

# **DRAINAGE DESIGN DOCUMENTATION**

*(An expansion of the Stormwater Management Design Report)*

**Note:** *This report outline is not all-inclusive. There may be situations when information not included in this outline should be included in the Drainage Design Documentation to provide adequate explanations/documentation for project specific issues.*

## **SECTION 1.0 – GENERAL INFORMATION**

### **1.1 Project Location.**

- ❑ *Overall project location (county, city, section/township/range, Turnpike milepost, etc.)*
- ❑ *Datum used for this project. Provide datum conversion.*

### **1.2 Purpose.**

- ❑ *Brief description of the intent of the report and purpose of the project.*

### **1.3 Existing Drainage Patterns.**

- ❑ *General drainage patterns in the vicinity of the project, on a regional basis.*
- ❑ *Address offsite areas draining toward the Turnpike right-of-way.*
- ❑ *Review KMZ file containing Drainage Connection Permits for projects that discharge to the project's right-of-way.*
- ❑ *Describe if project is in open and/or closed basins.*
- ❑ *Brief description of receiving water bodies and their classification (Outstanding Florida Water, etc).*
- ❑ *Brief description of proximity to potable well fields and well field protection zones.*

### **1.4 Tailwater.**

- ❑ *Discuss tailwater elevations used in the design for all cases such as ponds, storm sewers, ditches, underdrain, etc. Include pertinent information such as, previous studies from state or local agencies, etc. References should be made to the appropriate Appendix and/or Document for calculations and information related to tailwater determinations. Refer to the FDOT Drainage Manual for tailwater requirements.*

### **1.5 Floodplain Impacts and Mitigation/Floodway Involvement**

- ❑ *Describe whether or not the project impacts adjacent floodplain areas. If so, describe how it is being mitigated.*
- ❑ *Describe whether or not the project will have any floodway involvement and if a no-rise certification is needed.*

### **1.6 Rules & Regulations/Regulatory Agency Coordination**

- ❑ *Describe all stormwater and right of way occupancy permits needed to construct this project.*
- ❑ *Describe water quality and quantity criteria applicable to this project.*
- ❑ *Describe all stormwater recovery requirements applicable to this project.*
- ❑ *Summarize drainage criteria specific to this project.*
- ❑ *Describe any Special Basin Criteria that may apply to the project such as Outstanding Florida Waters or Wellfield Protection Zones.*
- ❑ *Describe whether the project discharges to an impaired water body and what TMDL's are associated with it.*

*All maps and figures should be included in Appendix A. These include the Project Location Maps, USGS Quadrangle Maps, Soils Maps, FEMA Maps, WMD Basin Maps, and Wellfield Protection Zone Maps.*

## **SECTION 2.0 – PRE-DEVELOPMENT ANALYSIS**

*The intent of Section 2.0 is to provide a brief narrative describing the existing condition of the project site as it relates to stormwater management. The narrative should include information on the number of drainage basins with their respective outfalls, as well as the type of existing stormwater management systems currently in use. Tables summarizing pre-development analysis should be included in Section 2.0. All supporting calculations, documentation, and the pre-development drainage map, for the pre-development analysis, should be presented in Appendix B. Refer to the FDOT Drainage Manual and the FDOT Drainage Design Guides Chapter 9 for guidance.*

### ***For each basin include the following:***

- Basin name.*
- Begin and end station limits.*
- Existing drainage patterns (i.e., time of concentration flowpaths).*
- Land uses (i.e., curve numbers).*
- Describe soils and hydrologic grouping.*
- Ultimate outfall location for discharge comparison (open or closed basin?).*
- Document/justify tailwater (provide source of information).*
- Identify hazardous materials, utilities, archeological, historical, and environmental information affecting the design of the stormwater facility.*
- Identify offsite areas draining towards the road and how offsite runoff is currently conveyed through the project.*
- Previously permitted information.*
- Previously permitted/required water quality, if applicable (is there surplus volume and/or discharge available?).*
- Existing permitted stormwater management system, if applicable.*
- Existing FDOT owned surplus property*

## **SECTION 3.0 – POST-DEVELOPMENT ANALYSIS**

*The intent of Section 3.0 is to provide a brief narrative describing the proposed condition of the project site as it relates to stormwater management. The narrative should include information on the number of drainage basins with their respective outfalls, as well as the type of recommended stormwater management systems to be used for the basin. Tables summarizing post-development analysis should be included in Section 3.0. Discharge rates may be compared at the ultimate outfall locations if more than one basin shares the same downstream outfall. All supporting calculations and documentation, including the post-development drainage map, for the post-development analysis should be presented in Appendix C. Refer to the FDOT Drainage Manual and the FDOT Drainage Design Guides Chapter 9 for guidance.*

### ***For each basin include the following:***

- Basin name.*
- Begin and end station limits.*
- Proposed drainage patterns (flowpaths in ditches and swales for example, time of concentration, etc.).*
- Land uses (i.e., curve numbers).*
- Discuss direct discharge to Outstanding Florida Waters, TMDLs or facilities within a Wellfield Protection Zones, if any.*
- Describe soils and summarize results from the geotechnical investigation.*
- Ultimate outfall point.*
- Discuss any Special Basin Criteria that may apply to the particular project basin.*
- Document/justify tailwater, seasonal high water table, control, and weir elevations.*
- Identify offsite areas draining towards the road and describe how it is to be conveyed through the project.*

- ❑ *Recommended stormwater management system.*
- ❑ *Total required and provided water quality (includes previously permitted, if applicable, as well as anything new) meet criteria.*
- ❑ *Treatment volume recovery meets criteria.*
- ❑ *Permanent pool volume meets criteria, if applicable.*
- ❑ *If compensating or over treatment to be used, provide detailed description of area of new impervious not being treated, area of existing pavement to be treated, etc.*
- ❑ *Retention systems certified by a Geotechnical Engineer.*
- ❑ *Post-development discharge rates compared to the pre-development discharge rates (meets critical duration criteria, as stated in Chapter 14-86, F.A.C.).*
- ❑ *Post-development stages provide for freeboard as stated in the FDOT Drainage Manual.*

## **SECTION 4.0 – FLOODPLAIN ANALYSIS**

*The intent of Section 4.0 is to provide a brief narrative describing the floodplain conditions at the project site and should include the following information. Tables summarizing floodplain impacts, locations, and compensation should be included in Section 4.0. All supporting calculations and documentation for the floodplain analysis should be presented in Appendix D.*

- ❑ *Brief narrative. Floodway involvement? No-rise certification required?*
- ❑ *Statement describing impacts have been avoided or minimized.*
- ❑ *Describe limits of impacts and final cut/fill quantities, if applicable.*
- ❑ *Describe where compensation is to occur, if applicable.*

## **SECTION 5.0 – BASE CLEARANCE ANALYSIS**

*The intent of Section 5.0 is to provide a brief narrative describing site specific base clearance issues as well as issues involved in determining the base clearance water elevation. Tables summarizing the calculated base clearances should be included in Section 5.0. All supporting calculations and documentation for the base clearance analysis should be presented in Appendix E. Refer to the FDOT Drainage Manual for base clearance water elevation guidance.*

- ❑ *Describe how the base clearance water elevation was established.*
- ❑ *Describe limits of project which do not meet Florida Department of Transportation Design Manual base clearance requirements.*
- ❑ *Describe how sections that do not meet base clearance are to be handled.*

## **SECTION 6.0 – CROSS DRAIN ANALYSIS**

*The intent of Section 6.0 is to provide a brief narrative discussing existing cross drains along the project alignment, how these structures will be impacted by the proposed design, and discuss the need for any new cross drain structures along the project alignment. A table summarizing the pre-vs-post condition flows and stages should be included in Section 6.0. All supporting calculations and documentation for the cross drain analysis should be presented in Appendix F. Refer to the FDOT Drainage Manual and the FDOT Drainage Design Guides Chapter 4 for guidance.*

*For each cross drain, include the following:*

- ❑ *Brief narrative.*
- ❑ *Cross drain name, size, shape, material.*
- ❑ *Location (include stationing).*

- ❑ *Describe the contributing drainage area for the cross drain.*
- ❑ *Describe the condition of the cross drain, including, but not limited to, age, erosion issues, maintenance issues, structural deficiencies and if an extension or replacement is proposed.*
- ❑ *Document/justify tailwater used in the design and provide source of tailwater information.*
- ❑ *Document the pre-development and post-development flows and stages.*
- ❑ *Provide a statement verifying that stages on off-site properties are not increased in the proposed condition and that the allowable high water conditions are met.*

## **SECTION 7.0 – ON-SITE CONVEYANCE ANALYSIS**

*The intent of Section 7.0 is to provide a brief narrative discussing the proposed methods of conveyance for drainage from the project. All supporting calculations and documentation for the on-site conveyance analysis should be presented in Appendix G. Refer to the FDOT Drainage Manual and Chapter 6 of the Drainage Design Guide for guidance.*

- ❑ *Brief narrative describing methods of conveyance for proposed drainage basins within the project (ditch flow, stormsewer, side drains, etc.)*
- ❑ *Document/justify tailwater used in the design and provide source of tailwater information.*
- ❑ *Describe critical ditch sections (such as sign post obstructions, narrow sections, steep slopes) and lining requirements, if applicable.*
- ❑ *Discuss areas of superelevation transitions, bridge end-treatments, sag inlets, etc.*
- ❑ *Discuss design frequencies used for the analysis of each method of conveyance.*
- ❑ *Include verification of wall zones for Wall Zone Pipes as outlined in the FDOT Drainage Manual Section 3.11 and Appendix D.*

## **SECTION 8.0 – MOT DRAINAGE**

*The intent of Section 8.0 is to provide a brief narrative discussing the proposed methods of conveyance for project drainage for the temporary condition (during construction). All supporting calculations and documentation for MOT drainage should be presented in Appendix H. Refer to the FDOT Drainage Manual for design frequencies and the FDOT Drainage Design Guides Chapter 10 for design guidance.*

## **SECTION 9.0 – OPTIONAL PIPE ANALYSIS**

*The intent of Section 9.0 is to provide a brief narrative discussing the process used to determine the pipe materials allowed for the project. Discussion should include steps performed to analyze corrosive parameters as well as structural restrictions (from Drainage Manual Appendix E). All supporting calculations and documentation for Optional Pipe Analysis should be presented in Appendix J. Refer to the FDOT Drainage Design Guides Chapter 8 for guidance.*

## **SECTION 10.0 – REFERENCES**

# APPENDICES

## **Appendix A – Figures**

- ❑ *Project Location Maps*
- ❑ *USGS Quadrangle Maps*
- ❑ *Soils Maps*
- ❑ *FEMA Floodplain Maps*
- ❑ *WMD Basin Maps*
- ❑ *Wellfield Protection Zone Maps*
- ❑ *Other*

## **Appendix B – Pre-Development Calculations and Documentation including:**

- ❑ *Pre-development drainage map with aerial background. (Do not include stormsewer – only cross drains, ponds, and outfalls).*
- ❑ *Supporting pre-development stormwater facility calculations; Tc, CN, Areas, etc.*
- ❑ *Pre-development ICPR Input and Output Data*
- ❑ *Pre-development nodal diagram. Reference specific structure numbers and pond names as shown in the construction plans.*

## **Appendix C – Post-Development Calculations and Documentation including:**

- ❑ *Post-development drainage map with aerial background. (Do not include stormsewer – only cross drains, ponds, and outfalls).*
- ❑ *Supporting post-development stormwater facility calculations; Tc, CN, Areas, etc.*
- ❑ *Post-development ICPR Input and Output Data*
- ❑ *Post-development nodal diagram. Reference specific structure numbers and pond names as shown in the construction plans.*
- ❑ *Post-Development recovery analysis*

## **Appendix D – Floodplain Encroachment/Compensation Calculations and Documentation**

## **Appendix E – Base Clearance Calculations and Documentation**

## **Appendix F – Cross Drain Calculations and Documentation**

## **Appendix G – On-site Conveyance Calculations and Documentation**

- ❑ *Ditch calculations – Document tailwater used in design. Describe critical ditch sections (narrow sections, steep slopes, etc.) and lining requirements. Include hydraulic worksheet and check freeboard*
- ❑ *Stormsewer tabulations – Document tailwater used in design and check HGL clearance and outfall erosion protection needs.*
- ❑ *Spread calculations – Include spread worksheet. Make note of areas of superelevation transition, bridge end treatment, sag inlets, etc.*
- ❑ *Shoulder capacity calculations – Include shoulder gutter conveyance worksheet.*
- ❑ *Noise Wall drainage analysis*

## **Appendix H – MOT Drainage Calculations and Documentation**

- ❑ *Spread calculations; verify sufficient shoulder width in MOT plans.*
- ❑ *Shoulder gutter capacity calculations*
- ❑ *Storm tabs*
- ❑ *Ditch calculations*
- ❑ *Maintenance of flow, if needed, such as canal relocation or cross drain extension*

## **Appendix I – Hydroplaning Calculations**

## **Appendix J – Optional Pipe Analysis Calculations and Documentation**

- ❑ *Run FDOT Culvert Service Life Estimator software (use latest version available).*

- ❑ *Include copy of geotechnical table of soil chemistry.*
- ❑ *Check CSLE results against Drainage Manual Appendix E for maximum and minimum fill heights and material availability (max cover check now included in the CSLE program).*

***Appendix K – Correspondence, Excerpts from Previous Permits and Studies***