CE 3372 – Water Systems Design
Exercise Set 12

Exercise

Three drainage areas that drain to inlets connected to storm sewer pipes are shown on Figure 1. A stormwater drainage system is being designed to carry the flow from the three areas.
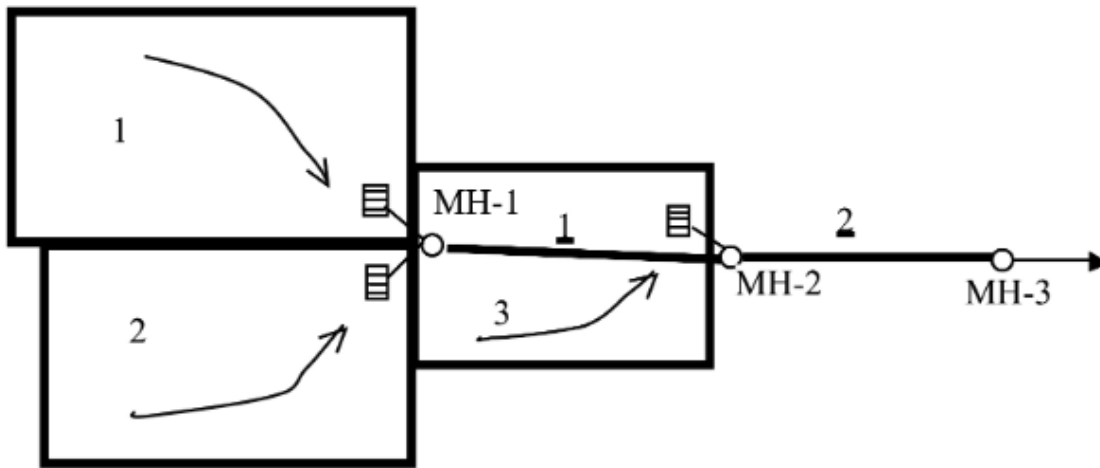

Figure 1: Drainage System Schematic (Plan View)

Figure 2 lists drainage area information.

Area ID	Area (acres)	C (runoff coefficient)	Inlet Time (minutes)
DA-1	6.0	0.66	18
DA-2	5.1	0.56	15
DA-3	3.5	0.75	13

Figure 2: Contributing Area Table

Figure 3 shows a list of pipe connectivity, flow lengths, design slopes, and pipe roughness data.

Pipe_ID	Upstream Junction	Downstream Junction	Length (feet)	Slope	Manning's n
P1	MH-1	MH-2	600	0.003	0.015
P2	MH-2	MH-3	600	0.003	0.015

Figure 3: Pipe Connectivity, Distances, and Slopes

Figure 4 is the 10-year ARI intensity equation for the area, where I is intensity in inches-per-hour, and T_c is the averaging time, in minutes. Depending on the location in the system it may be just the local inlet time, or a time of concentration that includes upstream contributions and pipe travel time.

$$I = \frac{56.6}{(T_c + 8.6)^{0.823}} \tag{1}$$

Figure 4: Drainage System Schematic (Plan View)

The allowable velocity at design flow is between 2 and 10 feet-per-second. The pipes are to be sized so they flow $\frac{1}{2}$ full at the design discharge.

Using the supplied problem data, and assuming the 10-year ARI is the design standard for the system, determine:

1. Determine the design flow rates in cfs for each pipe

2. Determine the associated pipe diameters in inches for both pipes.