

## **Urban Rational Example Instructions:**

This project is designed to help you apply the design steps that we've covered in the course, using QGIS and HydroCAD. If you get stuck, refer back to the relevant video lectures and the HydroCAD online help. The project site is located in Albany County, The Town of Colonie, approximately 4500 feet south/southwest of the Albany Airport terminal building.

Coordinates:

Lat/Long: 42.734596 North, 73.817841 West

UTM: Zone 18N, 596780m E, 4732029m N

Closest Address: 10b Airline Drive, Albany, NY 12235.

### **Step 1: Gather Background Data**

1. Digital Elevation Model (DEMs). This will serve as our survey for the project, and can be downloaded from the NY GIS Clearinghouse through the Orthoimagery Application Web map. This project has a small watershed. You will only need one tile of 2m DEM.

<https://gis.ny.gov/gateway/mg/>

2. Soils. Downloading soils data for this project is optional. The watershed we'll be using is 100% impervious, which has the same CN value regardless of hydrologic soil group.

### **Step 2: Draw your watershed**

Use QGIS to display contours from the 2m DEM. You don't need to convert the DEM to English units, but you may. Create a new shapefile and draw watershed polygons in it. You will need to draw two watersheds in the watershed shapefile.

The land use for the watersheds should be entirely impervious area. Assume that no water from the adjacent field runs into the parking lot. There is a low berm that prevents this but is hard to distinguish in the DEM.

### **Step 3: Compute the Watershed Areas**

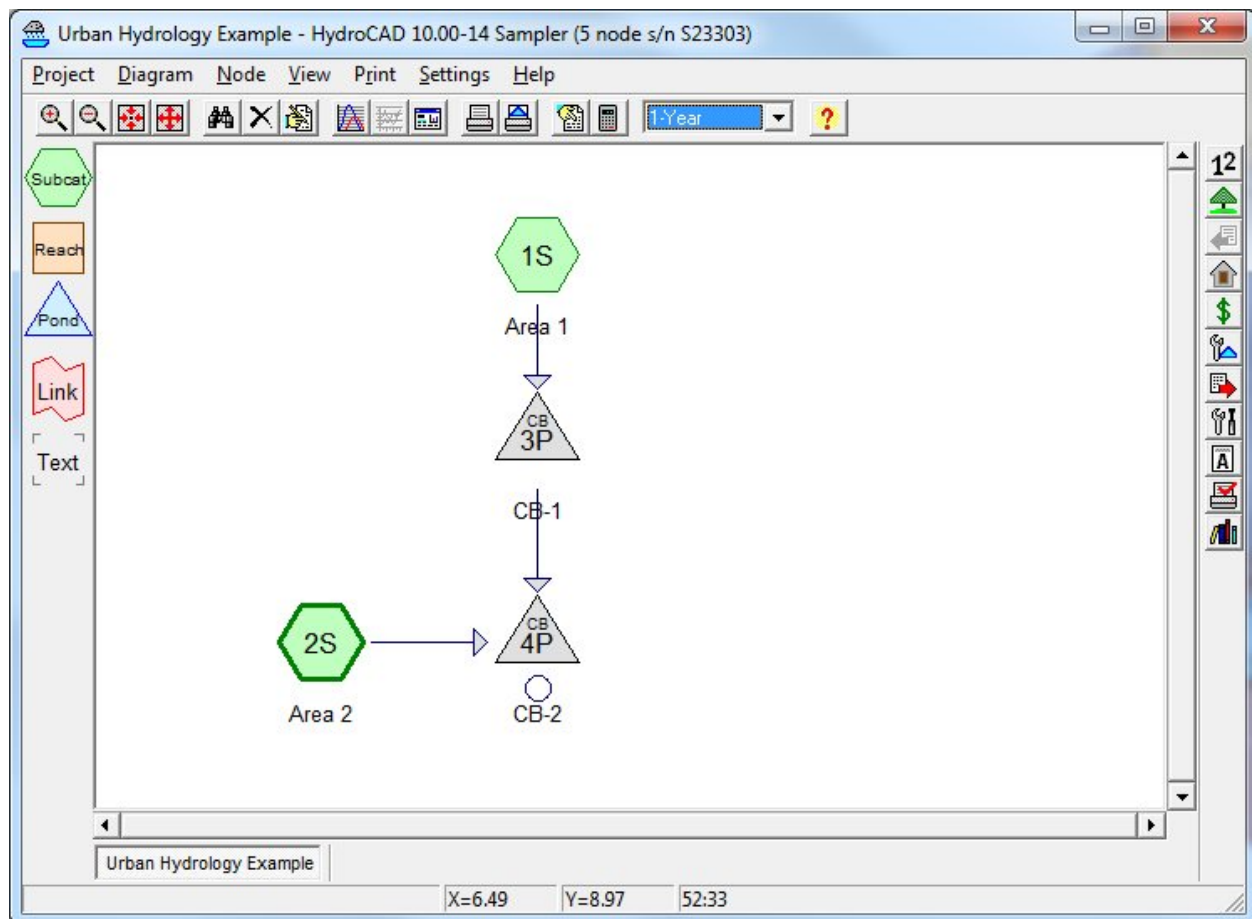
Look for the "Open Field Calculator" in the data table window. Tell the calculator to create a new field called, "Acres." The expression you'll need is " $\$area * 0.00024711$ " to compute the area.

In this case we do not need a pivot table to sum areas of similar land use. We will create 2 watersheds in HydroCAD and assign them these calculated areas.

### **Step 4: Layout the network in HydroCAD**

This example is a little more complicated than what I've covered in the lectures, so I'm going to show you the layout up front. I'm also including the catch basin and pipe invert elevations,

which you'll need to create the pond outlet pipes. HydroCAD is not the most intuitive software for designing storm sewer networks. Each catch basin or inlet starts out as a pond, and the pipes between each inlet are modelled as outlet pipes from the ponds. After you click and drag a pond into your project, there is a radio button on the first tab of the pond setup dialog that lets you switch to a catch basin. After that, it will ask you to setup at least one outlet, and you should choose "culvert," with the inverts that are given. For pipe material, use smooth interior polyethylene, 18" diameter, with a square edge headwall entrance.



	CB1	CB2
Top of Frame	289.46	288.80
Inv. In	--	283.9
Inv. Out	285.4	283.8

#### Step 5: Compute the Time of Concentration for each watershed

Draw in the longest flow path for each watershed into QGIS in a new shapefile. This shapefile should be set to contain polylines rather than polygons.

For each flow path, you'll need to determine the flow path slope. The easiest way to do this is by displaying the contours from the 2m DEM, computing the elevation drop along the flow path, and dividing by the length.

The first 100 feet of the flow path should be entered as overland flow (sheet flow). This is the limit for developed areas in NY state. The remaining flow path should be modelled as shallow concentrated flow. There is no channel flow in the parking lot.

#### **Step 6: Finish setting up HydroCAD**

Add the rational coefficients to your areas if you haven't done so already.

Now we need to set up the rainfall parameters in HydroCAD. Look for the calculator button in the top toolbar. For this model, we'll be using the rational method. Use the [precip.net](http://precip.net) website maps to download the rainfall idf curve as shown in the lecture.

While still in the calculation settings dialog, click over to the advanced tab. You need to set the minimum Tc to 5 minutes, because this is the lowest time increment given in the IDF chart. This is a setting that must be done for the rational method. Some jurisdictions also specify a minimum Tc for the TR-55/TR-20 method so check with your local reviewing agency.

To run the model, double click on the most downstream node – the second catch basin in this case.

Look for the "Current Messages" window and check down the list looking for warnings. Ideally you want no warnings displayed but hints are okay. In this example, you may have a "Submerged Pond Primary Device Outlet" warning but that is fine. Double clicking a warning or hint will bring up a help page to help you fix it or figure out whether it matters in the design.

The peak flow for the system is listed in the results dialog hydrograph and tables. If you have already done the TR-20/TR-55 analysis, is your result different?