to compare results to the full County-approved watershed model; and

ix. Availability of sufficient documentation for County review.

d) If an exception is granted, all applicable model submittal requirements of Section 4.8 must apply.

e) Approval of a clipped model or alternative software exception for one project must not establish approval for other projects.

f) The County may revoke or modify an exception approval if subsequent review indicates that the clipped model or alternative software does not adequately represent regional drainage conditions or project impacts.

4.12 COUNTY REVIEW AUTHORITY

4.12.1 The Public Works Department/Stormwater Modeling Team retains sole discretion to determine whether an alternative impact analysis, submitted model, clipped model, alternative modeling approach, RECM, PCM, or supporting documentation is acceptable for review and approval.

4.12.2 If the Public Works Department/Stormwater Modeling Team determines that the submitted analysis does not adequately represent regional drainage conditions, current field conditions, floodplain conditions, boundary conditions, or project impacts, the EOR must revise the analysis as directed. The Public Works Department/Stormwater Modeling Team may require additional calculations, limited modeling, use of the full County-approved watershed model, additional design storm simulations, revised model boundaries, additional supporting documentation, or correction of model assumptions, parameters, or geometry.

4.13 PROCEDURE

4.13.1 Private development stormwater modeling requests and alternative impact analysis requests must be submitted to the DSD/Development Review unless otherwise directed by the County. Development Services will coordinate review with the Public Works Department/Stormwater Modeling Team.

4.13.2 For County-sponsored projects, including CIP projects, stormwater impact evaluations, model reviews, alternative impact analysis requests, and modeling exceptions must be coordinated through the responsible County project manager or sponsoring County department with the Public Works Department/Stormwater Modeling Team. County consultants must provide the same technical documentation required by this section unless otherwise approved by the Public Works Department/Stormwater Modeling Team.

4.13.3 Submittals must clearly identify the request type, project name, parcel folio number or numbers

when applicable, project address or location, EOR, applicant or County project contact information, and the County watershed model used for the analysis when modeling is performed.

4.13.4 County Model Questions and FEMA Zone A Floodplain Base Flood Elevation Requests

a) Requests for County model information or FEMA Zone A floodplain base flood elevation information must include:

i. Parcel folio number(s), when applicable.

ii. Project name.

iii. Project address/location, including nearest street intersection if a specific address is not available.

iv. Description of the information being requested; and

v. Contact information for the applicant, EOR, or County project manager.

4.13.5 Peak/Volume-Sensitive Discharge Capacity Clarification Requests

a) Requests for clarification of peak-sensitive or volume-sensitive discharge capacity must include:

i. Parcel folio number(s), when applicable.

ii. Project name.

iii. Project address/location, including nearest street intersection if a specific address is not available.

iv. Description of the receiving system, proposed discharge location, and requested clarification; and

v. Contact information for the applicant, EOR, or County project manager.

The County may request additional supporting information as necessary to evaluate the request.

4.14 REVIEW PERIOD

4.14.1 The following review periods apply after the County determines that the submittal is complete and sufficient for review:

a) RECM: up to 20 working days.

b) PCM: up to 20 working days.

c) Resubmittal: up to 10 working days unless the original submittal is deemed insufficient.

d) Exception request: up to 10 working days.

4.14.2 Review periods for other request types, including alternative impact analysis requests, County model questions, FEMA floodplain base flood elevation requests, and peak/volume-sensitive discharge capacity clarification requests, will be established by the County based on the scope and complexity of the request unless otherwise specified.

4.14.3 The review periods listed above do not begin until the County determines that the submittal includes the files, documentation, and information necessary to perform the requested review. When a submittal includes multiple review components, the applicable review periods must run

sequentially and shall not run concurrently unless specifically authorized by the County in writing. Each subsequent review period must begin only after the County completes the preceding applicable review or determines that concurrent review is appropriate.

Section 5.0 STORMWATER DESIGN FOR RESIDENTIAL & COMMERCIAL SITE DEVELOPMENT

The County requires all residential and commercial projects to comply with the criteria within this section.

5.1 DEVELOPMENT REQUIREMENTS

5.1.1 Data and Documentation Requirements

a) The EOR must provide sufficient documentation to demonstrate compliance with this Manual. Additional or special documentation may be required based on project complexity or unique conditions.

b) Stormwater management systems designs must include water quality treatment that meets SWFWMD and other applicable agency requirements.

c) Site development construction plans must include provisions to control soil erosion and sedimentation during and after construction. Refer to Section 13.0.

d) Stormwater Management Plan Maps: The EOR includes a Master Stormwater Management Plan Map with the construction plan submittal that shows all existing and proposed land features and uses an appropriate scale to adequately represent the information on the map; prepares a Stormwater Management System Design Report as the technical backup for the Master Stormwater Management Plan; and includes the required Stormwater Management System Design Report or on the Master Stormwater Management Plan:

i. Plans in conformance with Chapter 4 of the Hillsborough County Development Review Procedures Manual (DRPM).

ii. Vicinity sketch and legal description.

iii. Basin Map, including all onsite and offsite areas contributing to the site, and the breakdown of the subarea(s) contributing to each inlet in the internal stormwater collection system.

iv. Topographic Site Data showing existing contours and spot elevations based on NAVD88. Contours must be shown at minimum one-foot intervals to at least 25 feet outside the project boundaries. The plans must reference the survey benchmark and provide a local conversion value if the vertical datum is not provided in NAVD88.

v. Flow paths that determine the basin and sub-basin times-of-concentration.

vi. Engineer shows existing stormwater management system features (ditches, ponds, etc.) within and downstream of the proposed development; investigates drainage patterns and stormwater management facilities within at least 1,000 feet of the site or to a point where capacity conditions can be determined, whichever distance is greater. Descriptions of capacity conditions are provided in Sections 5.3.2 through 5.3.4.

vii. Notes pertaining to standing water, springs, areas of seepage or seepage slopes and sources of highwater data.

viii. Proposed development layout with vertical controls, uses NAVD 88 as the vertical datum unless the County approves an alternative, and includes the topographic datum and an appropriate conversion equation on the grading plan sheets.

ix. Proposed stormwater management system features including, but not limited to, the locations of inlets, swales, ponds, conveyance systems, easements, etc.

x. General soil characteristics obtained from the Hillsborough County Soil Survey (Natural Resources Conservation Service (NRCS)) and existing land uses/ground cover.

xi. Flood zone designation determined from the FIRM. Elevations of the flood zone along with the Flood Hazard boundary must be delineated on the Master Stormwater Management Plan and on all Grading and Drainage Plans.

xii. For Master Stormwater Management Plans, drawings must provide sufficient information and references for use with future phases of the masterplan development.

1) For projects that are part of a masterplan development, the EOR provides related drainage information for both the proposed project and the existing master stormwater management plan to demonstrate compliance with the Stormwater Management Technical Manual. This information includes a drawing of the proposed drainage basins; proposed drainage calculations for design values for C or CN (signed and sealed by the EOR); and sufficient information from the master stormwater management plan (excerpts from the approved calculations for post-development C or CN, list of the included drainage basins with approved elevations for the design high water (DHW) and freeboard).

2) For phased projects, the EOR updates the Master Stormwater Management Plan Map and the Stormwater Management System Design Report when revisions occur. The Engineer submits the updated documents concurrently with the proposed phase construction plans and other supporting reports or data before processing or project review of the revised and future phases commences or continues, as deemed appropriate by County staff.

3) When revisions are not necessary, the Engineer provides the previously approved Master Stormwater Management Plan Map for all future phases.

4) For projects that are part of a masterplan development, the EOR must certify that the drainage design remains within the previously approved limits and that existing infrastructure conforms to the previously approved construction plans. The certification must include a summary of the related previously approved and proposed stages and rates of discharge for future phases for comparison and identifies the datum to which all elevations refer to.

e) Stormwater Management System Design Calculations

i. The EOR submits stormwater design calculations in a bound report that contains all hydrologic-hydraulic calculations and assumptions used to design the proposed development. These include stage-storage data, stage-discharge data (if applicable), inflow hydrographs, outflow hydrographs, assumed design tailwater

conditions, etc. A soils report must be included as an attachment. The stormwater management system design report must be signed and sealed by a Florida licensed Drainage P.E. When a separate geotechnical report is provided with the stormwater design calculations, it must be signed and sealed by a Florida licensed Geotechnical P.E.

ii. For ponds located above adjacent properties, a build-out groundwater table analysis using generally accepted methodology is required. This analysis demonstrates that design storms up to and including a 100-year storm do not adversely impact downgradient properties. An exemption may be made for detention ponds that are adjacent to an open conveyance system or sufficiently far from other private properties. The County requires certification from a geotechnical engineer or the EOR that there will be no adverse impacts for the exemption. The County reviewer may require the build-out groundwater table analysis if there is any doubt regarding the potential to impact offsite properties.

iii. Computer Programs: All reports containing computer generated information must include input and output data. When computerized flood routing techniques are utilized, input data must include: basin areas, curve numbers, rational coefficients, inflow hydrographs, NRCS peak rate factor, time of concentration values, rainfall distribution data, stage/storage information, etc. Retention pond recovery must be demonstrated through the use of a computer model. Any calculation generated by a program not recognized by Hillsborough County may be checked by accepted programs. The EOR is responsible for clarifying any discrepancies between programs. Input and output data must also be provided on appropriate computer disks, if requested by the County.

f) As-Builts

i. The following must be submitted to the Development Services Department (DSD) upon completion of work:

ii. PDF of the "As-Built" plans or record drawings, signed and sealed by a Florida licensed P.E.

iii. Digital drawing files (CAD) of the as-builts.

iv. Video tape of the internal features of the entire storm sewer system.

g) Flow Generation: The County requires the Rational Method or the NRCS Soil Conservation Service (SCS) Method to be used for sites greater than 5 acres in size. For sites that are 5 acres or less, use the Rational Method, otherwise see Section 1.6 of this Manual. Additional information and background on the Rational Method can be found in Appendix A.

5.1.2 Grading and Construction Requirements

a) The applicant must account for any County CIPs that the proposed site improvements may affect. If design conflicts occur, the CIP design constraints take precedence. The design must not rely on or hinder any County CIP improvements unless the County constructs the CIP before or concurrently with the proposed site.

b) General Grading and Excavation Requirements

i. Indiscriminate development can alter established drainage patterns and create

flooding conditions where none previously existed. The County LDC requires the appropriate permit for any action that changes the existing or natural contours of a site, except where exemptions apply.

ii. Sites must be graded so that post-development runoff from onsite to offsite areas does not exceed pre-development runoff rates. See Sec. 4.01.03 of the County LDC for exemptions. See Section 1.3.5 of the HCTDM for the deviation process

iii. Fill placed at right-of-way line must not exceed a maximum side slope of one foot vertical to two feet horizontal.

iv. Erosion Control: All sites must include an erosion control plan. Refer to Section 13.0. The plans must remain in effect until permanent vegetation is established.

c) Drainage Patterns Not to be Changed to the Detriment of Neighboring Properties

i. Regardless of any permitting to the contrary, no act of stockpiling material, grading, excavating, and other act(s) may affect drainage or change the surface drainage patterns to the detriment of neighboring properties or public rights-of-way.

ii. By common law, an upstream property owner has an easement over lands of a lower owner for surface waters to flow or escape from his land by natural ways and routes. An upper property owner may not, without liability, change the point of discharge of surface waters, nor concentrate them in ditches, nor divert in one direction waters which would have escaped in another direction, nor discharge them at a higher velocity, nor add to their pollution and cause a downstream property adverse impact. Likewise, the lower owner may not, without liability, obstruct natural flow of surface waters onto his land, either by excluding it or causing backwater on his neighbor. These criteria also apply to changes in seepage slope and/or phreatic surface conditions. In disputes between private property owners, it is the right of the injured private party to seek an injunction because of a private nuisance created when the drainage was altered.

d) Special Requirements for Designated Drainage Basins: Throughout unincorporated Hillsborough County, certain drainage basins have special stormwater management requirements based on County Stormwater Management Master Plans, improvement projects, or special studies. The County can provide information on whether a site lies within a designated drainage basin. If a site is within such a basin, the County may issue special stormwater management considerations upon request.

e) FFE Requirements: The Hillsborough County Construction Code specifies the criteria for the minimum FFE. FFE must be at or above the applicable FEMA or County-adopted 100-year flood elevation plus the applicable freeboard height.

f) Functional Stormwater System During Construction: During all phases of construction, the EOR controls stormwater entering, leaving, or flowing through the construction site in a manner consistent with the approved stormwater management plan and ensures that drainage of adjacent properties is not adversely affected.

g) Permits for Work in Public Rights-of-Way: Right-of-Way Use permits are required for all work proposed with the County limits of rights-of-way. Specific guidance can be found in the County's Utilities Accommodation Guide and Rights-of-Way Use Procedures Manual.

h) Protection of County Stormwater Management Systems

i. Structures in Drainage Easements: The County's LDC prohibits permanent structures within drainage easements.

ii. Ditch Relocation: If an existing County ditch conveys stormwater runoff from public rights-of-way, crosses private property, and then discharges to a receiving body or other public system, the County requires any proposed onsite relocation or alteration of the ditch to use appropriately sized pipes or ditches for the full length of the relocation or alteration. The County staff must also review and approve the proposed relocation or alteration and require dedication of an appropriately sized drainage easement. See Section 5.1.4 for ditch easement requirements.

i) Natural Depressed Areas

i. Natural depressed areas (i.e. viable wetlands, habitat diversity systems, centralized preservation areas, environmentally sensitive areas) located entirely within the project boundaries may be used for detention purposes when not adversely affecting offsite water levels.

ii. The storage above the seasonal high water level in natural depressed areas must be considered in the determination of predevelopment flows.

j) French Drain Standards: Underground French Drains employing filter gravel or rock bed and perforated pipe must be designed according to the following general design criteria:

i. Thirty percent of the rock bed measured from the bottom of the rock to the DHW elevation may be used for storage.

ii. Forty percent of an expanded shale rock bed may be used for storage as above provided appropriate test documentation is provided by a reputable test lab.

iii. The entire inside pipe area must be allowed for storage if the crown is below the DHW.

iv. The entire outer perimeter (including a 12-inch minimum overlap) of the rock bed must be encased with a suitable membrane filter material in order to prevent silting of the voids in the rock bed. No filter membrane must be used to encase the exfiltration pipe (i.e., no filter "sock" will be permitted around the pipe).

v. The discharge of the required volume by percolation through the french drains or other means must be completed in a maximum of 72 hours after the end of the storm event.

vi. Design high water elevation must be established in consideration of adjacent properties and facilities, but normally one foot below the ground surface adjacent to the facility. If necessary, a minimum of one-half foot at the basin may be combined with the remaining half-foot elsewhere on the property for sites with positive outfalls.

vii. Inlets must be sumped open bottom design (to a depth of four-feet below pipe inverts, where feasible) to trap sediment before it can enter the french drain.

viii. The distance between the trench bottom and the seasonal high groundwater table must be at least one foot.

ix. Aggregate for exfiltration trench must comply with current FDOT Standard Specifications for Road and Bridge Construction for coarse aggregate size number 5 (one to 1/2 inch), and excludes limestone, dolomites, and sandstones.

5.1.3 Maintenance Requirements

a) Maintenance of Private Drainage Facilities

i. Any portion of a drainage system, including onsite and offsite facilities located within easements or rights-of-way, that serves a specific development must be continuously maintained by the owner(s) or an entity identified by the EOR, such as a homeowner's association, unless the County officially accepts the facility for maintenance through dedication.

ii. When debris or sediment accumulates in a manner that interferes with free flow or the proper functioning of stormwater management facilities, the County requires the owner of such properties to remove the debris or obstruction so the stormwater management system functions effectively.

iii. After providing notice and making reasonable efforts to have the property owner remove the debris or obstruction, the County may authorize its forces to enter the drainage way and remove the debris or obstructions. The County may charge the cost of this work to the property owner who generated the debris or obstruction.

b) Maintenance for Retention/Detention Ponds, Vaults and Drain Fields

i. The maintenance of any privately owned stormwater management system included as part of an approved site plan must be the responsibility of the owner. This includes, but is not limited to, any scarifying or sediment removal in percolation ponds which is necessary to continue the design infiltration rates and storage volume. Every project must provide a plan which must include:

1) Maintenance of the bottom and sides of the retention pond to preclude silting up of the pond which would reduce its capacity or reduce the rate of percolation, and to prevent the pond from becoming a nuisance. Ponds with vegetation plans, landscaped littoral shelves or vines on fences must incorporate a maintenance element.

2) Maintenance of the interior of the stormwater vault or drain field to preclude reducing its capacity or the rate of percolation, and to prevent the facility from becoming a nuisance.

3) The property owner or their appointed designee must be responsible for the maintenance of the stormwater management system within the limits of their property.

4) The practice of burying construction debris or any other unsuitable material within the limits of any pond area is strictly prohibited.

5.1.4 Easement Requirements

a) Engineers must grant drainage easements to Hillsborough County for all stormwater management facilities that the County will maintain. The County may require offsite drainage easements when it cannot reasonably perform minimum maintenance activities for roads or stormwater management facilities dedicated to the County without such easements. Hillsborough County will not accept the dedication of easements that are

unnecessary to protect existing or future County-maintained roads or stormwater management facilities.

i. Enclosed Stormwater Conveyance Systems

1) Enclosed stormwater conveyance systems that the County will maintain must be located within dedicated drainage easements or rights-of-way.

2) For enclosed stormwater conveyance systems within drainage easements, the drainage easement width must be sufficient to encompass a work trench having 1:1 side slopes (measured from the proposed ground surface to the proposed invert of the enclosed stormwater conveyance system) and a bottom width two feet wider than the total width of the installed conveyance system.

3) The drainage easement width cannot be less than 20 feet otherwise see Section 1.6.

ii. Canals and Ditches

1) Canals and ditches that the County will maintain must be located within dedicated drainage easements or rights-of-way.

2) Provide sufficient drainage easement for canals and ditches and dedicate it to Hillsborough County to accommodate construction, including an unobstructed 20-feet-wide maintenance area on both sides measured from the top of bank; otherwise, see Section 1.6.

3) In situations where the canal is adjacent to a roadway, proposed canals must be aligned parallel to roadways such that the minimum distance from the canal top of bank to the roadway edge of pavement adheres to Chapter 215.3.2 of the FDOT FDM.

4) For canals not constructed parallel to an adjacent roadway, provide a minimum separation as follows:

- Provide at least 20 feet between the toe of the roadway front slope (for roadways in fill sections) and the top of the canal side slope nearest the roadway.
- Provide at least 15 feet between the inside edge of the roadside ditch bottom (for roadways in cut sections or with adjacent ditches) and the top of the canal side slope nearest the roadway.

iii. Detention and Retention Ponds:

1) For residential ponds, the EOR must allot for sufficient drainage easement areas. The pond easement must include the inside top of bank perimeter and an unobstructed 10 feet wide maintenance area offset from the inside top of bank. The maintenance area offset must be 20 feet wide when adjacent to a control structure. The maintenance area must extend to the outside toe slope when constructed on an embankment.

5.1.5 Design Classification

a) SMF reviews are required for the following development types:

i. Residential/Subdivision

ii. Commercial

iii. Industrial

iv. Multi-family/Non-subdivision

b) Redevelopment and expansion projects may include stormwater management facilities other than retention and/or detention ponds. Therefore, the other design requirements and standards contained in Sections 5.1.7 of this Manual also apply to these projects.

c) Onsite Detention/Retention Requirements: Onsite attenuation will be required for those project sites which exceed 10,000 square feet in area. Design criteria to be adhered to is outlined in Section 5.3.

d) Review of Offsite Improvements Associated with Commercial and Residential Development

i. In the event that public stormwater management improvements are necessary and are to be constructed by private development concerns, notification must be provided to the Stormwater Review Team in the County's Development Services Department using a site development and right-of-way use permit application.

ii. Plans must be submitted to the County's DSD and include the following:

1) Provide plans, cross-sections, and profiles of existing and proposed storm sewers, drainage structures, and ditches. Profile views must show all existing utilities at scale, and existing ditch cross-sections must include the most constricted areas. The submittal must include Letters of No Conflict for all utilities or construction notes on the plans identifying responsibility for and proposed resolution of utility conflicts. Construction notes must address restoration of the right-of-way, including shoulders, sidewalks, and pavement, following system connection. Cross-sections must conform to the standards in the latest edition of the Hillsborough County Transportation Technical Manual. The submittal must also include an erosion control plan in accordance with Section 13.0.

2) Upon completion of the work, the EOR must submit the following: one reproducible set and one hard-copy set of the As-Built plans or record drawings, signed and sealed by the respective Florida licensed P.E.'s for each discipline to County staff; digital CAD files of the As-Built drawings to the Development Services Department and the Stormwater Management Section of the Public Works Department on compact disk; and a videotape documenting the internal features of the entire storm sewer system to the Stormwater Management Section of the Public Works Department.

3) Note: All work in the right-of-way must be inspected by the County.

5.1.6 Residential Standards

a) The construction of one single family residence or duplex is exempt from standard stormwater treatment and attenuation requirements.

i. Platted No-Improvement Subdivisions are required to provide a drainage analysis, prepared by a Florida licensed P.E. This analysis must demonstrate that the post

developed discharge for the mean annual/24-hour storm does not exceed the pre-developed discharge rate for same event. A current topographic survey of the site must be submitted along with the drainage analysis.

b) Subdivision Standards: Subdivisions with total site areas of 10 acres or less are subject to the Commercial Standards found in Section 5.1.7. The County may grant attenuation requirement concessions only for small residential subdivisions certified as affordable housing, including farmworker housing that has obtained a conditional or special use permit in accordance with LDC Section 6.11.39, provided the development does not create adverse offsite stormwater impacts and complies with all limitations for small affordable housing subdivisions. Small affordable housing subdivisions may also be exempt from retention/detention SMFs located within a common area and establishing a Homeowners Association.

i. Definition of Applicable Developments

1) Subdivision certified by Hillsborough County as an Affordable Housing Project and so noted on the final plat and,

2) Subdivision must be comprised of less than 10 detached single family platted lots and,

3) Subdivision is not located in a volume or peak sensitive basin or Flood Hazard Area.

ii. Requirements

1) For subdivisions located on an existing paved roadway - no stormwater attenuation or retention is required, provided that it can be demonstrated per Section 5.1.6.a that there are no adverse downstream impacts.

2) If subdivision includes new roadway:

- Water quality analysis and treatment for entire subdivision per Section 5.1.6.a.
- Roadway to meet all County standards and be dedicated to the County.
- Water quality treatment to be provided in swales in the right-of-way. The County will assume responsibility for hydraulic maintenance when located within public right-of-way.

5.1.7 Commercial Standards

a) Redevelopment and expansion projects are required to address stormwater management issues. The following standards identify the County stormwater retention and detention requirements).

i. Existing stormwater management system attenuation, discharge, and treatment capacity must not be reduced due to redevelopment or expansions of existing development.

ii. Site alterations are cumulative with time, as indicated in the redevelopment site definitions. Therefore, a particular site might transition from an exempt redevelopment site to a minor redevelopment site, and then to a major redevelopment site as further expansion and redevelopment occurs. The site design

criteria will also transition accordingly.

b) Allowable Modifications to Standard Design: The following projects are permitted to stray from the standard stormwater attenuation and treatment requirements.

i. Discharges to Basins with Adequate Stormwater Management Facilities: The EOR determines whether a site within a master drainage plan design qualifies for an exemption from the standard retention and detention requirements. The site qualifies when it discharges to a stormwater management system designed and constructed in accordance with the approved master drainage plan, accommodates the project's intensity of development and five-year discharge using the Rational Method or the NRCS (SCS) Method, and provides equivalent water quality treatment.

ii. Minimum Retention/Detention Requirement Projects

1) The following projects are also allowed a deviation from the standards. In lieu of the standard requirements, the following will be applied:

2) The minimum retention/detention requirement is the retention of a volume equal to 1/2-inch of runoff over the entire site.

3) Those projects eligible for the minimum requirements are:

- Small Commercial Projects: New development of a parcel less than or equal to 10,000 sf of total site area which is not part of any larger development or redevelopment. Subsequent additions to the site will not be approved unless the entire site is brought into compliance with current standards.
- New Developments With Outfalls Directly to Receiving Waters: Projects with discharges in close proximity to an adequate County outfall may qualify for the Capacity Adjustment in Section 5.3.2.c.

5.2 WATER QUALITY

5.2.1 All development projects will provide treatment in accordance with the SWFWMD regulations; however, the minimum water quality treatment required for new development is ½ inch of runoff from the entire site.

5.2.2 Water quality must be retained below the discharge weir elevation for systems designed with a positive outfall.

5.2.3 For retention SMFs, storage volumes must be drawn down within a 72-hour period by natural percolation through the soil (for retention treatment). The distance between the pond bottom and the seasonal high groundwater table must be at least one foot.

5.2.4 For detention SMFs, water quality storage volumes must be drawn down within a 72-hour period. For instances where there is insufficient percolation rate and/or a high-water table, the required attenuation volume must be stacked over the required treatment volume.

5.2.5 Baffles or other appropriate devices must be provided to control floating material, while maintaining that the baffle design provides adequate hydraulic capacity for the design flow. Provide adequate protection against the growth of vegetation between the baffles and the control

structures (e.g., by constructing an appropriate impervious apron around the control structure).

5.2.6 Major and Minor Redevelopment Sites

a) Minor Redevelopment

i. Project must retain or provide appropriate stormwater treatment for a volume equal to 1/2 inch of runoff from the cumulative alteration area to satisfy water quality requirements. This requirement is in addition to the attenuation and treatment capacity of any existing site stormwater pond(s), unless the cumulative alteration area was appropriately included (i.e., a like or more intense use was considered in the original design(s) for the pond(s)).

b) Major Redevelopment

i. Project must retain or provide appropriate stormwater treatment for a volume equal to one inch of runoff from the area of cumulative alteration, including the existing site, if no stormwater treatment facilities are in place, to satisfy water quality requirements. This requirement is in addition to the attenuation and treatment capacity of any existing site stormwater pond(s), unless the cumulative alteration area was appropriately included (i.e., a like or more intense use was considered in the original design(s) for the pond(s)).

5.2.7 If the cumulative alteration area is greater than 10,000 square feet, in addition to the above water quality volume requirement, detention must be provided for the cumulative alteration area.

5.3 WATER QUANTITY

5.3.1 General Discharge

a) Stormwater management system components must be designed as follows:

i. Detention Ponds – 25-year 24-hour storm event

ii. Retention Ponds – 100-year 24-hour storm event

b) Design storm rainfall information must be obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14. Refer to FDOT DDG Section 2 for appropriate design-storm rainfall data and FDOT DDG Table B-4 for runoff coefficients.

c) Calculation of the instantaneous peak discharge from the undeveloped site must consider the effect of existing storage in attenuating said peak. Pre- and post-development initial stage elevations for calculating storage must be set and controlled at the seasonal high water elevation, as determined by biological indicators or geotechnical investigation.

d) Impervious areas include, but are not limited to:

i. Buildings

ii. Asphalt surfaces

iii. Concrete

iv. Shell

v. Limerock

vi. Any other temporary or permanent material that sheds more than 70 percent of the water that falls on its surface.

e) Project Outfall Design Criteria: The capacity of "receiving waters" is classified by the County as one of the following designations: more than adequate, adequate, peak sensitive or volume sensitive. A basin map with designated peak and volume sensitive basins is available on the Hillsborough County website for reference. Projects that do not directly discharge into a well-defined conveyance system (i.e. ditch, storm sewer, etc.) are considered to have volume sensitive capacity since they do not have a positive outfall. It is the responsibility of the EOR to classify the capacity of the receiving waters for a particular project site based upon the criteria described below; and to utilize the corresponding design standards defined in these criteria. The EOR is urged to confirm with the County the selection of Project Outfall Design Criteria for a project prior to submitting the site development application. For all projects regardless of basin capacity, recovery of the attenuation volume for all ponds is required within 72 hours after the end of the design storm event.

5.3.2 Adequate and more than Adequate Capacity

a) More Than Adequate Capacity

i. These receiving waters are large water bodies (i.e. Tampa Bay) which have in-bank storage and/or conveyance capacity which greatly exceeds that which is required to accommodate the 100-year event, and for which an increase in flow will not cause a measurable increase in water surface elevation.

ii. This attenuation design standard does not relieve the EOR of meeting the stormwater treatment requirements of any other local, state or federal agency.

b) Adequate Capacity

i. These receiving waters have no known inadequacies or flooding problems during the 25-year, 24-hour storm.

ii. A project discharging to this type of receiving waters must be designed such that the computed post-development peak discharge rate does not exceed the predevelopment peak discharge rate for the 25-year, 24-hour storm event.

5.3.3 Peak Sensitive Capacity

a) Peak sensitive basins are delineated by the County and available to view online using the Hillsborough County Peak Sensitive Basins Map Viewer.

b) These receiving waters generally have historic flooding problems related to resistance and restrictions within a channel and/or inadequate conveyance structures, and thus have inadequate flow capacities. All storm sewer systems which are used to convey discharge from stormwater ponds are considered to have peak sensitive capacity.

c) Projects discharging into this receiving water must be designed such that downstream flooding is not worsened in terms of stage and duration.

d) Projects that discharge to Peak Sensitive receiving waters must perform a pre vs. post peak flow timing analysis for the storm event correlating to the appropriate Level of Service (LOS) but less than the 25-year, 24-hour event to demonstrate no adverse stages will result. The analysis must show that the proposed development LOS peak flow to the receiving water's critical restriction at the time of the arrival will be less than the flood-free capacity.

e) As an alternative, the EOR can choose to design in accordance with the criteria contained in Section 5.3.4.b.ii.

f) Direct Connection to County Conveyance Systems: The maximum allowable discharge into a County system utilized in the design of systems to serve new development and redevelopments must be limited to the peak discharge based on the five-year design storm and the predeveloped condition. For sites of 10 acres or less, the Rational Method must be used to determine the pre-development five-year discharge rate. For sites greater than 10 acres, the SCS method must be used. The time of concentration must be determined utilizing the FDOT overland flow velocity chart (FDOT DDG Appendix B) or other methods approved by the County. For new development projects, the "predeveloped" condition is defined as raw land in a pervious condition or natural state before alteration (i.e., runoff coefficient approximately 0.20). For redevelopment projects, the "predeveloped" condition is defined as permanent impervious surfaces (not shell or clay) on the site which existed as of 1988 and are identifiable on the 1988 (or earlier) County Aerial Maps.

5.3.4 Volume Sensitive Capacity

a) Volume sensitive basins are delineated by the County and available to view online using the Hillsborough County Volume Sensitive Basins Map Viewer.

b) These receiving waters, also referred to as "blinds", do not have positive outfall for storm events less than or equal to the 25-year, 24-hour event.

c) In such areas, the site must be designed in accordance with either of the following criteria:

i. The difference between the pre-development and post-development runoff volumes for the 100-year, 24-hour storm event must be retained onsite and recovered by means of percolation within 72 hours after the storm event. This design storage volume requirement cannot be reduced through the consideration of percolation or any other means of discharge. Percolation calculations must include analysis of both horizontal and vertical movement of groundwater and any other effect that the seasonal high-groundwater table may have on infiltration. Post-development runoff volume in excess of the design storage volume may be discharged at a rate no greater than the pre-development 10-year, 24-hour event.

ii. The total post-development runoff volume for the 100-year, 24-hour storm event must be retained or detained on site. The outfall control structure must be designed to discharge at a rate which will result in approximately one inch of runoff from the total area contributing to the pond within 24 hours of the inception of inflow to the pond. When percolation is the only means of discharge from the pond, one inch of runoff is the minimum volume to be discharged in the 24-hour period previously described. However, in no case will a pond designed according to the requirements of this subsection contain less than the volumetric difference between the pre and post-development for the design event.

iii. Offsite point discharges are not allowed in instances where the pre-development condition discharges via sheet flow unless the receiving offsite area contains a conveyance system that can accommodate the post-condition design event.

5.3.5 Capacity Adjustment: Stormwater attenuation and discharge rates may be adjusted based on a drainage capacity analysis of the receiving waters performed by a registered engineer. A capacity analysis of specific drainage systems will be reviewed at the time of plan submittal. Such analysis will conform to standard engineering practice and must prove the proposed discharge will have no negative offsite impacts to the receiving system. Attenuation is not required for projects which have their own direct outfalls to the Tampa By-Pass Canal or Tampa Bay.

5.4 SMF DESIGN

5.4.1 SMF Geometry and Grading Requirements: Proposed excavation must meet the following requirements. This Manual does not address standards for mines and borrow pits.

a) Setback: The minimum horizontal setback from right-of-way line to the pond embankment edge or the outer edge of the maintenance berm is five feet. The maintenance berm does not count toward and must not encroach into the required setback. The minimum horizontal separation from any sidewalk, pedestrian area, slab or grade type patio, vehicular use area or leisure activity area to the top of bank for any excavation is five feet, unless a fence separates the area from excavation. The maximum allowable side slope within a setback area is one-foot vertical to eight feet horizontal.

b) Depth: Depressions less than or equal to two feet are considered a function of grading and are exempt from fencing/side slope criteria detailed below.

c) Side Slope: The maximum allowable side slope for an unfenced excavation is one-foot vertical to four feet horizontal. The maximum allowable side slope for a fenced excavation is one-foot vertical to two feet horizontal. Hillsborough County Public Works Department retrofit projects, including roadside ditches, may be exempt from these requirements on a project by project basis, provided the exemption does not compromise public safety.

i. The maximum side slope for both residential and non-residential site ponds without a fence must be no steeper than 1:4. Ponds with side slopes steeper than 1:4 but no greater than 1:2 must be fenced with a FDOT Type B Fence, or equivalent, along the outer perimeter or top of the maintenance berm.

ii. The maximum side slope for subdivision ponds must be no steeper than 1:4 (vertical: horizontal).

iii. All wet detention and wet retention ponds must have a minimum pond depth of six feet below normal water level. A 1:2 side slope is allowed 10 feet below the normal water level providing that side slope stability can be justified by a geotechnical engineer.

d) Fencing: All proposed excavations with side slopes steeper than one-foot vertical to four feet horizontal must include fencing constructed of FDOT Type B Fence, green or black vinyl coated or an approved equivalent. Install the fence along the outer perimeter or on top of the maintenance berm. Ingress and egress for pond maintenance must be provided and controlled by lockable gates sized to accommodate necessary maintenance equipment.

e) Maintenance: All site excavation activities must include a written maintenance plan. The plan must provide maintenance access to all areas within the excavation.

f) For all ponds: The maintenance berm cross slope must be no steeper than 1:20 and fully above the top of bank elevation.

g) The maintenance berm must be at least 10-feet wide for subdivision and residential ponds and 5-feet wide for non-residential ponds, except for clear access to the control structure, which must be at least 20-feet wide. Maintenance berms on an embankment require a maximum slope of 1:4 for the external pond slope that must not extend beyond a 5-feet offset from inside the property line.

h) All ponds and pond maintenance areas must be stabilized in accordance with FDOT Standard Specifications and clearly depicted and detailed in the site plans. For wet pond

stabilization, sodding limits must extend to the normal water line. Sod must not be placed on the bottom of dry ponds. Only sodding is permitted for side slopes steeper than 1:5.

i) Inflow must be conveyed using a closed drainage system. Only mitered or flared end sections are allowed as end treatments within a pond. Pipe inverts within wet ponds must be set such that the pipe is at least half full at the normal water elevation. Pipe inverts within dry ponds must be set at the pond bottom elevation. No sumps will be allowed for dry ponds.

j) Vertical walled ponds are not permitted in subdivisions. Vertical walls are allowed in commercial contexts but must not exceed 25 percent of the perimeter for wet ponds. Only 50 percent of the perimeter for dry ponds may be walled in commercial residential contexts. Back slopes must not exceed 1:2. Freestanding walls are not permitted. All vertical walls must be certified for structural integrity by a licensed structural P.E. A minimum five-foot berm/embankment width is required at the top of the wall. The entire pond area must be fenced with a green or black vinyl coated FDOT Type B Fence (or equivalent safety fence) constructed on top of the berm.

k) For commercial sites, a minimum berm width of five feet is to be provided for all ponds.

l) The retention pond bottom, for dry retention ponds, must be uniformly graded to provide a low point 12 inches below the bottom perimeter elevation. The final grading of the pond bottom must remove the final six inches and must be the last work in the construction of the site. Also, for dry retention ponds, a minimum of two feet of clearance is required between the seasonal high groundwater table and the proposed pond bottom.

m) The distance between the pond bottom and the seasonal high groundwater table must be at least one foot.

n) Ingress/Egress: The EOR must grant the County sufficient and perpetual legal access to a drainage easement. This access must be at least 20 feet in width.

o) If the design high water of a pond is proposed to be above the ground surface adjacent to or in the vicinity of the pond area, a geotechnical analysis to certify that there will be no adverse impacts due to potential seepage or change in ground water conditions will be required.

5.4.2 Stormwater Vaults

a) Floatation calculations must be provided for all vaults.

b) Stormwater vault must be designed to meet minimum confined spaces criteria as set by the Occupational Safety and Health Administration (OSHA) guidelines.

c) At least one access point is required for the first 250 square feet of the site limits; additional access points must be provided for each additional 1,000 square feet. Spacing locations must be designed for effective cleaning, ventilation, maintenance, and inspection. All access points must be adequate for adult ingress and egress.

d) Stormwater vaults are not permissible within County right-of-way.

5.4.3 Freeboard and Routing Requirements

a) Storage Volume: The net storage volume required will be in addition to the storage volume developed for satisfaction of water quality criteria. Use of a detention/retention basin or drain field must require that an inflow/outflow curve be submitted together with the

stormwater management calculations. SMF storage must occur above the seasonal high groundwater level.

b) No storage (i.e. attenuation) credit will be given below the seasonal high groundwater table elevation.

c) A stormwater routing analysis is required for the design of all ponds. All tailwater assumptions for use in routing calculations must be supported. Boundary-stage or boundary-flow nodes with static, non-varying inputs are not acceptable.

d) The runoff storage volume required for the 25-year/24-hour rainfall event is to be stored entirely within the pond. Stormwater routing analysis for the 100-year 24-hour storm event must be used to demonstrate no overtopping of the pond banks as well as for setting the FFE and floodproofing elevation for adjacent structures to meet freeboard requirements of the County's LDC. In the case of retention ponds without an out-of-bank overflow outlet, the FFE must be no lower than 2.5 feet above the Design High Water elevation.

e) For non-residential sites, storage may be allowed on top of paved parking areas when designing to the volume sensitive criteria, provided:

   i. The volume difference between the pre-developed and post-developed conditions for the 25-year, 24-hour is stored entirely within the SMF.

   ii. The DHW is at or below the lowest graded elevation prior to berming or curbing.

   iii. Depth of storage on the parking area does not exceed six inches.

   iv. Freeboard criteria can be achieved onsite using berming or curbing if needed.

f) Design High Water of Basin and Freeboard: The design high water elevation must be established in consideration of adjacent properties and facilities, but normally one foot below the ground surface adjacent to the facility.

   i. For subdivisions, the minimum freeboard for ponds must be one foot between design high water and top of bank. Freeboard credit extending up to the outside top of bank will be granted when the existing ground elevation at the property line is above the pond maintenance berm.

   ii. For non-residential sites less than five acres in size, a minimum of six inches of freeboard is permissible provided that the product of the rational coefficient times the area (CA) is less than or equal to two.

   iii. For non-residential sites only, no more than 50 percent of the required freeboard may be provided outside of the designated pond

   iv. For non-residential sites, detention storage may be allowed on top of paved parking areas provided that:

      1) The design high water elevation is at or below the lowest graded onsite.

      2) Maximum depth of parking area storage is six inches.

      3) Water quality volume cannot be credited for storage outside of SMF.

5.4.4 Control Structure Design

a) The outlets of detention ponds must have water level control structures that enable the ponds to function as indicated in the hydraulic calculations.

b) A water level control structure must not be a pipe riser and cannot be adjustable.

c) Control structures must be detailed as a modified ditch bottom inlet structure constructed in accordance with the FDOT Standard Plans and Specifications.

d) All control structures must be designed to prohibit the entrance of floating debris into the structure. This must be achieved by attaching a skimming device to the outfall structure. The bottom of the skimming device must be at least six inches below the normal water level and the top of the skimming device cannot be lower than the DHW. Supporting documentation will be required to ensure that the skimming device opening will not control pond discharge.

e) The control structure must have a weir-opening design of no less than three inches, for purposes of attenuation. The design low water elevation of the detention pond must be at the slot or orifice invert elevation. The top of the control structure must be at the elevation of the design high water. Since weir coefficients have been developed only for flow conditions where the length of the weir (L) is much greater than the head on the weir (H - depth of water above weir crest), losses attributed to contraction should be considered when H/L>1.

f) The water quality storage volume may also be considered for peak flow attenuation, only:

   i. If the pond is designed in accordance with Section 5.3.4.d.ii.2.

   ii. For that portion of the pollution abatement volume which is bled down within 36 hours after the end of the design storm through a positive discharge structure.

   iii. If the pond does not utilize underdrains for the purposes of water quality treatment.

g) Tailwater conditions must be accounted for in the design of the control structure.

h) Control structures are prohibited from placement in County Road right-of-way. Hillsborough County Public Works Department retrofit projects are exempted from this requirement to the extent that adequate public safety is not compromised by such an exemption, on a project by project basis.

i) Direct discharge from control structures into offsite collection systems or waterways will be permitted if the receiving system has capacity.

j) Discharge into lands naturally receiving sheet flow, natural streams, marshes, and environmentally sensitive areas must direct control structure outflow into an intermediate spreader swale system.

k) The outfall pipe from the control structure must not impede or control discharge from the pond.

l) Where environmentally feasible, the discharge from detention ponds directly to the Hillsborough, Alafia, and Little Manatee Rivers must flow through vegetated swales.

5.4.5 Percolation and Seasonal High Groundwater Determination

a) Results of all percolation and soils investigations must be certified by a Florida licensed Geotechnical P.E.

b) Sufficient test borings must be made by a certified testing firm to a minimum depth of ten feet below the bottom elevation of the SMF or infiltration bed.

c) For DRI tests that only provide vertical infiltration rate, the horizontal infiltration rate may

be obtained by multiplying the field-tested vertical infiltration rate by 1.5.

d) The percolation rate must reduced by 10 percent for each foot the water table rises above the bottom elevation of the SMF or infiltration bed. The maximum allowable percolation rate after adjustment for water table elevation is 1.5 feet/hour.

e) There must be at least one subsoil investigation per 10,000 square feet of pond bottom and one for each 500 feet of pond perimeter. One infiltration test per 20,000 square feet of pond bottom and one for each 500 feet of pond perimeter. These are to be placed at appropriate locations provided the entire pond area consists of the same soils type as identified in the NRCS Soils Survey of Hillsborough County. If multiple ponds are used, one soil boring and infiltration test will be required per site, regardless of the size. In addition, multiple borings or tests immediately adjacent to each other will not be accepted.

   i. There must be a minimum of two borings and one infiltration rate test

   ii. The borings must extend 20 feet below the pond bottom and must be uniformly distributed.

   iii. The soil profile and existing ground water elevation and estimated seasonal high groundwater elevation must be determined for each boring.

   iv. The soils must be sampled and classified in accordance with the American Society for Testing and Materials (ASTM) Standard Method D2487.

   v. The infiltration rate test (Double Ring Infiltrometer Test) must be ASTM Standard Method D3385-18. Infiltration tests must not be made in filled ground unless the soil has been thoroughly and mechanically compacted or allowed to settle for a period of six months or more

   vi. The representative field infiltration rate used for the pond design must be no greater than 3/4 of the lowest infiltration rate obtained from the tests, with the maximum allowable rate not to exceed 18 inches per hour.

   vii. The infiltration rate test must be performed at the depth and location which will provide representative test results for use in design of the retention pond.

   viii. Existing ground surface elevations at each boring location must be provided.

   ix. Results must be detailed in the geotechnical investigation report and included with the Drainage Report.

f) Where percolation from a pond bottom is to be considered, the final six inches of grading must not be completed until the development has been constructed. This procedure must be included in the stormwater management plan.

g) The County will require a seepage analysis to be performed by a Florida licensed P.E. to verify that a SMF will not adversely impact offsite properties in instances where the control or design elevation is above the existing ground of the adjacent property. Considerations to forgo a seepage analysis must be approved by the County through the Design Deviation Memorandum process as discussed in Section 1.0 of this Manual.

h) Retention Ponds

   i. Seasonal High Water Table (SHWT) Elevation: The SHWT elevation must be determined using groundwater field testing and verified by the United States Department of Agriculture (USDA) NRCS Soils Survey Map of Hillsborough

County, Florida. The results must be presented in a report format and signed and sealed by a State of Florida registered geotechnical engineer. The report must provide detailed information on all test procedures, test depths and locations, data measurements, and results. The following factors should also be considered:

1) Existing soil conditions (e.g.spodic stainlines). NOTE: The seasonal high groundwater level is typically one to two feet above the spodic stainline (per NRCS).
2) Soil profiles
3) Measured groundwater levels
4) Measured water levels surrounding water bodies

ii. The SHWT elevation must be shown on the Stormwater Facility sheets within the construction plans.

iii. A overflow outlet control structure must be provided for retention ponds in open basins. The overflow design must limit the discharge rate during the post-development 100-year/24-hour storm event to the pre-development 100-year/24-hour discharge rate. The pre-development flow distribution characteristics must be preserved through the use of spreader swales or other design features that disperse runoff.

iv. Retention ponds must have an infiltration rate test performed for each ½ acre of pond bottom, if percolation will primarily be through the pond bottom. One infiltration rate test will be needed for each 500 feet of pond perimeter, if percolation will primarily be through the pond side slopes.

v. The retention pond bottom must be no less than 15 feet above SM, SC, ML, CL, OL, MH, CH, OH and PT soils as defined by ASTM Standard Method D2487 and must be no less than 20 feet above bedrock. The EOR must consult with the County in conditions where discontinuous restrictive layers exist or where a definable combination of restrictive and non restrictive layers exist.

vi. The retention pond bottoms must be uniformly graded to provide a low point of 12 inches below the pond bottom perimeter elevation. Maintain a minimum 6-inch protective layer of in-situ soil above the pond bottom during construction to preserve the infiltration capacity of the underlying soils. After stabilizing the contributing drainage area, remove the 6-inch protective layer and any unsuitable material, including accumulated silts, clays, organics, and other fine sediments, to achieve the final pond bottom grade. Dispose of excavated unsuitable material outside the basin drainage area. Do not sod the final pond bottom.

vii. A minimum of one feet of separation is required between the Seasonal High Ground Water Level (SHGWL) and the proposed pond bottom. The SHGWL must be at least five feet below the retention pond bottom for CA of 2.00 or less. This clearance must increase linearly to 10.0 feet between CA=2.00 and CA=4.00. For a CA of 4.00 or more, the clearance to SHGWL must be at least 10.0 feet. Pond recovery calculations must account for the effects of groundwater mounding and seepage slopes during the rainfall event and during the recovery of the design storage volume.

viii. The EOR must consult the County Review in conditions where discontinuous

restrictive layers exist or where a definable combination of restrictive and non-restrictive layers exist to determine the applicability of the criteria above and the need for additional soil data.

ix. Retention pond recovery must be demonstrated through the use of a computer model.

5.5 OUTFALL CRITERIA

5.5.1 Offsite runoff: The EOR must provide appropriately sized drainage easements for all conveyance systems that handle offsite runoff bypassing onsite stormwater management.

a) Offsite runoff must be routed around or through the project without combining with onsite runoff unless the pond and discharge structure are designed to accept this offsite runoff. All conveyances for offsite flows must be contained within the limits of the property/site that is currently under review.

5.5.2 Projects that propose an outfall traversing offsite areas, or that establish an outfall for an existing landlocked site, must provide proof of drainage easement(s). If the offsite outfall lies within a jurisdictional wetland, the EOR must determine potential wetland water surface elevation impacts from the proposed discharge to qualify for consideration of an exemption from this requirement.

5.5.3 Discharge to Sinkholes: The County prohibits new discharges into known sinkholes without water quality treatment and approval from the appropriate regulatory agencies.

5.5.4 Discharge to Public Streets: A positive outfall to a public "curb and gutter" street can be claimed if gutter flow does not intrude onto other private property or encroach into the following areas referenced in the Florida Greenbook, Chapter 20, Section F.7 Spread Standards.

a) Should the EOR desire to discharge into a public "curb and gutter" street, the EOR must:

i. Provide a survey profile of the path of the gutter flow in 50 feet increments and provide cross sections at every change in the typical section and every 50 feet to the point of inlet into the County system.

ii. Provide calculations (suggest a modified storm sewer tabulation form) to document the quantity of stormwater runoff entering the road from the last point of inlet to the system (or the basin boundary). Refer to FDOT DDG Section 6.3.2. Pavement Hydraulics. The quantities will be calculated at the time of concentration corresponding to the maximum rate of discharge from the proposed project reaching that specific point.

5.5.5 Outfall Design

a) Outfall Pipes: Outfall pipes are to be no larger than necessary to flow the allowable capacity at the DHW head. The maximum velocity of discharge into a County system for any outfall is eight feet per second for closed storm sewer systems and six feet per second for ditches/canals. See Sections 9.0 and 11.0 of this Manual for pipe and ditch criteria and Section 13 for erosion control.

b) Ditch bottom inlets or "bubbler boxes" designed to discharge as an outfall for ponds are not permitted within County right-of-way.

5.6 FLOODPLAIN REQUIREMENTS

5.6.1 Equivalent Storage within Flood Prone Areas

a) The design must preserve floodplain storage capacity to avoid relocating flood problems or increasing their severity.

b) To ensure that proposed development does not reduce the floodplain storage capacity of stormwater conveyance systems, all development must comply with the following criteria:

i. Development may not place earth fill within a flood hazard area unless it creates an equal amount of flood storage through excavation below the base flood elevation (BFE) and above the seasonal high groundwater table elevation. When the flood storage compensation volume lies contiguous to an existing surface water body, use the seasonal high surface water elevation, rather than the groundwater table elevation, as the lower reference limit. For large sites (greater than 10 acres), the County may allow an alternative approach if computer modeling demonstrates that a single storage area can provide both the required attenuation and compensation volumes based on timing. When using timing, the computer model must also demonstrate that gravity flow can achieve full recovery of the required attenuation volume can be achieved within 72 hours after the storm event.

c) A structure may not reduce flood hazard area storage capacity unless the design provides an equal volume of replacement storage with the flood hazard area.

d) A flood hazard area includes any area shown on the FEMA Flood Insurance Rate Maps or the current floodplain maps in the Hillsborough County Stormwater Management Master Plan.

5.6.2 Development in 100-Year Floodplains

a) The criteria for development in 100-year floodplains apply to all such floodplains and are not limited to those identified on FEMA maps. All areas that convey or store stormwater will have an associated 100-year floodplain due to stormwater runoff and flow, including conveyance and storage facilities located within storm surge areas. When a FEMA study does not define onsite 100-year flood elevations, the EOR must determine those elevations. For any flood zone designation changes identified through a detailed area study, the EOR must submit a Letter of Map Amendment or Letter of Map Revision to FEMA.

b) Development, including structures or fill, may not occur within the conveyance portion of any 100-year floodplain associated with a freshwater stream, channel, lake, or waterway unless the design provides compensation for any reduction in conveyance caused by the development.

c) Development, including structures or fill, may not occur within any 100-year non-tidal floodplain or within any floodplain associated with riverine flooding in a tidally influenced area unless the design provides compensation for the reduction in storage volume caused by the proposed development.

i. The design must provide compensation storage volumes in addition to any stormwater detention or retention volumes required to reduce peak runoff rates from the development. For large sites greater than 10 acres, the County may allow an alternative approach if H&H modeling demonstrates that a single storage area can provide both the required attenuation and compensation volumes based on

timing. When using timing, the H&H model must also demonstrate that gravity flow can fully recover the required attenuation volume within 72 hours after the storm event.

ii. Development may not place earthen fill within a 100-year floodplain unless the design creates an equal volume of flood storage through excavation below the 100-year flood elevation and above the controlled seasonal high groundwater table. When the flood storage compensation area lies contiguous to an existing surface water body, use the seasonal high surface water elevation, rather than the groundwater table elevation, as the lower reference limit.

1) The County will consider DDM for any approach that impacts a floodplain and does not pertain to bullets i) and ii) immediately above.

d) For a highway or similar facility requiring a "causeway" type encroachment across a floodplain, the County may allow a small cumulative increase (0.1± feet) in upstream offsite elevations. FEMA and the SWFWMD must approve this allowance. In addition, all affected upstream property owners must agree, through deed restrictions, to accept the increased flooding.

e) Development may not encroach within a regulatory floodway designated on FEMA Floodway Maps unless the design meets FEMA requirements and Hillsborough County accepts the proposed approach.

f) Refer to Hillsborough County LDC Section 6.02.11 – Stormwater Management for all developments in floodplains.

Section 6.0 COUNTY MAINTAINED PONDS

6.1 DESIGN CRITERIA

6.1.1 For County-owned and maintained ponds, the same requirements specified in Section 5.4 will apply. In retrofit situations, the EOR may vary from subdivision criteria when the County determines such variation serves the best interest of the public. The following alternatives are acceptable:

a) Pond side slopes as steep as 1:2 may be used if appropriate analyses demonstrate adequate slope stability. Protect the entire area of the pond with a green or black vinyl coated, Florida FDOT Type B Fence, or an equivalent safety fence, installed along the outer perimeter and atop the maintenance berm. Provide ingress/egress access to the pond maintenance area with lockable gates, with a minimum clear opening of 20 feet, to accommodate maintenance equipment. For ponds with 1:2 side slopes, construct a minimum 20-foot-wide maintenance berm or corridor with a maximum cross slope of 1:20.

b) As another alternative to fencing, provide a side slope no steeper than 1:8 from the outer edge of the maintenance berm or corridor to a depth of two feet below normal water level. From that point to 10 feet below the normal water level, limit the side slope to no steeper than 1:4. Slopes as steep as 1:2 may be used below this depth if a geotechnical engineer demonstrates slope stability. For this alternative, measure the required 20-foot-wide maintenance berm or corridor from the Design High Water elevation.

c) Maintenance berm or corridor widths as small as 15 feet with cross-slopes no steeper than 1:10 can be considered for ponds with side slopes no steeper than 1:3.

6.1.2 Maintenance Berm or Corridor Width: Maintenance berm or corridor widths as small as 15 feet with cross-slopes no steeper than 1:10 can be considered for ponds with side slopes no steeper than 1:3.

6.1.3 For subdivisions and County-owned and maintained ponds, inflow must be conveyed using a closed drainage system.

6.1.4 Vertical walled ponds are not permitted in county-maintained ponds.

6.1.5 Retrofit projects by Hillsborough County Public Works Department may be exempt from the requirement to install control structures within County road right-of-way, provided that the exemption does not compromise public safety. Exemptions must be evaluated and approved on a project-specific basis.

6.1.6 Stormwater management facilities transferred to County ownership must include drainage easement(s) along the outfall where it traverses offsite property.

Section 7.0 RESIDENTIAL LOT GRADING

7.1 GENERAL

Proper lot grading ensures safe and convenient access to homes, creates livability, protects lot improvements from flooding, and reduces County maintenance efforts.

7.2 APPLICABILITY

This Section applies to all newly-platted subdivisions with associated infrastructure, individual lots in platted subdivisions, and metes and bounds lots and parcels.

7.3 LOT GRADING PLAN DESIGN REQUIREMENTS

7.3.1 Lot Types: Lot Type designations should be assigned in conjunction with the proposed drainage patterns of the site. Type A lots can be integrated with Type B & C lots, provided yard swales are designed to drain stormwater runoff.

7.3.2 Lot Grading Plan Requirements. The Lot Grading Plan must be submitted with the construction plans. The Lot Grading Plan must be signed and sealed by a Florida licensed P.E. The Lot Grading Plan must be supported by topographic data provided by a signed and sealed Florida licensed Professional Surveyor. The lot grading plan must be designed to account for offsite runoff and not increase site runoff to adjacent properties. The Lot Grading Plan will include the following items:

a) Name of owner(s), address, date, and telephone number of the EOR.

b) NAVD88 vertical datum, north arrow and scale.

c) All easements of record (e.g. Drainage, Utility, Access, etc.), existing right-of-ways and all abutting streets and/or alleys.

d) Topographic data and limits of existing FEMA 100-Year Floodplain. Indicate the zone type and BFE (if applicable) along with FEMA Community Panel Numbers.

e) Identify all EPCHC wetland-delineated boundaries and all significant habitat areas.

f) Property elevations at all corners and grade break points at 25-feet intervals to extend 25 feet beyond all property lines.

g) Roadway elevations at high points and low points along the longitudinal profile on edge of pavement, centerline, and at intersection centerlines.

h) All proposed and existing drainage features, including type and size, that are to remain (inlets, manholes, culverts, rivers, lakes, ponds, ditches, swales, etc.) along with arrows indicating direction of flow from structures and flow arrows for lot grading.

i) The FFE for each dwelling must be designated, along with the lot type for each proposed lot. This FFE must be established in accordance with the requirements of the Hillsborough County Construction Code, applicable at the time of permit issuance. In all cases the finish floor must be set a minimum of one foot above the flood zone elevations of the nearest water body as recorded on the FEMA panel or County floodplain maps for the area, or the 100-year DHW for the site's detention pond, or 2.5 feet above the 100-year DHW for the site's retention pond with no overflow outlet, whichever is higher. When applicable, the 100-year BFE must be designated for each lot.

j) The minimum lowest floor elevation for structures constructed in an area without an

approved lot-grading plan and outside of the Special Flood Hazard Area must include the requirement of 18 inches above the crown of the road.

k) Proposed drainage easements.

7.3.3 Development in Existing Low Lots

a) A request or an application for a building permit for construction in a lot which is lower than the street will require the following:

i. If the lot is lower than the street and receiving runoff from the road due to a low point in the road located along the front area of the lot in question, a building permit may be issued. However, no fill will be permitted, except as follows: Within the foundation limits, sufficient fill may be allowed to raise the building floor elevation to meet the minimum floor elevation requirements. The yard will not be permitted fill except in the event that a raised drain field is required by the Health Department or if there will be no adverse offsite impacts. In these cases, detailed evaluation of offsite impacts will be required. If the project proposes fill and has no positive discharge for drainage, equivalent storage will be required.

ii. If the lot is lower than the street but located at the top of a hill or between two street intersections where the grade in the road continues (no low point between intersections exist), then the yard may be filled (in accordance with provisions in the Land Development Code) provided neighboring property will not be adversely affected.

7.3.4 The following notes are required on the Lot Grading Plan and each affected deed:

a) For drainage easements, see Section 6.02.11 B. of the County LDC.

b) For rear yard swales along the back property, see Section 4.1.4.1.2.2.2.D.6 of the County's DRPM.

7.3.5 Lot Grading Plans that are part of a Master Development Plan must depict and dimension the following features with associated calculations and cross sections, as applicable: detention/retention areas, perimeter swales, and closed conveyance systems.

7.3.6 Cross-sections of the property that show the disposition of swales, foundation, and finished floor slab to an extent of at least 25 feet beyond the property line.

a) Cross-sections must be provided along property boundaries using site-specific topographic data and labeling existing and proposed elevations for all features. Cross-sections must demonstrate that all stormwater runoff drains in a manner that does not adversely impact adjacent properties.

b) Spot elevations in perimeter swales and conveyances must be provided to demonstrate positive drainage.

7.4 LOT GRADING, AS-CONSTRUCTED INFORMATION

A lot grading as-constructed survey is to be provided for every residential unit and certified by a Florida licensed professional Surveyor. The survey is to be performed once final lot grading is completed and stabilized. The survey will contain all information set forth in Section 7.3. of this Manual and will comply with Florida Statutes 472 and Florida Administrative Code 61G17-6. The

survey will demonstrate compliance with the approved lot grading plan and that the lot grading meets or exceeds the minimum requirements of the Florida Building Code.

7.5 INVESTIGATION OF LAND ALTERATION VIOLATIONS

7.5.1 Land Alteration Impacts on Drainage

a) Land alteration activities are not to impede or divert the flow of surface water entering or leaving land in a manner that adversely impacts offsite property. Observing the altered area from as many angles as possible is necessary. Establish the probable direction of flow by establishing the lowest point between the altered area and adjacent property. Surface water will seek the lowest area in which to settle.

b) In conducting an investigation, the task is to determine if a land alteration has occurred. It is a violation of the Hillsborough County Land Development Code if an alteration required a Natural Resources Permit and a permit was not obtained prior to the alteration activity. Typically, drainage complaints are triggered by unpermitted land alterations that have impeded or diverted surface water flow. Physical evidence or other documentation of an alteration is necessary to issue a citation for violation of the Land Development Code. If physical evidence is not present at the time of the investigation, it becomes the responsibility of the complainant to produce such evidence or documentation.

c) Prompt notification by the complainant to the County of any alleged unpermitted land alteration activity is vital for a proper investigation. If a violation cannot be identified, or sufficient documentation by the complainant cannot be produced, the investigation will be closed. Sufficient documentation can be either photographs or video recordings that have been properly dated.

7.6 NATURAL RESOURCES PERMITS

Applicants for single family/duplex Natural Resources Permits, including those for lots in platted subdivisions, as well as metes and bounds lots and parcels, must meet the submittal requirements established by the County. These requirements include providing existing and proposed corner grades, proposed FFEs, drainage flow arrows, tree surveys and location of environmental wetland lines.

Section 8.0 ROADWAY CULVERT AND BRIDGE DESIGN

8.1 GENERAL

8.1.1 Roadway Culvert Design uses the same factors as storm sewer design, including entrance, exit, and junction losses, which can significantly affect upstream (headwater) elevations and the required culvert sizes. Close attention should be given to the downstream water surface elevation (i.e. tailwater condition) in selecting the appropriate culvert sizes. The County uses procedures published by the FHWA HDS-5, FDOT Drainage Manual and DDG for analysis and design of culverts.

8.1.2 The design criteria for bridges presented in this Manual include: design frequency of storm event, design high water elevations, vertical and horizontal clearance requirements, and scour protection considerations for both the channel and embankments in the vicinity of a bridge. Per FHWA National Bridge Inspection (NBI) Standards, structures with an opening greater than 20 feet, measured along the roadway centerline between the extreme ends of the openings, must be classified as a bridge.

8.2 ROADWAY CULVERT DESIGN CRITERIA

8.2.1 Design Storm Frequency Requirements:

- Under high use or essential highway, or collector/ arterial roadway - 50-year event
- Under low use or non-essential highway, or local roadway - 25-year event

8.2.2 Design Flows: The determination of design flows for a culvert installation must be in accordance with the methods and procedures in FHWA HDS-5 and FDOT DDG Chapter 4.

8.2.3 Culvert Roughness: The roughness coefficients (i.e. Manning's N value) indicated in Table 8-1 must be used for culvert design.

8.2.4 Minimum Culvert Size: Criteria for minimum culvert size is in Table 8-2.

Table 8-1: Manning's n Values for Culvert and Storm Sewer Design

Pipe	N
Smooth Interior HDPE or PVC Pipe - all sizes	0.012
Concrete Pipe	0.012
Concrete Box Culvert Precast or Cast-in-Place	0.012
Spiral-Ribbed Corrugated Metal Pipe - 18" to 96"	0.012
Corrugated Metal Pipe (Annular - 2-2/3" by ½" Corrugation, round, all sizes)	0.024
Corrugated Metal Pipe (Annular - 3" by 1" Corrugation, round, all sizes)	0.027
Corrugated Metal Pipe (Helical - 2-2/3" by ½" Corrugation)	
Diameter or Span	N
15"	0.012
18"	0.014
24"	0.017
30"	0.018
36"	0.019
42"	0.020
48"	0.020
60" and larger	0.021
Corrugated Metal Pipe (Helical - 3" by 1" Corrugation)	
Diameter or Span	N
48"	0.023
54"	0.023
60"	0.024
66"	0.025
72"	0.026
78" and larger	0.027
Corrugated Metal Pipe Arch All Sizes:	
Corrugation Size	N
2-2/3" by ½"	0.024
3" by 1"	0.027
5"by 1"	0.027
Corrugated Structural Plate Pipe and Pipe Arch All Sizes:	
Corrugation Size	N
6" by 1"	0.030
6" by 2"	0.033
9" by 2-1/2"	0.034

Notes:
Refer to Section 3.6.4 of the FDOT Drainage Manual for pipe material types not covered in the above table.
Refer to Section 8.4 for acceptable pipe materials.

Table 8-2: Minimum Pipe Size Criteria

Pipe Application	Minimum Size
Culvert Crossing	18 inches or Equivalent (24 inches or Equivalent for Arterial Roads with area > 1 ac.)
Storm Sewer	15 inches or Equivalent
Side Drain	18 inches or Equivalent
Box Culvert	3 feet by 3 feet (precast) 4 feet by 4 feet (cast-in-place)

8.2.5 Pipe Size Increment: Round pipe sizes greater than 18 inches will be increased in six-inch increments (or elliptical equivalent).

8.2.6 Design Tailwater

a) The tailwater of the receiving SMF or waterbody (inlet or outlet control) must be taken into consideration for culvert design. Determine the tailwater elevation using hydrologic and hydraulic calculations based on the applicable design storm frequency.

b) When the tailwater elevation is higher than the proposed culvert crown elevation, the downstream hydraulic grade line elevation must be at the tailwater elevation.

c) When the tailwater elevation is below the culvert crown elevation, the downstream hydraulic grade line elevation must be at or above the crown of the proposed culvert for final design.

8.2.7 Allowable Headwater: The constraint that establishes the lowest allowable head water (AHW) should establish the basis for hydraulic design.

a) The AHW should be determined by the EOR but should not be set at an elevation that would violate the minimum freeboard requirements of 1 foot below the adjacent top of bank, nor should it be set above the roadway shoulder elevation.

b) When endwalls are used, the AHW should not exceed the top of the endwall at the entrance. If the top of the endwall is inundated, then special protection of the roadway embankment and/or ditch slope will be necessary for erosion protection.

c) Upstream analysis is necessary to identify any conditions where flooding is unacceptable. The AHW must be kept below these elevations (e.g. FFE of existing buildings)

d) The AHW should be checked against the BFE (i.e. 100-year 24-hour storm event) and the culvert should be sized to maintain flood-free conditions for one-half lane of two-lane facilities and one lane of multi-lane facilities.

8.2.8 Endwalls

a) All endwalls must be installed on all roadway culverts outside of the clear zone. If there is an existing endwall in the clear zone, it must be removed and replaced with a mitered end section (MES).

b) All precast endwalls are to be per FDOT Standard Plans. Cast-in-place endwall designs must be signed and sealed by a Florida licensed PE.

c) Entrance loss coefficients (Ke) for end treatment structure types are shown in FDOT DDG Appendix F: Application Guidelines for Pipe End Treatments. For other types of end treatments not referenced in the FDOT DDG, refer to FHWA HDS-5 Table C.2. Entrance Loss Coefficients.

d) Endwalls must not be used inside detention or retention ponds or within roadway clear zones.

e) End treatments conforming to fill slope (made of either metal or concrete) are commonly available from manufacturers and equivalent in operation to a headwall in both inlet and outlet control. End treatments incorporating a closed taper into the design have a superior hydraulic performance.

8.2.9 Side drains: Driveway side drains, existing or proposed, within the Hillsborough County right-of-way, must be designed as described below:

a) Minimum pipe cover standards are presented in Section 9.2.9.a.

b) Minimum standard side drain pipe size is 18” round Reinforced Concrete Pipe (RCP), or 18” round Corrugated Metal Pipe (CMP), or equivalent 14" x 23" Elliptical Reinforced Concrete Pipe (ERCP), or 14” x 23” Elliptical Corrugated Metal Pipe (ECMP) for shallow systems with minimal cover.

c) Side drain pipes must be sized to meet the flow conditions of the side drain system. Should there be a variation in the driveway pipe sizes along the roadway, please contact Hillsborough County’s Technical Service Division’s Stormwater Engineering Services at PW-Stormwater for assistance in determining required pipe size.

d) Installation or replacement of side drain pipes larger than 18” must equal existing pipe size of the side drain system while also meeting the required cover requirements. Equivalent ERCP's or ECMP’s are allowed to meet shallow conditions with a minimum cover thickness of 4” of "base material" over the side drain pipe.

e) Replace all side drain pipes made of plastic type materials and damaged metal pipes with round RCP or round CMP or equivalent ECMP and concrete or metal MES’s.

f) Pipes and MES’s replaced at driveways will require a 5’ wide shoulder to be constructed adjacent to each side of the driveway. The MES must not encroach on the shoulder. Refer to FDOT Standard Plans, Index 330-001 for shoulder requirements.

g) Existing 12" and 15” pipes that require extension to meet shoulder requirements must be replaced with pipes sized to meet the flow conditions of the side drain system. Please contact Hillsborough County’s Technical Service Division’s Stormwater Engineering Services at PW-Stormwater for direction if it is not possible to meet the clearance requirements by employing ERCP or ECMP and elevating the driveway apron.

h) MES must be used as pipe end treatments when pipe is in the clear zone. If there is an existing end wall in the clear zone it must be removed and replaced with a MES. Some site conditions may not allow for the installation of an MES within the clear zone and may require system reconfiguration. Contact Hillsborough County’s Technical Service Division’s Stormwater Engineering Services at PW-Stormwater for clarification.

i) Where new side drains or end treatments are installed, or a system is reconfigured with new drainage structures, notify Hillsborough County GIS office of the drainage system change providing the upstream and downstream pipe inverts conforming to the minimum

flow rate identified in Section 9.2.6. Where these assets are included in as-built submittals or Right-of-Way Use Permits no additional steps are required.

8.3 ROADWAY CULVERT DESIGN PROCEDURES

8.3.1 Culvert Hydraulics

a) For flow in culverts, a wide range of flow regimes can occur depending on flow rate, bed slope and cross-sectional geometry as well as other factors. For a given flow rate, there are two different depths of flow that have the same energy; a high velocity with low depth (supercritical flow) and a low velocity with a high depth (subcritical flow). There is one depth for a given flow, the critical depth, which corresponds to the minimum energy of flow and depends on the shape and size of the culvert. For any given discharge and cross-section, there is a unique slope (critical slope) that will produce and maintain flow at critical depth. Generally, for most culverts, the culvert slope will not be critical, and flow will be supercritical or subcritical.

b) A culvert can operate under either inlet control (the barrel has a greater hydraulic capacity than the inlet) or outlet control (the inlet has a greater hydraulic capacity than the barrel). During a given storm event a culvert may operate under inlet control, outlet control, or may transition from one control to the other as the storm progresses.

i. Culvert Design Criteria:

Culverts must be designed according to the "inlet and outlet control" methodology. The recommended design procedures can be found in the FDOT DDG, Chapter 4 and FHWA HDS-5.

ii. Inlet Control

Inlet control occurs when the capacity of the culvert is controlled at the culvert entrance by the depth of headwater and the entrance geometry of the culvert, including barrel shape, cross-sectional area, type of inlet edge, and shape of headwall. Culvert inlet control analyses must be performed in accordance with FDOT DDG Chapter 4 and FHWA HDS-5 for hydraulic characteristics, performance equations, and design procedures associated with the various inlet configurations. Refer to FHWA HDS-5, Section 3.1.3 Inlet Control for different configurations.

iii. Outlet Control

When a culvert is designed to efficiently operate under outlet control, the barrel typically flows full. Culvert outlet control analyses must be performed in accordance with FDOT DDG Chapter 4 and FHWA HDS-5 for hydraulic characteristics, performance equations, and design procedures associated with the various inlet configurations. Refer to FHWA HDS-5, Section 3.1.4 Outlet Control for different configurations.

8.4 MATERIAL SPECIFICATIONS FOR ALL CULVERTS

The design and procedure for selecting culvert and other stormwater management system pipe materials is governed by the optional pipe material criteria found in the FDOT Drainage Manual - Chapter 6 Optional Culvert Materials and the FDOT DDG - Chapter 8 Optional Pipe Material. An Optional Materials Tabulation sheet must be provided in the plans to identify optional pipe materials. Otherwise, it is understood that all pipes in the plan set are proposed to be concrete. Chapter 916 of the FDOT Design Manual (FDM) illustrates the method of presenting the acceptable

pipe materials in the plan. Specifications Regarding materials workmanship, joints and installations must be in accordance with FDOT Specifications Section 430 Pipe Culverts.

8.5 BRIDGE DESIGN

8.5.1 Bridges are used when clearance requirements for navigation, hydraulic efficiency, geometrics, constructability, environmental concerns, costs, or aesthetics preclude the use of multiple culverts. The basic hydraulic design criteria for bridges include the frequency of the design storm event, design high water elevation, allowable backwater, vertical and horizontal clearance, and channel and abutment protection. Any variations in meeting the bridge design criteria specified in this Manual must have prior approval in writing from County staff. FDOT design criteria and procedures (Drainage Manual, DDG, and Bridge Hydraulics Handbook) should be followed unless otherwise stated in this Manual.

8.5.2 Hydraulic Bridge Design Criteria: Each bridge requires development of site-specific design criteria that will meet the needs of the crossing.

a) Design Storm Frequency Requirements:

   i. Under high use or essential highway, or collector/ arterial roadway - 50-year 24-hour event

   ii. Under low use or non-essential highway, or local roadway - 25-year 24-hour event

b) Design High Water Elevation

   i. Design high water for freshwater channels is defined as the water elevation just upstream of the bridge for the design storm event.

   ii. In tidally influenced areas, the design high water is the greater elevation of either the design frequency tidal surge event or the design frequency freshwater event superposed with the one-year tidal surge event.

   iii. The 100-year flood must be conveyed through the structure with no rise in the preconstruction upstream, offsite 100-year water surface elevation.

c) Vertical Clearances: For bridges on piers or piles, the minimum required freeboard clearance is measured from design high water to low chord member. For collector and arterial roads, the minimum freeboard clearance must be two feet.

d) Horizontal Clearance: Horizontal clearance should be provided to comply with applicable Coast Guard or District requirements. In addition, environmental or fill constraints may influence the selected horizontal clearance. Bridge embankments must not encroach into FEMA designated floodways.

e) Scour: The effects of scour should be considered in the design of all bridge crossings. Consideration should be given for scour protection if velocities exceed three feet per second, or if highly erodible soil is encountered (See Tables 11-1 and 11-2).

Section 9.0 STORM SEWER DESIGN

9.1 GENERAL

The purpose of this section is to establish design criteria for storm sewer systems constructed within Hillsborough County. This criterion is intended to govern the design of new systems as well as the analysis and/or redesign of existing systems. Additional design information and criteria related to drainage of street and roadway pavement and inlet spacing along streets and roadways are included in Section 12.0.

9.2 DESIGN CRITERIA

9.2.1 Roadway Internal Collection Systems Design Storm Frequency Requirements:

- Arterial and Collector – 10-year event
- Local - 5-year event
- Other Structures for Conveyance of Stormwater Offsite Improvements – 25-year event
- For all contexts: The computed hydraulic grade line elevation at each junction/inlet in a system, including minor losses, must be below the lowest of the following: edge of pavement elevation, gutter line elevation, top of grate elevation, or top of manhole elevation.

9.2.2 Design Discharges: The determination of design flows for internal storm sewer systems must be by the Rational Method or the NRCS Method (individual subareas draining to inlets are typically less than 10 acres due to constraints on inlet capacity and spread-of-flow on pavement criteria - see APPENDIX A for methodology). For calculated times of concentration of 15 or less, a minimum time of concentration of 15 minutes must be used in the storm sewer analysis. If a drainage area is greater than 10 acres for either an internal or external system, the EOR must consult with County Stormwater Staff concerning the appropriate runoff method.

9.2.3 Allowable Materials: Refer to Sections 8.4.

9.2.4 Roughness Coefficients for Storm Sewer Systems: Refer to Table 8-1.

9.2.5 Minimum Pipe Size and Pipe Size Increment: Refer to Table 8-2.

9.2.6 Minimum and Maximum Physical Slopes

a) The minimum physical slope for a culvert must be that which will produce a velocity of at least 2.5 feet per second when the culvert is flowing full and the hydraulic gradient is equal to the bottom slope of the culvert. The effects of the end treatment and/or the conditions of any outfall must be considered in this hydraulic analysis. The Manning equation must be used to calculate the velocity under these conditions.

b) The maximum physical slope of a pipe will usually be less than 10 percent and must not exceed 15 percent.

9.2.7 Maximum Hydraulic Gradient and Maximum Hydraulic Grade Elevation

a) The maximum hydraulic gradient allowed will be that which will produce a velocity as shown in Table 9-1.

Table 9-1: Maximum Velocities for Given Types of Pipe

Type of Pipe	Maximum Velocity
O-Ring RCP	20 feet per second
Diaper Joint RCP	12 feet per second
Gasketed CMP	12 feet per second

b) For storm sewer outfalls, the maximum allowable velocity must take into consideration the soil stability and water level conditions at the pipe outlet. If the velocities exceed permissible velocities for the outlet soil conditions (see Section 11.1.6), the installation of staked sod, pavement or structural energy dissipaters may be required.

c) The maximum hydraulic grade elevation must be no higher than the edge of pavement at the inlet throat for roadway stormwater collection systems.

d) The maximum internal and outlet velocities are the same velocity, and must be computed by dividing the design discharge by the cross sectional area of the culvert.

9.2.8 Maximum Length of Pipe: The maximum length of pipe to be used without an access structure is specified in Table 9-2.

Table 9-2: Maximum Pipe Length Criteria

Culvert Size	Maximum Length (Feet)
15"or Equivalent	100*
18"or Equivalent	300
24" to 36" Pipe or Equivalent	400
42" and Larger Pipe or Equivalent	500
Box Culvert	500

* Up to 300 feet maximum length may be used when debris control is provided at any and all inlet locations, and full-flow culvert velocity exceeds three feet/second.

9.2.9 Pipe Cover, Clearances, and Conflict Structures:

a) Pipe cover for stormwater culverts must follow the FDOT Drainage Manual, Appendix C: Cover Height Tables. Achieve an absolute minimum cover thickness of four (4) inches of "base material" over side drain pipes when the minimum cover cannot be achieved.

b) Refer to the Hillsborough County Water, Wastewater and Reclaimed Water Technical Manual for clearances between the outside surfaces of stormwater culverts and outside surfaces of Hillsborough County utility pipes.

c) The minimum clearance between outside surfaces of stormwater culverts and other utilities or supply lines will be as directed in the technical design manuals for the specific utilities or suppliers (for example: gas, electric, telephone, cable TV, internet, signal interconnect, other municipality water, wastewater and reclaimed water, chilled water, hazardous liquid pipelines {fossil fuel, chemical}). If the utility or supplier does not have specific clearance between outside surface of their pipes or conduits, then the minimum clearance will be six (6) inches between the outside surface of their utility pipe and the outside surface of Hillsborough County stormwater culvert. Should it be impossible to maintain these

separations, then adequate means (i.e. encasement, flowable fill, full-depth pavement) must be utilized to protect both the storm sewer system and the obstructing facility.

d) Clearances within stormwater manholes will be as designated in the FDOT Standard Index 425-080.

e) Conflict structures must be included in the design where conflicts occur with other utilities. Utility lines passing through conflict structures must be a minimum of one foot above the bottom of the structure and any energy losses created by the presence of the utility must be accounted for in the storm sewer tabulations of the hydraulic grade line.

f) Any variation from the above criteria will necessitate the Design Deviation Memorandum procedure. See Section 1.6 of this Manual.

9.2.10 Design Tailwater: A design tailwater elevation for each outfall of a storm sewer system must be determined. The design tailwater elevation is the initial downstream elevation for the computed hydraulic grade line. The tailwater elevation must be determined from measured data, or by hydrologic and hydraulic calculations that use the same design storm frequency for sizing the storm sewer system. Storm sewer system outfalling into a stormwater pond with no calculated tailwater must begin the hydraulic gradient at the crown of the outfall pipe, or at an elevation equal to the average of the design high water and normal pool elevations, whichever elevation is higher The tailwater elevation for Tampa Bay and all adjoining bays will be assumed to be no lower than elevation 1.6 feet NAVD 88.
Storm Sewer Tabulations: In developments where storm sewers are planned, the Stormwater Design Calculations must include a Storm Drain Tabulation Form that can be found in FDOT DDG Chapter 6 Storm Drains and a map containing the individual sub-basin delineations with inlet/junction and pipe numbering system used.

9.2.11 Inlets, Manholes and Junction Boxes: All inlets, manholes and junction boxes must conform to the FDOT Standard Plans, the FDOT Specifications, and the Hillsborough County Transportation Technical Manual. All inlets are to have manhole lids for maintenance access. All manhole lids must state “HILLSBOROUGH COUNTY” along with “Dump no waste, waste drains to the waterway”, or similar language. All pipes are to be cut flush with the inside walls of inlets, manholes and junction boxes. Bubbler boxes are prohibited within County right-of-way.

9.2.12 Storm Sewer Alignment: All storm sewer alignments must avoid abrupt changes. Any changes in alignment or slope must take place within manholes or junction boxes. Inlets with manhole access must be used whenever possible. Storm sewer pipes are to be placed outside the edge of pavement and must be oriented such that maintenance can be accomplished within one lane of the roadway. Where it is unavoidable to place long sections of pipe greater than 1,000 feet directly underneath a travel lane, see Section 1.6 of this Manual.

9.2.13 Determination of Design Hydraulic Gradient Line

a) Local losses at structures must be determined for all inlets, manholes, wye branches and bends in the design of closed conduits. When more than one discharge enters a manhole, the pipes should not be oppositely aligned. If directly opposite discharge pipes are necessary, a deflector must be placed within the manhole in order to reduce the losses caused by the discharge jets impinging upon each other. See Chapter 6 of the FDOT DDG for computing minor losses.

9.2.14 Inlet Capacities

a) Maximum inlet capacities must be determined utilizing drainage calculations that demonstrate that the spread of flow will not exceed the criteria found in 12.6.1.

b) FDOT inlet capacity charts are to be utilized to determine flow capacity of FDOT standard inlets per Appendix I of the FDOT's DDG.

c) The effects of inlet flow bypass must be considered for the spacing and capture of subsequent downstream inlets.

9.2.15 Inlet Location: The location and spacing of inlets and manholes must be based on Table 8-2, inlet flow capacity and roadway spread analysis. Stormwater must not be transported across any intersection or in gutters for distances exceeding 500 feet.

9.3 DESIGN PROCEDURE

Refer to FDOT DDG Chapter 6 Storm Drains for recommended design procedures and FDOT Storm Drain Tabulation Form.

Section 10.0 ROADWAY UNDERDRAIN DESIGN

10.1 ROADWAY UNDERDRAIN CRITERIA

10.1.1 General

a) The criterion within this section pertains to the utilization of underdrains for the purposes of roadway groundwater level control only. For incorporation with SMF design, see Chapter 5 and Chapter 9 of the FDOT Drainage Manual and DDG, respectively.

b) A Letter of Certification from the EOR must be submitted for privately owned and maintained townhome subdivisions. See Appendix E for Certification of Townhome Subdivision Underdrain Design template.

c) Underdrains may be utilized to facilitate groundwater control for roadway applications only and must not be used for effluent treatment applications within roadway R/W or at stormwater ponds. . Arterial and collector roadways must be designed so that the SHWT is at least three feet below the low edge of pavement.

d) The construction plans must include all details necessary to illustrate the underdrain locations and design/construction parameters.

e) Underdrains are considered to be permanent controls of the groundwater table. The design of the roadway may be based on long term groundwater level control through the use of underdrains. Underdrain system must be designed by a qualified professional with experience in groundwater analysis.

f) The use of roadway underdrains is dependent on soil types, seasonal high water table (SHWT) elevation, land slope, elevation of the roadway base, and outfall conditions. Roadway underdrains are required as follows:

   i. SHWT within three feet of low edge of pavement - underdrain on one side of road.

   ii. SHWT within two feet of low edge of pavement - underdrain on both sides of road.

   iii. SHWT less than one foot below low edge of pavement - elevate roadway.

   iv. An analysis of SHWT sustainability will be required if a "controlled" SHWT level (i.e., a SHWT level controlled by a manmade system to be lower than the estimated predevelopment SHWT elevation) is considered in determining the need to elevate a proposed roadway. The analysis must include the evaluation of the proposed underdrain system for an entire, typical “wet season” pattern of rainfall on the proposed roadway, project area, and receiving waters, to determine if the controlled SHWT elevation can be maintained. Recommendations made by the geotechnical EOR must be included in the plans.

g) The underdrains must be centered 24 inches outside of the curb and a minimum of 24 inches below the bottom of the curb and must have a positive slope with inverts set so it has a positive outfall.

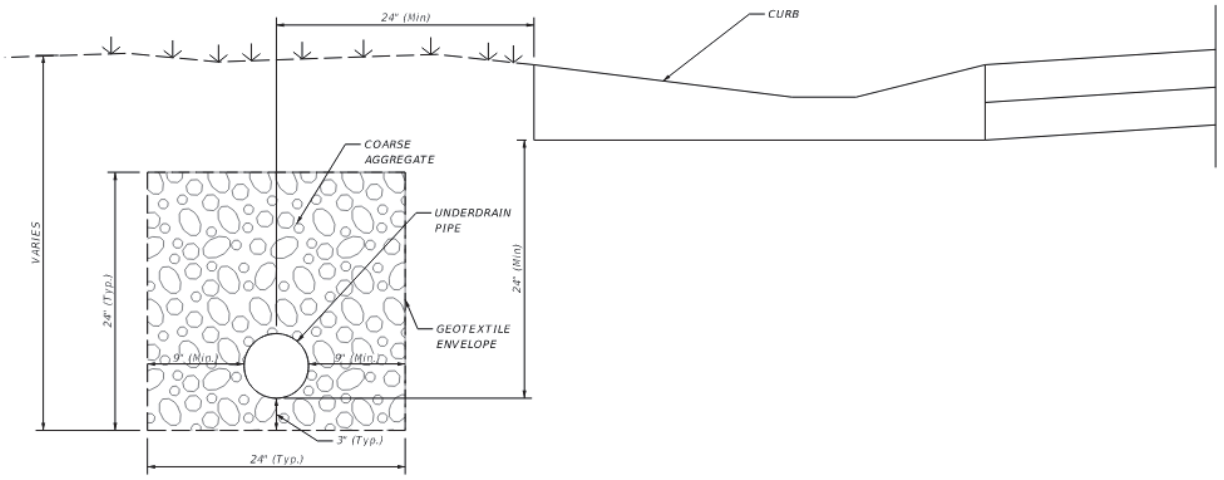


Figure 10-1: Roadway Underdrain

h) All underdrain designs must utilize filter fabric, underdrain pipe, and filter aggregate.

i) When an underdrain is required to control high groundwater adjacent to proposed roadways, the roadway base must not be limerock.

10.1.2 Filter Fabric

a) A filter fabric envelope must be used with underdrains. Refer to FDOT Specifications, Section 514 and Standard Plans, Index 440-001.

b) The filter envelope must weigh a minimum of 2.5 ounces per square yard, must retain soil particles larger than two hundred twelve (212) microns (No. 70 sieve) and must pass particles finer than 25 microns.

c) When tested in accordance with ASTM D1682, the grab strength (wet) of the filter fabric must not be less than 100 pounds and the grab elongation must not be less than 60 percent.

d) Storage and handling of the filter fabric must be in accordance with the manufacturer's recommendation.

e) Torn or punctured filter fabric must not be used.

f) The filter fabric must not be exposed to sunlight for periods exceeding the manufacturer's recommendation, or six weeks, whichever is shorter.

g) The filter fabric must be placed around the aggregate and, if appropriate and approved by the County staff, around the underdrain pipe.

10.1.3 Underdrain Pipe

a) Underdrain pipe must be of sufficient size to effectively control and convey the anticipated flow. Refer to FDOT Standard Specifications for Road and Bridge Construction Section 440. Calculations are to be submitted to justify proposed underdrain size. Refer to FDOT DDG Section 9.3.4.4

i. Diameter of perforations must be 3/16” to 3/8”.

b) The length is not to exceed 500 feet without increasing pipe size to the next diameter. Cleanouts are to be spaced no greater than every 250 feet, be located at the ends of the underdrain, and be in accordance with the FDOT Standard Plans, Index 440-002. Cleanouts are to extend to the ground surface and all cleanout locations must be marked, in a permanent manner, along the roadway curb or on other appropriate and permanent fixtures as approved by the County staff. The cleanout cap is to be enclosed in a Standard Concrete Meter Box with Cast Iron Cover. Cleanout caps must not be installed in driveways, sidewalks, curbs or any other concrete structures.

c) Underdrain pipe slopes should be sufficient to maintain velocities at or above two feet per second for design flow conditions. Underdrain must typically be constructed on a grade parallel with the edge of pavement profile, but in no case must the minimum underdrain slope be less than 0.10 percent).

d) Underdrain pipe material must be polyvinyl-chloride.
   i. Underdrain materials must be in accordance with the FDOT Standard Plans, Index 440-001 and the FDOT Specifications, Section 948.
   ii. The tubing must not be exposed to sunlight for periods exceeding the manufacturer's recommendation, or six weeks, whichever is shorter.
   iii. Tubing must be placed and maintained true to line and grade until secured with compacted backfill.
   iv. Perforated tubing must not be placed under street pavement. When tubing must be extended beneath the crossroad, a non-perforated section must be used.
   v. Underdrain sections which deflect or collapse greater than five percent must be rejected.

10.1.4 Aggregate

a) Fine aggregate for cement concrete, in accordance with the FDOT Standard Specifications for Road and Bridge Construction Section 902, must be used to backfill the trench above and around the underdrain aggregate envelope. Other backfill material may be used if tests are submitted to County staff indicating the material will serve as a filter.

b) The minimum density of the backfill must be in accordance with the Testing Schedule provided in Appendix E of the Transportation Technical Manual for Subdivision and Site Development Projects.

c) The underdrain cross-section is to be in accordance with FDOT Standard Plans. FDOT Type II will be the only underdrain design allowed for arterial and collector roadways within Hillsborough County.

Section 11.0 NON-ROADWAY DITCH DESIGN

11.1 GENERAL DESIGN CRITERIA

Hillsborough County Public Works Department retrofit projects are exempt from the following criteria to the extent that public safety is not compromised and is subject for consideration on a project-by-project basis.

11.1.1 Design Storm Frequency: 25-year 24-hour event.

a) Design Discharge Methodology: See APPENDIX A for methods and procedures to be used for the determination of design flows for an open channel system.

11.1.2 Design Methodology

a) See Chapter 3 of the FDOT DDG for design methodology approach.

b) No credit for water quality or quantity volume storage will be allowed for ditches. A ditch is considered to be a means of conveyance only.

c) No ditch blocks will be permitted in road right-of-ways for internal subdivision drainage.

d) All projects should consider Low Impact Development (LID) and Green Infrastructure (GI) elements for incorporation into the stormwater design.

11.1.3 Maximum Side Slope: The maximum side slope must be 1:4 for all non-roadway ditches.

11.1.4 Minimum Bottom Width: The minimum bottom width for ditches must be four feet.

11.1.5 Design Tailwater

a) All open channel systems must be designed taking into consideration the tailwater of the receiving facility or body of water.

b) The appropriate tailwater elevation must be determined by hydrologic and hydraulic calculations based upon the design storm event.

11.1.6 Maximum Allowable Velocities for Unlined and Lined Open Channels

a) The maximum allowable velocities for unlined open channels (bare soil condition) are listed in Table 11-1 and based on a flow depth of 3 feet.

Table 11-1: Maximum Allowable Velocities for Unlined Open Channels

Soil Type	Allowable Velocity (f.p.s.)
Silt or Fine Sand	1.50
Sandy Loam	1.75
Silt Loam	2.00
Firm Loam	2.50
Stiff Clay	3.75
Hardpans	6.00

b) The maximum allowable velocities for lined open channels are listed in Table 11-2.

Table 11-2: Maximum Allowable Velocities for Lined Open Channels

Type	Allowable Velocity (f.p.s.)
Grassing & Mulching	See Table 11-1
Standard Sod	4.0
Lapped Sod (25% overlap)	5.5
Asphaltic Concrete	8.0
Concrete Ditch Paving	10.0

11.1.7 Minimum Longitudinal Grade: For open channels that are intended to remain dry except during runoff conditions, the minimum grade allowable must be 0.10 percent.

11.1.8 Skewed Ditch Alignment at Crossing: Roadway culverts must maintain skewed ditch alignment at road crossings.

11.1.9 Channel Curvature: The minimum channel centerline radius must be the greater of either 50 feet or 10 times the bottom width. Channel protection must be provided when channel curvature produces erosive velocities in excess of those shown in Section 11.1.6.

11.1.10 Minimum Freeboard: A minimum freeboard of one foot must be maintained between design high water surface elevation and the adjacent top of bank.

11.1.11 Ditch Erosion Protection

a) Ditches must be provided with permanent and appropriate erosion protection. Erosion protection may consist of sod, seed & mulch, hydro-seeding, other approved vegetation, or any type of approved ground cover/liner/mat suitable to stabilize the soil of the proposed ditch side-slopes or banks.

b) When turf protection is used, ditches must be sodded, sprigged or seeded for a lateral distance extending from within one foot of the road pavement to the top of the swale ditch backslope.

c) Ditches must be vegetated sufficiently to stabilize soil in accordance with the FDOT Standard Specifications for Road and Bridge Construction, latest edition. Side slopes steeper than 1:5 must be vegetated sufficiently to stabilize soil.

d) Ditch pavement must be in accordance with the FDOT Standard Plans and the FDOT Specifications, latest editions.

e) Unarmored side slopes extending from a ditch pavement section must be shaped and vegetated sufficiently to stabilize soil on a slope of 1:4 or flatter.

11.1.12 Grading Adjacent to Ditches: Areas adjacent to ditches must be graded to preclude the entrance of excessive stormwater runoff except at locations provided for such purpose.

11.2 UTILITIES CROSSING DITCHES

11.2.1 Aerial Crossing: A minimum of one-foot clearance is required from the design high water to outside of utility with the area underneath the crossing to be concrete lined to prevent vegetative growth.

11.2.2 Underground Clearance: A minimum of two-feet of cover is required from the design ditch invert to the utility.

11.2.3 Utility Identification: Utilities must be adequately marked to protect against accidental damage during maintenance operations.

11.2.4 Aerial Supports: No aerial supports must be allowed in the confines of the ditch.

11.2.5 Utility Crossing Demarcation: Underground and overhead utility crossings at all floodways, open channels and ditches must be clearly labeled onsite with suitable markers or permanent signs.

Section 12.0 ROADWAY DRAINAGE DESIGN

12.1 GENERAL

12.1.1 Roadway drainage design consists of the proper selection of design factors to effectuate removal of the design storm rainfall from the pavement in a cost-effective manner. In addition, the design should provide for the preservation of safety, traffic capacity and integrity of the road system.

12.1.2 Hillsborough County has adopted the FDOT Drainage Manual as the primary criteria for roadway drainage design, except for modifications as mentioned herein.

12.1.3 Roadway design criteria can be found in the TTM and HCTDM.

12.2 LOW ROADWAY BASE CLEARANCE AND EDGE OF PAVEMENT ELEVATION

12.2.1 Design criteria for roadway base clearance and low edge of pavement elevation are specified in Table 12-1. Also refer to Section 10.0 for additional criteria related to controlling the seasonal high water table (SHWT) elevation.

12.3 DESIGN STORM FREQUENCY

12.3.1 Refer to the FDOT Drainage Manual for design storm frequency criteria. The computed hydraulic grade line elevation at each junction/inlet in a system, including minor losses, must be below the lowest of the following: edge of pavement elevation, gutter line elevation, top of grate elevation, or top of manhole elevation.

12.4 STORMWATER RUNOFF DETERMINATION

12.4.1 The design peak rates of stormwater runoff of the pavement drainage system must be determined by the Rational Method or the NRCS Method. See Chapter 2 of the FDOT DDG.

12.5 ROADWAY DITCHES

12.5.1 Design

a) Roadway ditches must be sized using the criteria in Section 11.1.

b) In all cases, drainage area, velocity, and depth of flow data must be included in the Stormwater Management System Design Calculations.

c) The minimum bottom width must be four feet.

d) The maximum side slope must be 1:4. If the ditch is located completely outside of the clear zone, then no Design Deviation is required.

e) Standard ditch sections must be provided along external roadways.

12.5.2 Improvements Beyond Project Limits

a) Ditch conveyance design must be accounted for in limits downstream of project that receive discharge from the project.

b) Standard ditch sections in the plans must be provided for downstream offsite limits and accounted for in the corresponding ditch calculations.

c) County projects will require right-of-way acquisition for the limits of any ditch improvements outside the project limits.

12.5.3 Maximum Allowable Velocity: The maximum allowable velocities for unlined and lined open channels are listed in Tables 11-1 and 11-2, respectively.

12.5.4 Roadway Ditch Grades

a) Minimum: A 0.10 percent grade, or the minimum required to provide for the design flow, whichever is greater, must be the minimum allowable grade.

b) Maximum: Maximum allowable ditch grades will be governed by maximum allowable velocities as listed in Tables 11-1 and 11-2.

c) Ditch Protection: Ditch protection is required when the design velocities exceed allowable velocities for unlined channels. Refer to Tables 11-1 and 11-2.

12.5.5 Depth of Roadway Ditches

a) Minimum Depth: Two feet from the low edge of shoulder.

b) Maximum Depth: 3.5 feet from the low edge of shoulder.

12.5.6 Grassing and Mulching, Sodding: All roadway ditches must be grassed and mulched or sodded in accordance with the FDOT Standard Specifications for Road and Bridge Construction, latest edition. Side slopes steeper than 1:5 must be sodded.

12.6 STREET DRAINAGE

12.6.1 Design Criteria

a) The maximum length of gutter prior to the need for an inlet must be controlled by the allowable spread of flow on the pavement, or 500 feet, whichever is smaller.

b) See Florida Greenbook, Chapter 20, Section F.7 Spread Standards for spread criteria. No spread of flow calculations must be required for inlet spacing that is less than 300 feet. The time of concentration for spread of flow calculations must be equal to the appropriate overland flow travel time

c) Stormwater must not be transported across major street intersections.

d) Streets that exceed a one percent longitudinal or gutter slope must have inlets constructed at intersections to intercept upstream flow. Curb inlets, including inlet transitions, must not be located within handicap drop curb locations. Inlets should not be placed within curb returns.

12.6.2 Gutter Flow Calculations: Refer to Chapter 6 of the FDOT DDG for determining the spread of flow in gutters.

Table 12-1: Design Criteria for Roadway Base Clearance and Low Edge of Pavement Elevation

Location	Freeboard from DHW to Low Edge of Pavement Elevation	Basis for Determining the DHW Elevation	Minimum Standard Roadway Base Clearance (1)	Allowable Roadway Base Courses (3)
Near Hillsborough Bay, Old Tampa Bay & Tampa Bay	> 0 foot	5.1 feet NAVD88 (4)	None	Crushed Concrete or Asphalt Base
Near Retention Ponds	> 1.0 foot	100-year storm	2.0 feet (2)	Other Roadway Bases
Near Detention Ponds & Streets with crushed concrete (3) Roadway Bases	> 0.5 foot	25-year storm	2.0 feet (2)	Other Roadway Bases
Streets with Other Roadway Bases	> 1.0 foot	25-year storm	2.0 feet (2)	Other Roadway Bases

(1) The roadway base clearance is defined as the distance between the seasonal high water table (SHWT) elevation and the bottom of roadway base elevation. The SHWT elevation must be determined using the Soil Survey of Hillsborough County, Florida and acceptable engineering practices based upon the United States Department of Agriculture, NRCS methodology. The results must be included in a subsoil investigation report and be signed and sealed by a qualified soils engineer.

(2) This criterion can be reduced to greater than or equal to one foot if crushed concrete, soil cement base, or asphalt is utilized. However, underdrains must be installed on each side of the roadway and designed to maintain a 1.0-foot minimum roadway base clearance. Refer to Section 10.0 for roadway underdrain design and criteria.

(3) Crushed concrete or soil cement may be used as allowed per Hillsborough County criteria.

(4) Elevation derived from NOAA Tide Data.

Section 13.0 WATER QUALITY PROTECTION AND IMPROVEMENT

13.1 GENERAL

13.1.1 The protection, and the improvement of water quality, as well as the control of stormwater and sediment runoff into receiving waters are primary concerns for Hillsborough County. The management of stormwater runoff is essential for flood control and for the containment of pollutants which might otherwise result in water quality degradation of Tampa Bay and other receiving waters. Additionally, the County requires that any water entering the MS4s meet Class III water quality standards, as established by the Florida Department of Environmental Protection.

13.1.2 All projects should consider Low Impact Development (LID) and Green Infrastructure elements for incorporation into the stormwater design.

13.1.3 In order to minimize the potential water quality impacts of new development, both during and after site construction, design and management requirements are specified herein for:

a) Stormwater Treatment and Pond Design

b) Erosion and Sediment Control

c) Construction Site Operation and Maintenance

d) SMF Operation and Maintenance

13.1.4 These requirements are established by the Future of Hillsborough County Comprehensive Plan, the FDEP NPDES Program and the Hillsborough County Stormwater Quality Management Ordinance (Ordinance # 14-4 as amended). The FDEP and the U.S. Environmental Protection Agency have identified certain water bodies or parts of water bodies that are impaired and not meeting state water quality standards. New construction that discharges to these impaired water bodies must demonstrate adherence to statewide water quality standards for reduction of pollutant loadings. These requirements are applicable to all new development and redevelopment, and to all infrastructure retrofitting and maintenance activities.

13.1.5 A proposed land alteration activity must demonstrate no negative impacts to the water quality of receiving water bodies during construction and operation phases through use of an empirical model such as BMPTrains or other accepted models.

a) Stormwater Treatment and Pond Design

i. The long-term protection of water quality can be provided by the proper design, construction, operation and maintenance of effective stormwater treatment systems. Effective stormwater treatment systems are required for new and redeveloped sites as identified in Section 5.0.

ii. SWFWMD also requires the construction of a stormwater treatment system as part of a permitted site's overall stormwater management system. Therefore, the submittal to the DSD of a copy of the appropriate SWFWMD permit for a site is sufficient to demonstrate that reasonable stormwater treatment provisions will be provided. Submittal of the approved SWFWMD permit to the County is required before final construction plan approval can be authorized.

iii. The integration of maintainable sediment sumps into the design of a stormwater

pond is recommended. These sumps should be located at the outlet ends of the storm sewer pipes or other stormwater conveyance structures which discharge into a pond.

iv. GI and LID treatment systems are encouraged per the County's Green Infrastructure Manual.

b) Erosion and Sediment Control: The site construction plans and associated documentation must include a detailed plan to control soil erosion and sedimentation during the construction phase of the project. Erosion and sedimentation control plans must be submitted and contain a systematic and comprehensive erosion sedimentation control plan for both the construction phase and the completed project. Proposed temporary and permanent erosion and sediment control plans must be submitted with each application for development approval. These plans must specify in detail the erosion and sedimentation control measures to be used during all phases of clearing, grading, filling, construction and permanent development, and accurately describe their proposed operation Erosion and sediment control measures shall apply to all features of the construction site, including street and utility installations as well as to the protection of individual lots. Erosion and sedimentation control provisions and plans must be in accordance with the latest applicable specifications and recommendations as contained in the Florida Department of Environmental Protection's (FDEP's) publication, "The Florida Stormwater, Erosion and Sedimentation Control Inspector's Manual", latest edition. Such provisions must address:

i. Methods of Controls: Erosion must be minimized and sediment retained on the site of development through the application of best management practices approved as part of the Natural Resources permit, while assuring that any discharges from the site do not cause or contribute to a violation of Florida's turbidity standard per 40 Code of Federal Regulations (CFR) 131. Construction activities are to be suspended if such offsite discharge occurs and may be resumed only after the cause has been determined, and appropriate measures are implemented, for the offsite discharge to meet Florida's turbidity standards. Methods of control must include, but not limited to, the following:

1) Providing turbidity barriers or similar devices for the duration of dewatering and other construction activities in or adjacent to wetlands or other surface waters;

2) Stabilizing newly created slopes or surfaces in or adjacent to wetlands and other surface waters to prevent erosion and turbidity;

3) Construction sequencing, to maximize the retainage of sediments onsite (see Chapter 4 of FDEP manual).

4) Limiting the amount of clearing necessary;

5) Staging clearing activities to minimize the length of time any area is left unstabilized and to minimize the total area cleared at any one time;

6) Temporary gravel construction entrances;

7) Silt fences;

8) Storm drain inlet protections;

9) Temporary diversion dikes;

10) Temporary sediment traps;

11) Temporary sediment basins;

12) Temporary stream crossings;

13) Seeding so as to establish an appropriate vegetative ground cover;

14) Sodding;

15) Erosion control and seeding mats; or

16) Other suitable methods as approved by the County.

ii. Where the previously mentioned allowable methods will not, or do not, sufficiently control erosion and sediment runoff, installation of part or all of the final stormwater treatment system components, including internal grading to direct stormwater toward the system, must be required. The construction plans must specify that the contractor is responsible for successfully controlling erosion and sediment runoff. If the recommended or specified techniques do not sufficiently control erosion and sediment runoff, then the contractor must successfully implement alternative techniques.

iii. Installation of Controls: No clearing, excavation, filling, or other disturbing of the natural terrain will be permitted until County-approved erosion and sediment control measures have been properly installed, in accordance with the approved plans, between the area to be disturbed and adjacent property, water bodies, watercourses (including inlets and culverts), and wetlands. Clearing and excavation required for installation of erosion and sedimentation control devices is allowed provided no activity occurs beyond five feet from the control devices as specified in the approved plans.

iv. Maintenance of Controls: Once properly installed, erosion and sediment controls must be continuously maintained until a permanent vegetative ground cover is established. Any site or portion thereof where work is not being performed as part of the current phase of development, and which remains, or is projected to remain, cleared for over seven days, must be stabilized to minimize the occurrences of both water and wind erosion through measures such as the establishment of appropriate vegetative ground cover. All disturbed areas must be permanently stabilized through the establishment of appropriate vegetative ground cover upon completion of development activities on the site.

c) Construction Site Operation and Maintenance: Proper management and operation of construction site activities, and continuous maintenance of safeguards will further reduce the potential for water quality impacts attributable to development. Construction plans or associated documentation must address issues such as:

i. Providing proper construction access for barges, boats and equipment to ensure that propeller dredging and rutting from vehicular traffic does not occur.

ii. Maintaining construction equipment to ensure that oils, greases, gasoline, or other pollutants are not released into any wetlands, other surface waters, or County MS4.

iii. Controlling the discharge from spoil stockpiles.

iv. Providing measures to minimize the tracking of soil, mud, concrete, etc., onto public roadways or other offsite paved areas. Measures to include, but are not

limited to, temporary gravel entrances, rumble racks, and wash stations. All must be maintained in functional order during construction.

v. Providing measures to control dust generation and movement.

vi. Providing a Spill Prevention & Response Plan. See Chapter 62-730, F.A.C. and Chapter 403, Florida Statutes (F.S.) for hazardous material handling requirements.

vii. Preventing any other discharge or release of pollutants during construction or alteration that will cause violations of any state or local water quality standard, including but not limited to:

1) The rules of the Environmental Protection Commission of Hillsborough County.

2) The rules of FDEP.

3) The rules of SWFWMD.

d) Stormwater Management Facility Operation and Maintenance

i. A recommended operation and maintenance plan must be developed and submitted along with the approved plans and associated documentation.

ii. All stormwater inlets, pipes and ponds must be cleaned of accumulated sediments upon completion of site construction activities, and prior to final project closeout or final approval and acceptance of facilities for maintenance by the County.

iii. The final grading for ponds must not be completed until all other construction activities, including the cleaning of inlets and pipes, have been completed.

APPENDIX A: DETERMINATION OF STORM RUNOFF

DETERMINATION OF STORM RUNOFF

A.1 GENERAL

This appendix outlines the approved methods available to the EOR for estimating storm runoff. Of the many methods available, this Manual makes use of three (listed below), which have proved convenient and reliable.

* THE RATIONAL METHOD (for areas of ten acres or less)
* THE MODIFIED RATIONAL METHOD (for areas of ten acres or less)
* SCS SYNTHETIC UNIT HYDROGRAPH METHOD (SCS)

These methods should be used to calculate the discharge and runoff volumes resulting from rainfall events of specified design frequency and duration.

A.2 RAINFALL CRITERIA

See Chapter 2 of the FDOT DDG for guidance on obtaining rainfall intensity and depth design data.

The only allowable rainfall distribution for design use in Hillsborough County is the SCS Type II Florida Modified rainfall distribution. This distribution can be found in Table A-1 and can be used for the calculation of both the pre- and post- development runoff hydrographs.

A.3 TIME OF CONCENTRATION

See Chapter 2 of the FDOT DDG for guidance on performing time of concentration calculations.

A.4 RATIONAL METHOD.

See Chapter 2 of the FDOT DDG for guidance on utilizing the Rational Equation.

A.5 MODIFIED RATIONAL METHOD INFLOW HYDROGRAPH APPROACH

See Chapter 2 of the FDOT DDG for guidance on utilizing the Modified Ration Method hydrograph.

A.6 SCS SYNTHETIC UNIT HYDROGRAPH METHOD

See Chapter 2 of the FDOT DDG for guidance on utilizing the NRCS Hydrograph.

Table A-1: SCS Type II Florida Modified – Rainfall Distribution (24-Hours)

Time (hrs)	Rainfall Ratio
0.0	0.000
0.5	0.006
1.0	0.012
1.5	0.019
2.0	0.025
2.5	0.032
3.0	0.039
3.5	0.047
4.0	0.054
4.5	0.062
5.0	0.071
5.5	0.080
6.0	0.089
6.5	0.099
7.0	0.110
7.5	0.122
8.0	0.134
8.5	0.148
9.0	0.164
9.5	0.181
10.0	0.201
10.5	0.226
11.0	0.258
11.5	0.308
12.0	0.607
12.5	0.719
13.0	0.757
13.5	0.785
14.0	0.807
14.5	0.826
15.0	0.842
15.5	0.857
16.0	0.870
16.5	0.882
17.0	0.893
17.5	0.904
18.0	0.913
18.5	0.923
19.0	0.931
19.5	0.940
20.0	0.948
20.5	0.955
21.0	0.962
21.5	0.969
22.0	0.976
22.5	0.983
23.0	0.989
23.5	0.995
24.0	1.000

APPENDIX B: RECOMMENDED DESIGN PROCEDURE FOR CULVERTS

RECOMMENDED DESIGN PROCEDURES

B.1 RECOMMENDED DESIGN PROCEDURE FOR ROADWAY CULVERTS

See Chapter 4 of the FDOT DDG for guidance on roadway culvert design procedures.

B.2 RECOMMENDED DESIGN PROCEDURE FOR STORM SEWERS

See Chapter 6 of the FDOT DDG for guidance on closed storm sewer design procedures and the Storm Drain Tabulation Form template.

APPENDIX C: DESIGN AIDS

DESIGN AIDS

- See Appendix B of the FDOT DDG for overland flow velocity, shallow concentrated flow, and kinematic wave for overland flow design aids.
- See Appendix C of the FHWA HDS-5 for roadway culvert nomographs.
- See Chapter 6 of the FDOT DDG for Storm Drain Tabulation Form template.

APPENDIX D: GLOSSARY

GLOSSARY

The following definitions are for the purpose of making clear and distinct the intentions of the language used in this Manual except where specific definitions are used within specific sections. For the purpose of such sections, the following terms, phrases, words and their derivation must have the meaning given herein and not be inconsistent with the text. Throughout the Manual and herein, words used in the present tense include the future tense; words used in the plural number include the singular number; and words used in the singular number include the plural number.

ADEQUATE OUTFALL
Outfall which has no known inadequacies or flooding problems during a 25-year/24-hour storm, but an increase in inflow could cause an increase (actual or computed) in water surface elevations.

ADVERSE IMPACT
Any modification, alteration, or effect on a feature or characteristic of stormwater management systems/facilities, other water bodies, groundwater and natural resources, or flood prone lands, including their quality, quantity, hydrodynamics, surface area, species composition, living resources, aesthetics or usefulness for human or natural uses, which are or potentially may be harmful or injurious to human health, welfare, safety or property, biological productivity, diversity or stability, or which reasonably interfere with the enjoyment of life or property including outdoor recreation or cause damage to adjacent property owners, due to development and other construction activities. The term includes secondary, indirect and cumulative as well as direct impacts.

ANGLE OF REPOSE
Maximum angle at which a sideslope in natural bare soil will not have a high risk of failure due to gravitational forces.

ANTECEDENT MOISTURE CONDITIONS
The degree of moisture within, or the wetness of, a drainage basin and/or watershed at the beginning of a storm. Generally, for design purposes, this condition is defined in terms of the quantity of rainfall which can be expected to occur during a specified period of time prior to the inception of the design storm. Antecedent Moisture Condition II is assumed in Hillsborough County for the SCS Unit Hydrograph Methodology.

AREA OF SPECIAL FLOOD HAZARD
Land in the floodplain within a community subject to a one percent or greater chance of flooding in any given year.

ARTERIAL STREET
A road or thoroughfare that has been or may be designated for the movement of large volumes of traffic between points in the County, which said road will ordinarily have controlled or limited rights of access.

ATTENUATION
The reduction of stormwater discharge through the provision of storage volume, to minimize downstream impacts. (See also Detention Pond)

AVERAGE (or MEAN) ANNUAL FLOOD
A flood which has a statistical recurrence interval of 2.33 years.

BASE FLOOD ELEVATION (BFE)
A flood having a one percent chance of being equaled or exceeded in any given year.

BASEFLOW
Surface water recharge which originates from ground water seepage during low flow conditions.

BASIN (DRAINAGE BASIN or AREA)
Surface drainage area which is defined by topographic boundaries that direct stormwater runoff to a common point or receiving waters, and is a subdivision of a watershed.

BEST MANAGEMENT PRACTICES (BMPs)
Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce pollutants from entering Hillsborough County's Municipal Separate Storm Sewer System (MS4) or being discharged from the MS4. BMPs include, but are not limited to, both structural and nonstructural treatment methods and practices to control the discharge of pollutants.

BRIDGE
A structure required to carry traffic or other moving loads across a channel, ditch or other conveyance way when a culvert or culverts are not suitable, due to clearance requirements for navigation, hydraulic efficiency, geometrics, constructability, environmental concerns, costs or aesthetics.

CAPACITY
The limiting volume or flow that the conveyance channel, pond, pipe or other hydraulic structure can manage, without causing adverse impact, in accordance with the criteria specified in this Manual.

CAPACITY ANALYSIS
A determination of a Stormwater Management facility's ability to provide a given Level of Service, or the determination of the Level of Service of the facility.

CAPITAL IMPROVEMENT
The acquisition of land or property and/or the construction of, or improvements to public facilities including, but not limited to, the following: Building or structure, stormwater or surface water management facility, utility, road, park, open area or other public place requiring the expenditure of public monies.

CATCH BASIN
Inlet structure that is usually built at the curb line of a street which permits surface water runoff to flow into a storm sewer while retaining grit and debris below the invert elevations of the storm sewer pipes.

CATCHMENT OR SUBAREA
Small area of surface drainage which is a subdivision of a drainage basin.

CHANNEL
A natural or artificial watercourse of perceptible extent, with a definite bed and banks to confine and convey continuously or periodically flowing water. Channel flow thus is that water which is flowing within the limits of the defined channel.

CHANNELIZATION
Creation of a new channel, or alteration of an existing channel's width, depth, length, lining, and/or geometry in order to improve flow capacity and or channel storage.

CLOSED DRAINAGE BASIN OR BLIND
A drainage basin which does not have a positive outfall for storm events less than or equal to the 25-year, 24-hour event. The receiving waters in such drainage basins are considered to have "volume sensitive" capacity, and the allowable discharges from new developments or redevelopments in such drainage basins at least partially rely upon percolation (and other groundwater flow), evaporation, and evapotranspiration.

COLLECTOR STREET
A roadway designated under the Hillsborough County Functional Classification System.

COMPENSATING STORAGE
Constructed or otherwise provided new flood storage volume required to compensate for storage volume lost due to filling, within the portions of the 100-year floodplain associated with the storage and/or conveyance of stormwater.

CONSTRUCTION
The act of altering land or vegetation in preparation for development, or any action or activity which results in an alteration of either land, vegetation, or existing structures or the building of new structures.

CONSTRUCTION ACTIVITIES (FOR NPDES REQUIREMENTS ONLY)
Includes clearing, grading, and excavation activities except operations that result in the disturbance of less than five (5) acres of total land area which are not part of a larger common plan of development or sale.

CONSTRUCTION PERMIT
Surface water management permit issued by the Southwest Florida Water Management District authorizing construction, alteration or abandonment of a surface water management system in accordance with the terms and conditions of the permit. Also, a permit obtained from the Building Department to construct in County rights-of-way or easements.

CONTROL ELEVATION
The crest elevation of a control structure’s overflow weir, the weir through which the detention volume of a pond or lake is discharged.

CONTROL (or WATER LEVEL CONTROL or DISCHARGE) STRUCTURE
A structural device, usually of concrete, metal, etc., which regulates the release of water from a project to the receiving waters.

CONTROLLED SEASONAL HIGH WATER ELEVATION
The elevation to which the groundwater can be expected to rise during a normal wet season after modifications to the surface and groundwater regime have occurred in the area.

CONVEYANCE
The transport of stormwater via pipe and/or open channel system(s).

CONVEYANCE WAY
A path for water to move from one place to another in a continuous flow.

CRITICAL DEPTH
Depth at which the specific energy (sum of depth and velocity head) is minimum.

CRITICAL SLOPE
Slope required to maintain uniform flow at critical depth.

CULVERT
A structure supporting a public roadway that crosses transversely over a watercourse.

CUT AND FILL
Alteration of land surface by excavating part of an area and using the excavated material for adjacent embankments or fill areas.

DAM or DIKE
A barrier created to impound or restrain the flow of water or fluid materials for storage, diversion, or detention.

DEPRESSION STORAGE
Capacity of a watershed, catchment or drainage basin to retain water in small puddles and depressions.

DESIGN CAPACITY
The amount of flow and/or storage a stormwater facility is designed to manage, usually expressed in cubic feet per second for flow and cubic feet or acre feet for storage.

DESIGN HIGH WATER
Peak water surface elevation of a surface water body (e.g., detention or retention facility) which is determined according to the flow conditions of a specified design storm(s).

DESIGN LIFE
Period of time for which a facility is intended to perform its designated function.

DESIGN LOW WATER
Water surface elevation of a surface water body (e.g., detention or retention facility) typically corresponding to the top of the stormwater treatment pool, and below which no credit is allowed for meeting Hillsborough County's attenuation and storage requirements.

DESIGN STORM
An adopted amount, intensity, duration, distribution, and frequency of rainfall used as the basis of design criteria and specifications.

DETENTION or TO DETAIN
To temporarily store stormwater runoff in such a way as to reduce its flow, for the purpose of either limiting downstream impacts or providing treatment for water quality, or both.

DETENTION POND/BASIN
A stormwater management facility designed to temporarily delay stormwater runoff and attenuate peak flow prior to discharge into a receiving system/pond.

DETENTION TIME
Theoretical time required to displace a given volume of water at a given rate of discharge.

DETENTION VOLUME
Volume of water equal to the potential pond storage volume available between the design high water elevation and the control elevation of the discharge structure.

DEVELOPER
Owner or agent of the owner of land on which land alteration or development activities are proposed, and who must have the legal right to bind the owner to all legal obligations. This includes the person or persons, corporation, or other entity applying for a permit.

DEVELOPMENT
The act of building, engineering, mining or other operations in, on, over, or under land or the making of any material change in the use of any building or other land. Also, any man-made change to real property, including but not limited to dredging, filling, grading, paving, excavating, clearing, timbering, ditching or draining.

DISCHARGE (FOR NPDES REQUIREMENTS ONLY)
Any release, spill, leakage, seepage, pouring, emission, emptying or dumping of any substance or material.

DRAIN
An open or closed conduit which transports stormwater runoff.

DRAINAGE
A general term applied to the removal of surface water or ground water from a given area either by drains, grading or other artificial or natural means.

DRAINAGE BASIN
See definition for "Basin".

DRAINAGE DIVIDE
Physical boundary which separates two drainage basins, and away from which stormwater runoff flows on either side.

DRAWDOWN
Lowering the level of surface water, groundwater or the potentiometric surface as a result of changes in outflow in the system.

EASEMENT
An interest in land owned by another that entitles its holder to a specific limited use or enjoyment.

EMBANKMENT
Man-made fill, constructed of soil, rock or other material, which is supported by banks or sideslopes.

ENCROACHMENT
Infringement into the floodplain/floodway by development causing a reduction in volume and/or conveyance.

ENERGY GRADE LINE
Line showing the total estimated energy needed at any point in a conveyance system to cause given stormwater discharges to flow through the system.

ENGINEER OF RECORD (EOR)
An individual registered by the State of Florida as a Professional Engineer. Further, the individual must be registered to perform engineering assignments in the discipline of Civil Engineering

ENVIRONMENTALLY SENSITIVE AREAS
Conservation Areas and Preservation Areas pursuant to the Conservation Element of the Hillsborough County Comprehensive Plan. Conservation Areas include the following types of wetlands (w), natural water bodies (nwb), and uplands (u): freshwater marshes (w), wet prairies (w), hardwood swamps (w), cypress swamps (w), natural shorelines other than natural beaches and dunes (w), Class III Waters (w, nwb), and significant wildlife habitat (w, nwb, u). Preservation Areas include the following types of wetlands, natural water bodies and uplands: coastal marches (w), mangrove swamps (w), marine grassbeds (w, nwb), natural beaches and dunes (w, u), Class I and II Waters (w, nwb), aquatic preserves (w, nwb), essential wildlife habitat (w, nwb, u), and natural preserves (w, nwb, u).

EROSION
The general process whereby soils and sediments are moved by flowing surface water, wind, or mechanical action.

EROSION CONTROL PLAN
A plan to control onsite soil that may ordinarily be moved by flowing surface water, wind, or movement of vehicles. The erosion control plan may consist of a separate and distinct plan or details and notes on the site plan as appropriate for the location and proposed activity.

EVAPOTRANSPIRATION
Loss of water which results from evaporation from soil, water, vegetation and other surfaces in combination with transpiration from plants.

EXFILTRATION TRENCH
A subsurface facility designed to convey stormwater into the underlying soil, providing both treatment through filtration and volume reduction.

FILTER FABRIC
Water-permeable material (i.e., geotextile) which prevents the movement of fine-grained soils into a subsurface drainage system.

FIRST FLUSH
First portion of stormwater runoff which is generated by a rainfall event and contains the bulk concentration of contaminants which are washed into the drainage network by the storm.

FLASHBOARD
Temporary barrier placed along the crest of the control-structure's overflow weir, which allows the surface water elevation in a reservoir or pond to be raised above the normal control level. The installation of flashboards or other water-level adjustment devices on control structures is prohibited, unless specifically and formally authorized by both Hillsborough County and the Southwest Florida Water Management District.

FLOOD
A general and temporary condition of partial or complete inundation of normally dry land areas from: (1) the overflow of inland or tidal waters; and/or (2) the unusual and rapid accumulation or runoff of surface waters from any source.

FLOOD HAZARD AREA
An area that has experienced flooding in 1979 or later or is recorded in either the FEMA Flood Insurance Rate Maps or the current floodplain maps of the Hillsborough County Stormwater Management Master Plan.

FLOOD HAZARD BOUNDARY MAP (FHBM)
An official map of a community, issued by the Federal Emergency Management Agency, where the boundaries of the area of special flood hazards have been designated.

FLOOD INSURANCE RATE MAP (FIRM)
An official map of a community, on which the Federal Emergency Management Agency has delineated both the special hazard areas and the risk premium zone applicable to the community.

FLOOD PEAK
Highest value of discharge or stage which a flood attains for a given frequency event.

FLOOD ROUTING
Determination of changes in flood water elevation and flow throughout the course of a stream, channel, lake, reservoir, pond, or other conveyance way.

FLOOD STAGE
Stage or elevation at which surface water begins to overflow from the natural banks or other confining boundaries of a stream, channel lake reservoir pond or other conveyance way.

FLOOD ZONE
A special flood hazard area depicted on the FIRM.

FLOODPLAIN
Land which has been or may be covered by water as a result of a storm event, including but not limited to the 100-year storm.

FLOODPRONE
Any land area susceptible to being inundated by water from any source, including: the floodplain associated with the 100-year flood; those lands frequently subjected to inundation; and those lands identified as "Red Line" lots due to frequent localized flooding problems.

FLOODPROOFING
Any combination of structural and nonstructural additions, changes or adjustments to structures which reduce or eliminate flood damage to real property or improved real property, water and sanitary facilities, structures, and their content.

FLOODWAY
The conveyance portion of a water course and its adjacent floodplain areas that must be reserved in order to discharge the 100-year flood without increasing flood heights by a specified amount.

FLOWPATH
The direction or course which stormwater would move or flow due to natural or modified land surface elevations.

FLUME
A usually steeply inclined, lined channel.

FREEBOARD
A vertical distance between the elevation of the design highwater or hydraulic grade line and the inside top of bank, top of dam/dike/levee, ground level or edge of pavement, as applicable.

GRADING
The action or process of changing the elevation contours of a specified site.

GRADING PLAN
A plan to accurately show the proposed change in elevations of a specific site, or portion of a site.

GROUNDWATER RECHARGE OR RECHARGE
Addition of water to the subsurface saturated zone by subsurface inflow, or by surface water infiltration, percolation or seepage, as a result of natural and/or artificial means.

HEAD LOSS
Loss of energy available or needed to cause flow, which results from friction, eddies, and changes in velocity and direction of flow.

HEADWATER
Source of a water course or the water upstream from a control structure or culvert.

HYDRAULICS
Study of the mechanics of water movement.

HYDRAULIC GRADE LINE
The line showing the pressure head, or piezometric head as an elevation above a datum at any point in a pipe.

HYDROGRAPH
Graph of the stage or discharge of a water body versus time.

HYDROLOGIC CYCLE
The continuous circulation of a particle of water from the ocean to the atmosphere, to the land, and ultimately discharging back into the ocean.

HYDROLOGY
Study of the occurrence and movement of water on the surface and beneath the surface of the earth.

ILLICIT DISCHARGE
Any discharge to a MS4 or to waters of the U.S. that is not composed entirely of stormwater. Any discharge in violation of a NPDES permit must constitute an illicit discharge. Exempt discharges are defined in Section 6-1 of the Stormwater Management Ordinance.

IMPERVIOUS SURFACE
A surface which has been compacted or covered with a layer of material so that it is highly resistant to infiltration by water.

INDUSTRIAL ACTIVITIES (FOR NPDES REQUIREMENTS ONLY)
Activities which are conducted on properties designated for Industrial Land Use in accordance with the Hillsborough County Comprehensive Plan and/or at facilities identified by the U.S. EPA as requiring a NPDES stormwater permit under the definition of "Storm Water Discharge Associated with Industrial Activity" in Title 40, Section 122.26 of the Code of Federal Regulations or any amendment thereto.

INFILTRATION
Movement of water through the ground surface and into the soil zone.

INITIAL ABSTRACTION
Amount of precipitation that is infiltrated into the ground, intercepted by plant cover, and stored in depressions prior to the inception of runoff.

INLET
A structure which allows stormwater to flow into a conveyance system.

INSIDE TOP OF BANK
The "waterward" or internal top of bank at the lowest of the high points on the sideslope of a pond.

INSPECTION (FOR NPDES REQUIREMENTS ONLY)
Includes, but is not limited to, any onsite physical examination of facilities and grounds which may discharge to a MS4, a review of records on operation and maintenance of facilities and the results of any monitoring performed for compliance with state, federal, and local regulations or permit conditions.

INTERNALLY DRAINED
See "Landlocked Area".

LAG TIME
The time from the center of mass of rainfall excess to the peak of a unit hydrograph.

LAND ALTERATION
Any activity which removes vegetation from or changes the topography of the land by grubbing, tree removal, clearing, grading, filling, or excavating, except for activities undertaken to maintain existing features.

LANDLOCKED AREA
An area in which runoff does not have a surface outfall up to and including the 25-year flood elevation.

LEVEL OF SERVICE
An indicator of the extent or degree of stormwater management facility function or ability; the potential capacity or potential performance of the facility in terms of level of protection provided (e.g., 25-year/24-hour design storm protection).

LOCAL STREET
A street of limited continuity used primarily for access to abutting property and the local needs of the neighborhood.

LOT
A platted portion of land identified as a single unit in a subdivision and intended for lease, transfer of ownership, use or improvements, or a combination thereof. The term lot includes the terms "plot", "parcel", and "tract".

MANHOLE
A structure which allows access to a stormwater management facility but is not designed to allow the input of stormwater directly from the surface.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4)
A conveyance or system of conveyances (including, but not limited to, roads with drainage systems, streets, catch basins, curbs, gutters, ditches, manmade channels or storm drains) owned or operated by local government that discharges to waters of the United States or connects to other MS4s, that is designed solely for collecting or conveying stormwater, and that is not part of a publicly owned treatment works (POTW) as defined by 40 CFR 122.2 or any amendment thereto.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
The federal program for issuing, modifying, revoking, reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing re-treatment requirements, under Sections 307, 402, 318, and 405 of CWA. The term includes an “approved program”.

NON-POINT SOURCE POLLUTION
Pollution that enters a water body from diffused origins in the watershed and/or drainage basin.

NORMAL WATER LEVEL
The typical water elevation of a surface water body or wetland. This elevation is at or below the design low water elevation and below the seasonal high water elevation.

OBSTRUCTION
Any dam, wall, wharf, embankment, levee, dike, pile, abutment, projection, excavation, channel rectification, bridge, conduit, culvert, building, wire, fence, rock, gravel, refuse, fill, structure, or matter in, along, across, or projecting into any channel, watercourse, flow path or flood plain area which may impede, retard, or change the direction of the flow of water, either by itself or by catching or collecting debris carried by such water, or that is placed where the flow might carry the same downstream to the damage of life or property.

100-YEAR STORM EVENT
A storm event which has a one percent chance of occurring in any year.

ORIFICE
An opening with a closed perimeter through which a fluid flows.

OUTFALL
The point, location or structure where stormwater runoff discharges from a stormwater management facility to a receiving body of water.

OUTLET
Point at which stormwater runoff discharges from a stream, river, lake or other receiving body of water.

OUTSIDE TOP OF BANK
The "landward" or external top of bank which is typically the lowest of the high points at the external limit of the maintenance area.

OPERATION PERMIT
Surface water management permit issued by the Southwest Florida Water Management District authorizing the operation and maintenance of a surface water management system in accordance with the terms and conditions of the permit.

OVERFLOW
Structure which transports excess stormwater into receiving water after the maximum capacity of a limited (or stormwater treatment volume) discharge device has been exceeded.

PARENT SITE
The original development site plus any adjoining properties onto which the original development was or is to be expanded.

PEAK DISCHARGE
Maximum instantaneous flow from a given storm event for a specific location, or the maximum instantaneous outflow from a stormwater management facility during a given storm event.

PEAK SENSITIVE AREAS
Areas where the receiving waters are sensitive to changes in timing and/or magnitude of peak flows.

PERCOLATION
Movement of water through the soil.

PERMISSIBLE VELOCITY
Maximum velocity at which water may be transported through an open channel, storm sewer or other stormwater management system without excessive damage or erosion.

PHREATIC SURFACE
The phreatic surface, or water table, is an imaginary surface that bounds the saturated zone from the unsaturated zone above. It is defined as the surface at every point of which the water pressure is atmospheric.

PLAN OR SMMP
This term refers to the Hillsborough County Stormwater Management Master Plan.

POINT SOURCE POLLUTION
Pollution that enters a water body at a discernible, confined or discrete location, and from a discrete location in the watershed and/or drainage basin.

POLLUTANT
Dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive material (except those regulated under the Atomic Energy Act of 1954, as amended (42(U.S.C. 2011 et seq.)), heat, wrecked or discharged equipment, rock, sand, and industrial, municipal, and agricultural waste discharged into water.

POPOFF
Elevation at which discharge occurs from a water body.

POSITIVE OUTFALL
Positive outfall is defined as the ability to discharge directly into a manmade or natural channel, waterway or pipe system which is part of receiving waters which has more than adequate, adequate or peak sensitive capacity.

POROSITY
Ratio of the volume of pore space to the total unit volume of a soil or rock.

PREDEVELOPED CONDITIONS
For new development, raw land in a natural state before alteration (i.e., Rational coefficient approximately 0.20). For redevelopment projects "predeveloped conditions" include those permanent impervious surfaces on the site on or before October 1, 1988 (or permitted improvements after this time).

REACH
Specified portion or segment of a watercourse.

RECEIVING WATERS
Bodies of water, and ancillary facilities thereof, which serve as the receptacles for stormwater discharges. Generally, receiving waters include significant wetland areas, lakes, rivers/streams, other major stormwater conveyance or storage systems, bays, etc.

RECHARGE BASIN
Retention pond/basin which is underlain by an unconfined aquifer composed of deep sands, gravels and cobbles that is specifically designed to induce replenishment of groundwater supplies.

REDEVELOPMENT
The modification or further development of a parcel with existing improvements on the site. Existing improvements include those on the site on or before October 1, 1988, or permitted improvements after this time.

RETENTION or TO RETAIN
To store stormwater to prevent its discharge into receiving waters or to provide a storage facility for stormwater where no outfall is available.

RETENTION POND
A pond which is designed to retain, without surface discharge, a specified volume of stormwater runoff, and in which recovery of the available storage volume occurs only by percolation and evapotranspiration.

RIGHT-OF-WAY
Land dedicated, deeded, used or to be used for a street, alley, walkway, boulevard, drainage or stormwater management facility, access for ingress, egress or other purpose by the public, certain designated individuals or governing bodies.

ROADWAY BASE CLEARANCE
The distance between the Seasonal High Water Table (SHWT) elevation and the roadway base course.

RUNOFF
That portion of rainfall which is not evaporated, transported, infiltrated, intercepted or retained in small depressions.

SCOUR
Abrasive action of flowing water on soils and sediments in pipes, channels or ponds causing the soils and sediments to move from their existing location.

SEASONAL HIGH WATER TABLE (SHWT) ELEVATION
The elevation to which the groundwater can be expected to rise during a normal wet season.

SEEPAGE SLOPE
The change in the phreatic surface elevation over a horizontal distance resulting from a water body, either natural or manmade.

SEDIMENT
Fine particulate material, whether mineral or organic, that is in suspension or has settled in a water body or has been deposited by flowing water, wind, or other sources.

SETTLING POND/AREA
Area of a stream, channel or pond which has been physically altered and enlarged to permit suspended sediment and debris to settle out from discharging surface water.

SHEET FLOW
Uniform overland flow of water in a thin layer over a sloping surface.

SIDE DRAIN
Storm pipe(s) that convey non-public access roads across roadside swales or ditches.

SINKHOLE
A depression in karst terrain caused by the collapse of the underlying rock and soil or the migration of the underlying soil into an underground cavern. May be dry or wet, depending on the characteristics of the soils/sediments at the bottom of the sink, and the potentiometric surface elevations of the underlying and surrounding aquifers in relation to the bottom of the sink. A common feature of closed drainage basins.

SITE
Any tract, lot or parcel of land or combination of tracts, lots or parcels of land which are in one ownership, or are contiguous and in diverse ownership where development is to be performed as part of a unit, subdivision, or project. Included in the definition of a site are parking and other areas used by the site even if not contiguous.

SPILLWAY
A channel for surplus water to be transmitted over and around a structure or dam.

SPODIC STAINLINE
Soil stainline indicating presence of groundwater at some point in time.

STORM FREQUENCY
The statistical, long-term average number of years within which a particular storm event of specified magnitude will be equaled or exceeded (e.g., 25-year/24-hour storm).

STORM SEWER SYSTEM
Underground pipeline system that collects and conveys surface water discharge and stormwater runoff to receiving waters.

STORMWATER
Flow of surface runoff water which results from and which occurs during and immediately after a rainfall event.

STORMWATER MANAGEMENT SYSTEM
The surface and subsurface system for the removal of water from or control of water on the land, including both the natural elements of streams, marshes, swales and ponds, whether of an intermittent or continuous nature, and man-made elements which include culverts, ditches, channels, piping, and storage facilities. Any system which collects, conveys, channels, holds, inhibits, diverts or treats stormwater. The storm sewer system may be referred to as a stormwater management facility, conveyance system, etc.

STORMWATER TREATMENT FACILITY
A structural Best Management Practice (BMP) designed to reduce pollutant loading to receiving waters by reducing the volume of stormwater discharge, providing for the biological uptake of pollutants, and/or inducing pollutants to settle out of stormwater flow. Structural BMPs include, but are not limited to, detention basins, retention basins, open bottom inlets, undercut ditches, exfiltration trenches, and swales.

SURCHARGE
Flow condition which occurs in a closed conduit when the hydraulic grade line is above the crown of the sewer. Also, flow out of any stormwater management facility at a point upstream from the facility's outfall resulting from inflow into the system in excess of its designed capacity.

SURFACE WATER MANAGEMENT SYSTEM
A stormwater management system, dam, impoundment, reservoir, appurtenant work, or works, or any combination thereof. The term includes dredged or filled areas.

SURFACE WATER MANAGEMENT PERMIT
Letter of conceptual approval, construction permit or operation permit issued by the Southwest Florida Water Management District.

SWALE
A generally shallow grassed waterway which has a cross-sectional ratio for depth to top width of at least one to 11 and a maximum sideslope ratio at 1:4 (vertical: horizontal), and has been designed to resist soil erodibility, slumpage and contamination which may result from stormwater runoff.

SWFWMD
Southwest Florida Water Management District. One of five regional water management districts organized by the state to oversee the management of surface and subsurface water resources in the State of Florida. SWFWMD is the local district for Hillsborough County.

TAILWATER ELEVATION
Water surface elevation of the receiving waters at the discharge end (most downstream end) of a stormwater management facility outfall. Tailwater depth is then the height of the tailwater elevation above the invert of the outfall at this discharge or downstream end.

TIME OF CONCENTRATION
Travel time required for the surface runoff from the most hydraulically distant point of the drainage basin to reach the measurement or collection point, or otherwise to the point of interest of the basin.

25-YEAR STORM EVENT
A storm event which has a four percent chance of occurring in any year.

UNIT HYDROGRAPH
Time distribution of runoff from a basin representing the basin response to one inch of direct runoff distributed uniformly over the basin in space and time.

URBAN RUNOFF
Surface water runoff from an intensely developed drainage area which typically discharges into, or is collected by, a storm sewer system or other man-made or modified watercourse.

VARIANCE
Authorization for the construction or maintenance of a building or structure, or for the establishment, maintenance or operation of a use of land, which is prohibited by the Code (LDC) without such authorization, except as otherwise provided. A relaxation by the Board of Adjustment of the dimensional regulations of the Code where such action will not be contrary to the public interest and where, owing to conditions peculiar to the property and not the result of actions or the situation of the applicant, a literal enforcement of this Code would result in unnecessary and undue hardship.

VOLUME SENSITIVE AREAS
Areas where the receiving waters do not have positive outfall for storm events less than or equal to the 25-year/24-hour event, and areas which do not directly discharge into a well-defined conveyance system (i.e., ditch, storm sewer, etc.).

WATER SURFACE ELEVATION
Surface water elevation expressed in terms of feet above mean sea level according to the North American Vertical Datum (1988 NAVD 88).

WATERS OF THE UNITED STATES (U.S.)
As defined by the U.S. Environmental Protection Agency (EPA) in Title 40, Section 122 of the Code of Federal Regulations or any amendment thereto.

WATERCOURSE
Any natural or artificial channel, ditch, canal, stream, river, creek, waterway or wetland through which water flows in a definitive channel, bed, bank or other discernible boundary.

WATERSHED
The land area which contributes to the flow of water into a receiving body of water.

WEIR
A notch of regular form through which, or a barrier on the bottom of a conveyance way over which, water flows with a free, unconfined surface. A weir structure is typically used for measuring or regulating/controlling surface water discharge.

WETLANDS
Land that is inundated or saturated by surface or ground water in years of normal water conditions at a frequency and duration sufficient to support and that, under normal circumstances, does support a dominance of vegetation typically adapted for life in saturated soil conditions. Wetland also includes non-vegetated beaches, mudflats and salt barriers.
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APPENDIX E: CERTIFICATION OF TOWNHOME SUBDIVISION UNDERDRAIN DESIGN

CERTIFICATION OF TOWNHOME SUBDIVISION UNDERDRAIN DESIGN

I hereby certify that based upon the evaluation of site specific seasonal high water information for (PROJECT NAME) _____, hereafter referred to as the "Development", underdrain is / is not (circle one) necessary to protect the pavement base material from impacts that may be attributed to continued inundation by an elevated groundwater table. I have followed best engineering practices in making this determination. All proposed pavement grades, including the lowest edge of pavement, are at a minimum of six inches above the design high water of the receiving stormwater pond where soil-cement or crushed concrete has been specified as the pavement base material. A minimum of one foot of separation has been provided where other base materials are specified. The six inches or one foot minimum separations will be increased when the design process or site conditions warrant it.

When depicted on the site development construction plans ("plans") for the Development, the underdrain dimensions and materials detailed on said plans have been provided in accordance with FDOT minimum standards.

I further certify that a copy this certification along with an appropriate maintenance schedule (attached) has been provided to the property owner/applicant of the Development.

Signed and sealed this _____ day of _____, 20____.

_____
Signature

Florida Professional Engineer No. _____

Affix Seal

APPENDIX F: TECHNICAL BULLETINS POSTED DURING THE PREVIOUS BIANNUAL UPDATES

Bulletin Number	Subject	SMTM Location	Modifications
18-01	Section 10.0 Roadway Underdrain Design and Appendix D Stormwater Modeling Review Requirements	10.0 Roadway Underdrain Design. 4.0 Stormwater Modeling Review Requirements	Per manual update, Revised Language for Section 10.0 and moved "Certification of Townhome Subdivision Underdrain Design" form to Appendix E. Moved Appendix D Stormwater Modeling Review Requirements to Section 4.0 Stormwater Modeling Review Requirements and revised language.
23-01	Minimum Pipe Cover and Clearances for Stormwater Culverts	9.2.9 Pipe Cover, Clearances, and Conflict Structures	Per manual update, section number has been revised.
25-01	Maximum Pipe Length Underneath Hillsborough County Travel Lanes	9.2.12 Storm Sewer Alignment	Per manual update, section number has been revised and revised language.
25-02	Preclusion of Bubbler Box Construction	5.5.5 Outfall Design 9.2.11 Inlets, Manholes, and Junction Boxes	Per manual update, section number has been revised and revised language.
25-03	Side Drain Requirements	8.2.9 Side Drains	Per manual update, new section with revision has been included.