

HEC-HMS Lab 5 – Hydrologic Modeling of Fish Creek in Indiana

Created by Venkatesh Merwade (vmerwade@purdue.edu)

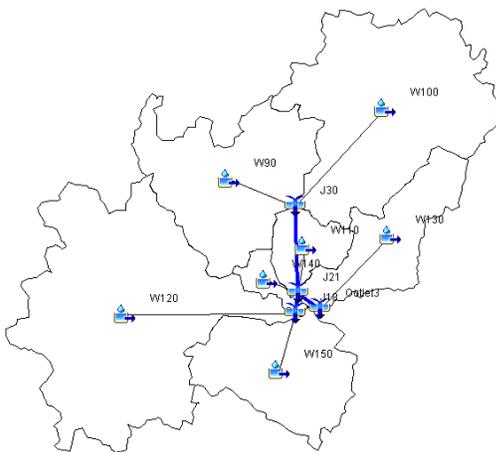
Until now, all the HEC-HMS models that you created involved using schematic tools in the model to place the basin and assign parameters. This is an acceptable approach, but this can get complicated when you deal with complex systems with multiple sub-basins, reaches (rivers), and other hydrologic components. These days GIS (geographic information systems) data and tools are used to create the schematic for many models and extract the relevant hydrologic or hydrographic information for use in a model. One of the advantages of such an approach is that the schematic network generated by GIS is geo-referenced, which means you can overlay land use and aerial images to see the exact location of your sub-basins and incorporate physical description of these features easily in the model.

In this lab you will use a relatively sophisticated HEC-HMS model for a small watershed in Indiana that was created using the HEC-GeoHMS tool in ArcGIS. The HEC-HMS basin model of this watershed, its background GIS map and an Excel file is provided to you under Lab 5 on blackboard or at <ftp://ftp.ecn.purdue.edu/vmerwade/class/fishcreek.zip>. The Excel file contains observed rainfall and direct runoff for a storm event in 2004.

Open HEC-HMS, and create a project called fish_creek in your working directory by using **US Customary units**. Save the project.

Import the Fish Creek basin model by going to File→Import→Basin Model... when prompted, select the “Use data in local project, ignore missing data” in the import options. <Note: Depending on the version of HEC-HMS you may not see any messages. Add the basin model if you do not see any messages>

Next import the watershed boundary or sub-basins boundaries within the watershed by going to view→Map Layers→Add and select map.shp. Your map should look like below.



Explore the model, and turn-in the answers to the following questions: (answering the following questions will be easier if you also try to explore some of the menus on the HEC-HMS toolbar, especially, the Parameter menu)

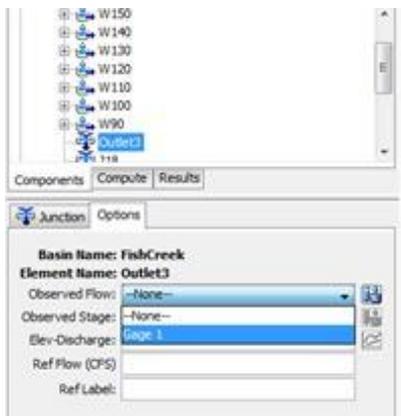
- 1) How many sub-basins, reaches and junctions do you have in the model? Which element represents the watershed outlet?
- 2) By using the name of each sub-basin, reach and junction, draw a flow schematic by hand, and write a narrative on how the water is flowing within the Fish Creek watershed.
- 3) What is the total area of the Fish Creek watershed? How did you find this out?
- 4) What method is used for computing losses in the model? What parameter(s) are used in the loss method, and what are their values?
- 5) What method is used for transformation in the model? List the parameters and their values.

Run the Fish Creek model by using the rainfall data provided in the Excel File (Rainfall sheet). This will involve creating rainfall gage, meteorologic model, control specification model and a simulation run. Use a time step of 10 mins.

- 6) Justify your choice of Start and End date/time for the simulation.
- 7) Plot the hydrograph (at the outlet) in the Excel file that is provided to you, and report the total rainfall, total discharge, peak discharge value, time to peak.

You will see that the Excel file also has data on observed direct runoff at the watershed outlet (see Direct Runoff Sheet). Lets include this information in the model. Create a new discharge gage by going to Components→Time Series Manager and selecting the discharge gage. Use the information in the Excel file to store the observed data at this gage.

After the discharge gage is created, select “Outlet3” in the component window, then go to the Options tab, and link your discharge gage to Outlet3 as shown below.



Run the model again (you may want to match the simulation end time with the end time of discharge data provided to see the complete hydrograph), and see the results at Outlet3. You will now see both the model hydrograph and the observed hydrograph.

- 8) Create a plot in Excel to show these two hydrographs.
- 9) Which sub-basins produced the lowest and highest hydrograph peaks? Why?
- 10) What key differences do you see between the hydrographs produced by the model and the observed data? Think about what parameters will you change in your model and whether you will increase or decrease the values of these parameters in trying to bring the model output closer to the observed data. You do not have to change any parameter, just write few lines describing your approach. You will perform this operation, called calibration, in your next lab.

Turn-in your answer for each question and label the answer with corresponding question number in this handout. Due date: Feb 28, 2018 by 1:30 PM.