Technical Procedure Document

Subject: 1 Percent Annual Exceedance Probability Storm Event Analysis

Introduction

The City of Charleston (City) has formalized a procedure to further explore any upstream and downstream stormwater runoff impacts associated with new development or re-development projects. For projects in an area in which a City stormwater master plan and model is available, the stormwater management analysis shall use the boundary conditions from the modeling provided by the City (see **Technical Procedure Document *City Watershed Modeling Data***) for the 1 Percent Annual Exceedance Probability (AEP) storm event analysis. For projects that are not located within an area without a completed City stormwater master plan and model, **Section 3.9.4 of the 2020 SWDSM** must be followed by the design engineer to complete the assessment of the watershed to establish reasonable boundary conditions for the 1 Percent AEP storm event analysis.

Circumstances often occur where even with a site meeting applicable stormwater management requirements for peak flow and volume control at a site's outfall, adverse upstream and downstream impacts can occur due to the shifting of the peak of the storm event to coincide with other peaking of the storm event within the overall watershed. This section of the SWDSM requires design engineers to examine upstream and downstream conditions to demonstrate a proposed development would not adversely impact upstream and downstream conditions. For this analysis, the water surface elevations and existing drainage system capacity will have to be examined from the top of the watershed to a point down system of the site where the site makes up 10% of the watershed area. The evaluation should also continue downstream for the project to identify any likely choke points. If any adverse impacts are indicated, the stormwater runoff peak flows and volumes discharging from the site must be reduced until such point that there are no adverse impacts.

Required Criteria

The required criteria of the 1 percent AEP storm event analysis for sites where a stormwater master plan and model are not available includes, but is not limited to:

- Using current zoning for all upstream and downstream land parcels
- Existing land use curve numbers for all developed areas outside the project
- Utilization of existing City watershed boundaries and LiDAR data to support overall watershed area delineations
- The weighted curve number for the proposed development site
- Flows shall be routed using a hydrologic and hydraulic method accepted by the City Department of Stormwater Management

Other criteria may be required by the Department of Stormwater Management based on the severity of potential impact and the location of the project. Any additional criteria will be outlined as much as possible during the initial planning stages of the project as part of the Technical Review Committee (TRC) process.

Procedure

The following steps are to be used for the 1 percent AEP storm event analysis:

1. Determine which watershed the project is located within and if the City has a master plan and model for that watershed.
2. If the city does not have a master plan and model for the watershed that the project is located within, then determine the watershed extents from available watershed boundary and terrain information (i.e. City watersheds https://data-charleston-sc.opendata.arcgis.com/search?groupIds=01e7dd3a8e8348ab9ad63e12170ff4bf; 2017 SCDNR LiDAR data available from http://portal.dnr.sc.gov/GIS/lidar.html). For watersheds not defined by the City or for which the design engineer would like to propose a modified watershed boundary, coordination with the Department of Stormwater Management should occur early in the design's stormwater management analysis.
3. Complete an analysis up to the top of the watershed and down to any perennial water of the State or to a point in which the project comprises 10% of the total contributing area, whichever occurs first. This includes the entire contributing watershed area.
    a. Example 1: A 5-acre project at the top (highest point) of the watershed will have to examine downstream until the total drainage area for the outfall channel or structure is at least 50 acres. If the total area of the watershed does not total 50 acres before reaching the ultimate outfall, then the entire watershed will be used.
    b. Example 2: A 5-acre project in the middle of the watershed will need to first determine how much upstream area is contributing to the outfall channel or structure before reaching the site. If the upstream area is equal or greater than 45 acres, then only the next downstream structure from the site will need to be analyzed (if the upstream area is greater than 45 acres then the entire upstream area must be included in the analysis of the next downstream structure from the site). However, if the upstream basin is less than 45 acres, then continue downstream of the site until the 10% requirement is met. Note that the evaluation should also continue downstream for the project to identify any likely choke points.
4. Locate all off-site downstream structures and open-conveyance cross sections for the outfall channel or structure within the total watershed area and include those features in the modeling analysis.
5. Determine the land-cover data and curve number information for the watershed by using zoning information. Undeveloped portions of the watershed shall be modeled as if in the built condition and according to the zoning classification.
6. Build a stormwater model to determine the impacts of the proposed development on all upstream and downstream conveyances until the 10% analysis point is reached as well as continue downstream for the project to identify any likely choke points The extent to which upstream drainage is routed through existing stormwater management systems will be up to the design engineer as the un-routed upstream system approach would yield more conservative 1 Percent AEP storm event water surface elevations. Additionally, the existing boundary conditions

for this analysis must take into account either an elevation of 5.5 NAVD88 datum tailwater elevation as a minimum or elevations associated with any downstream constrictions (crown of pipe elevation), whichever is higher.

Additionally, the modeling must take into account the displacement of any existing storage provided on the site that will be displaced as part of any fill associated with the development. This is often modeled treating the site as a pond to realize how much volume is available for storage between the seasonal high water table (SHWT) and the resultant 1 Percent AEP storm event elevation. This displaced storage volume must be accounted for in the 1 Percent AEP modeling to reflect the loss of storage on the site prior to the development. This displaced storage can be offset through the on-site stormwater management practices (i.e. runoff reduction measure or additional storage volume) or simply by completing a fill balancing approach.

7. If any adverse impacts (i.e. increased water surface elevation) are noted upstream or downstream, the design of the proposed site will need to be modified until all upstream and downstream impacts have been eliminated.

Required Output of Analysis

Results of the 1 Percent AEP storm event analysis are required to be presented in the Stormwater Technical Report prepared by a South Carolina Licensed Professional Engineer and submitted to the Department of Stormwater Management as part of the Construction Activity Application package. The required items for the 1 Percent AEP storm event analysis are:

- Discussion of the 1 Percent AEP storm event analysis approach and design assumptions, including, but not limited to the following:
  - Sources for watershed area delineations
  - Land-use curve number determinations
  - Any upstream routing considerations made in the analysis
  - Tailwater conditions and the basis for those tailwater conditions
  - How the displacement of storage on the site was offset in the analysis and site design approaches
- Summary table with Pre-development and post-development peak flowrates for the 1 Percent AEP storm event for the appropriate upstream and downstream analysis points
- Summary table with Pre-development and post-development runoff volumes for the 1 Percent AEP storm event for the appropriate upstream and downstream analysis points
- Summary table with Pre-development and post-development water surface elevations for the 1 Percent AEP storm event for the appropriate upstream and downstream analysis points
- Pre-development and post-development watershed mapping that includes contour data as well as the link-node diagram consistent with the modeling provided
- Pre-development and post-development model input
- Pre-development and post-development model output