

## **11.4 System Planning**

### **11.4.1 Introduction**

The design of any storm drainage system involves the accumulation of basic data, familiarity with the project site, and a basic understanding of the hydrologic and hydraulic principles and drainage policy associated with that design.

### **11.4.2 General Design Approach**

The design of a storm drain system is generally a process which evolves as a project develops. The primary ingredients to this process are listed below in a general sequence by which they may be carried out.

- data collection
- preliminary sketch
- inlet location and spacing
- plan layout of storm drain system
- locate main outfall
- determine direction of flow
- locate existing utilities
- locate connecting mains
- locate manholes
- size the pipes
- review hydraulic grade line
- prepare the plan
- provide documentation

### **11.4.3 Required Data**

The designer should be familiar with land use patterns, the nature of the physical development of the area(s) to be served by the storm drainage system, the stormwater management plans for the area and the ultimate pattern of drainage (both overland and by storm drains) to some existing outfall location. Furthermore, there should be an understanding of the nature of the outfall since it usually has a significant influence on the storm drainage system. In environmentally sensitive areas, there may be water quality requirements to consider as well.

Actual surveys of these and other features are the most reliable means of gathering the required data. Photogrammetric mapping has become one of the most important methods of obtaining the large amounts of data required for drainage design, particularly for busy urban roadways with all the attendant urban development. Existing topographic maps, available from the U. S. Geological Survey, the Natural Resource Conservation Service, many municipalities, and private developers are also valuable sources of the kind of data needed for a proper storm drainage design. Developers and governmental planning agencies should be consulted regarding plans for the area in question. Often, in rapidly growing urban areas, the physical characteristics of an area to be served by a storm drainage system may change drastically in a very short time. In such cases, the designer is to anticipate these changes and consider them in the storm drainage design. Comprehensive Stormwater Management Plans and Floodplain Ordinances should be reviewed when they are available.

#### 11.4.4 Preliminary Sketch

Preliminary sketches or schematics, featuring the basic components of the intended design, are useful to the designer. Such sketches should indicate watershed areas and land use, existing drainage patterns, plan and profile of the roadway, street and driveway layout with respect to the project roadway, underground utility locations and elevations, locations of proposed retaining walls, bridge abutments and piers, logical inlet and manhole locations, preliminary lateral and trunk line layouts and a clear definition of the outfall location and characteristics. This sketch should be reviewed with the traffic staging plans and soils recommendations for areas which are incompatible with required construction staging. With this sketch or schematic, the designer is able to proceed with the detailed process of storm drainage design calculations, adjustments and refinements.

Unless the proposed system is very simple and small, the designer should not ignore a preliminary plan as described above. Upon completion of the design, documentation of the overall plan is facilitated by the preliminary schematic.

#### 11.4.5 Special Considerations

Consideration and planning should be directed toward avoidance of utilities and deep cuts. In some cases, traffic must be maintained or temporary bypasses constructed and temporary drainage provided for during the construction phase (See Chapter 6, Hydrology, for Temporary Facilities). Further consideration should be given to the actual trunk line layout and its constructibility. For example, will the proposed location of the storm drain interfere with in-place utilities or disrupt traffic? Some instances may dictate a trunk line on both sides of the roadway with very few laterals while other instances may call for a single trunk line. Such features are usually a function of economy but may be controlled by other physical features.

Except in unusual circumstances, storm drains should discharge to a single outfall. A storm drain which branches, thereby distributing the discharge, should be avoided.

Storm drain pipes should not decrease in size in a downstream direction regardless of the available pipe gradient.

#### 11.4.6 ConnDEP Requirements

The following requirements for storm drainage systems taken from Section 25-68h-3c of the Flood Management Statutes and Administrative Regulations shall be incorporated into all ConnDOT projects.

All subsurface storm drainage systems shall be designed in accordance with the methods and procedures defined in this manual as may be amended and shall meet the following requirements:

- 1) Storm drainage systems for parking lots, driveways, and roads shall be designed for a ten year frequency storm without closing the facility.
- 2) The design of storm drainage systems for depressed roads and driveways shall comply with this manual.
- 3) Use of curbing shall be minimized in order to encourage overland disbursed flow through stable vegetated areas.
- 4) The hydrology and hydraulic design of catch basins, gutters, and storm drain pipes shall comply with this manual.
- 5) Design computations shall be prepared on the appropriate forms contained in this manual.

- 6) The foundation drains and floor drains of buildings connected into storm drainage systems shall be designed to prevent backflow for the 100 year frequency flood into the building.
- 7) Surface runoff shall be directed through vegetated filter strips or grass swales wherever possible prior to storm drain inlets.
- 8) The design of the storm drainage system should be coordinated with the soil erosion and sediment control plan.
- 9) Storm drainage discharges shall be coordinated with the National Pollution Discharge Elimination System permit program administered by the Water Compliance Unit of DEP.  
*Note: To this end, guidance has been provided within this manual relative to the design of water quality basins and hydrodynamic separators. See Chapter 10 (Storage Facilities) and Appendix C of this chapter.*
- 10) Storm drainage systems discharging into watercourses tributary to public water supply reservoirs shall be in compliance with the Public Health Code.
- 11) Storm drains shall be extended to a suitable discharge point into a watercourse or public drainage system, or to where drainage rights have been secured

#### 11.4.7 Documentation

The following items shall be included in the documentation file (see Chapter 1, Section 1.6). The intent is not to limit data to only those items listed, but rather establish a minimum requirement consistent with the storm drainage system design procedures as outlined in this chapter. If circumstances are such that the system is prepared by other than the normal procedures or is governed by factors other than the design criteria, a narrative summary detailing the design basis shall appear with the other data.

- computations for inlets and pipes, including hydraulic grade lines
- copies of the standard computation sheets given in this chapter
- complete drainage area map
- design frequency
- information concerning outfalls, existing storm drains and other design considerations
- computations for temporary facilities where applicable (Chapter 6, Appendix F)
- a properly labeled schematic indicating storm drain system layout