DRAINAGE DESIGN MANAGEMENT SYSTEM FOR WINDOWS

VERSION 5.6.0

TUTORIAL # 2

DEVELOPING A NEW HEC-1 MODEL USING GIS SHAPEFILES

KVL Consultants, Inc.

DEVELOPING A NEW HEC-1 MODEL USING GIS SHAPEFILES

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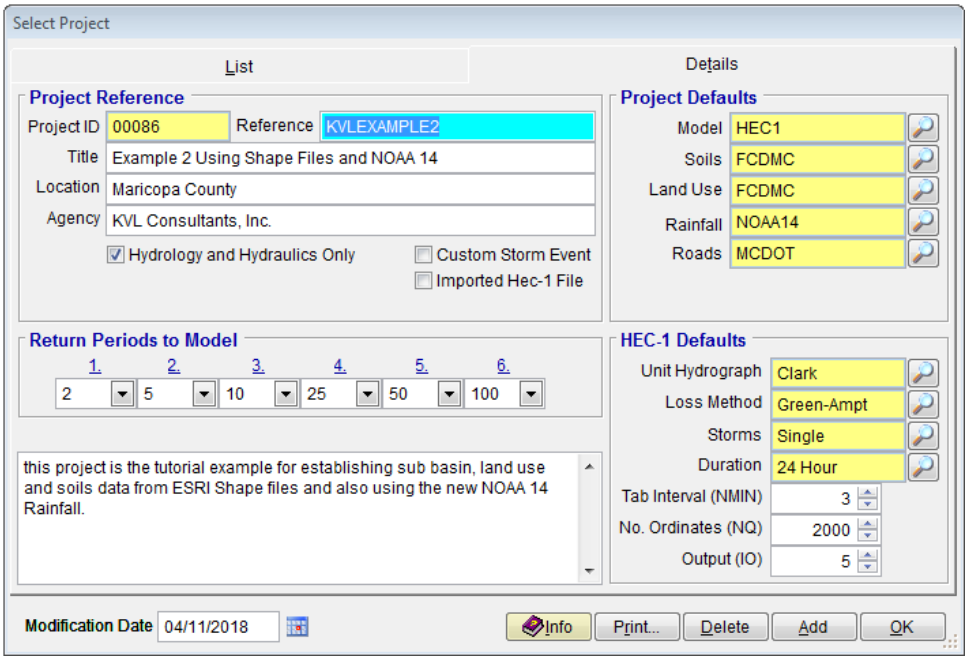
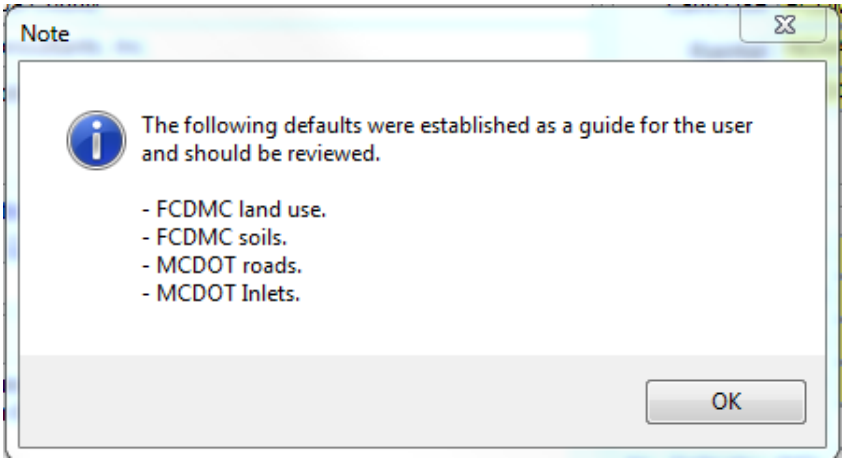
1.0 ESTABLISH A NEW PROJECT AND SET DEFAULTS

Select *File* ➔ *New Project*. Fill in the fields using the data shown in the screen capture below. Each project must have a unique Reference (without spaces), a formal Title, a project Location and an Agency name (this can be your firm's name if a consultant). Then select the appropriate Model (*HEC1* or *Rational*, but select HEC1 for this example), *Soils*, *Land Use* and *Roads Agency* and *Rainfall Method*. Finally select the appropriate HEC-1 parameters: *Unit Hydrograph*, *Loss Method*, *Storms*, *Duration*, *Tab Interval*, *No of Ordinates* and default *Output*. Also add any appropriate comments.



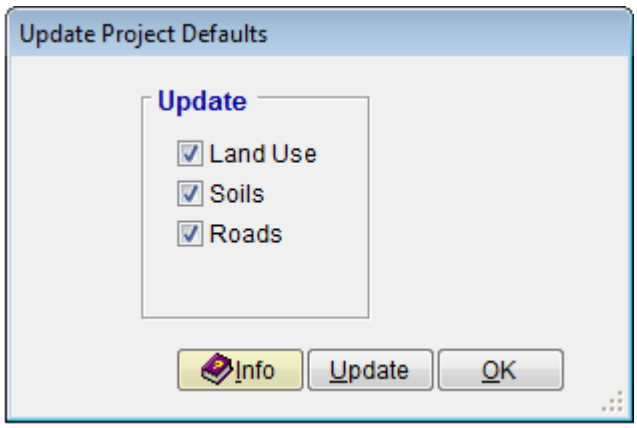
After entering the data, press '*Save'*. Then, press *'OK.'* to exit the Select Project form.

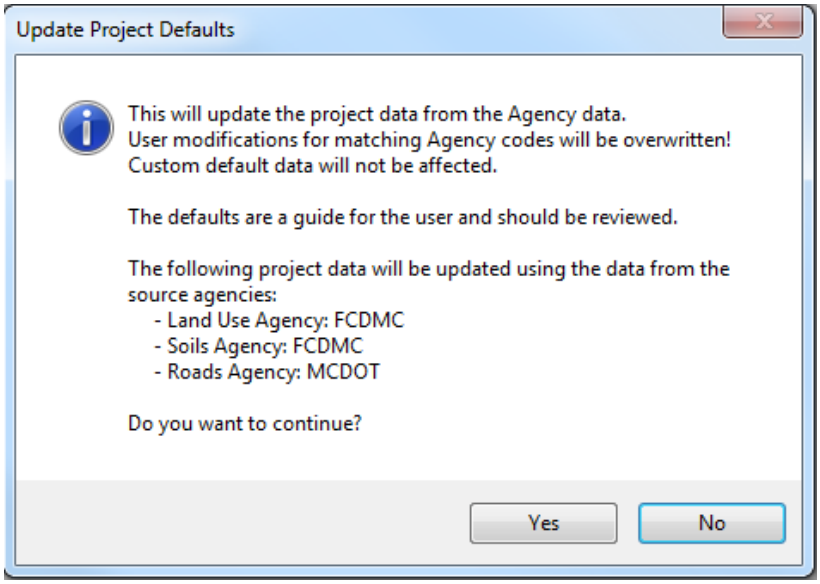


Then click '*OK*' to accept the land use, soils, roads, and Inlets defaults.

2.0 UPDATE PROJECT DEFAULTS

Select *File* ➔ *Update Project Defaults*. Check all the boxes and then press *'Update'.*





Click '*Yes*' to continue. If the users have already made a lot of changes in either Land Use or Soils or both, and they want to preserve these changes, DO NOT click '*Yes*'. That will overwrite all the changes already made.

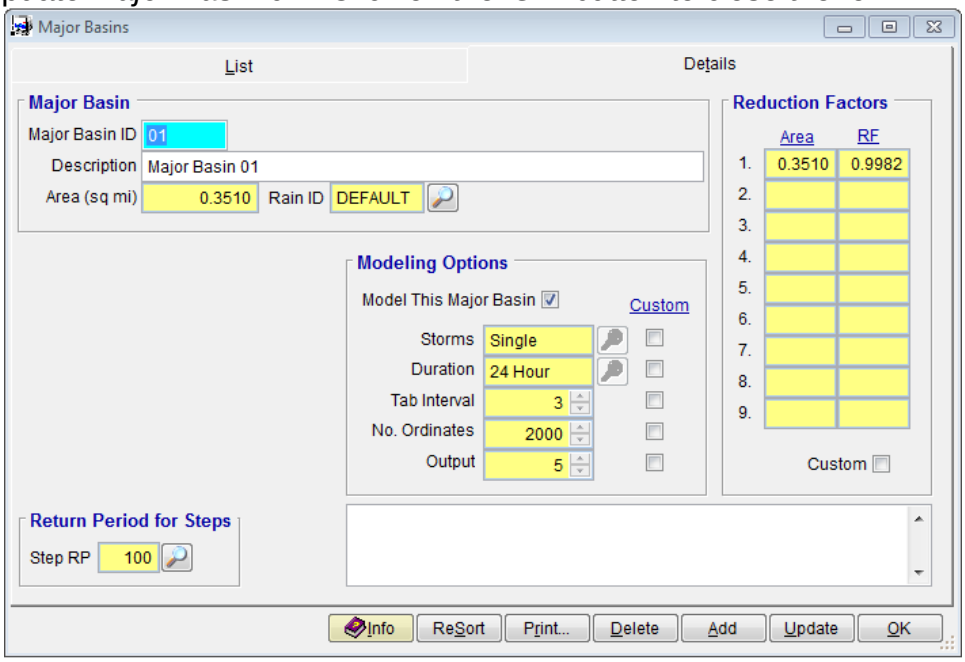
3.0 SETTING THE MODEL RUNS PATH

When running models, the input and result files have similar file names for each project. Therefore to prevent one project overwriting the results of another project, it is necessary to establish a unique directory for each project's model runs.

Go to *File* ➔ *Project Paths* to establish the model runs path. Press the ellipse button ('…') to the right of the '*Model Runs Path*' field and navigate to an appropriate directory. Identify and select this folder as the model runs path or press the '*Make New Folder*' button if the desired folder does not exist. Press '*OK'* after identifying and selecting the model runs path location. Press '*OK'* to close the Project Paths form. Note that the file path defined in the '*Model Runs Path*' in the following figure is not necessarily the same as the Model Runs Path for all users. The path depends on the location of the program installed.

4.0 ESTABLISH MAJOR BASIN ID'S

Select *Hydrology* ➔ *Major Basins* to access the *Major Basins* data. The software automatically establishes at least one *Major Basin* (01) when creating a new project. Since we will only have one major basin in this project, no modification on the form is needed at this time. After the sub basins are established, the user needs to return here to update *Major Basin* 01. Click on the *'OK'* button to close the form.

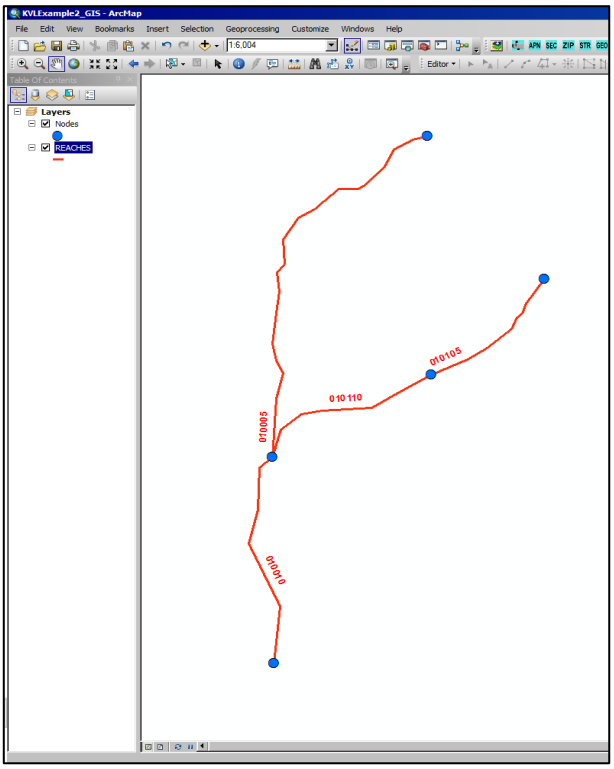


5.0 DIGITIZE THE DATASETS IN GIS

All GIS files must be in ESRI Shape file format.

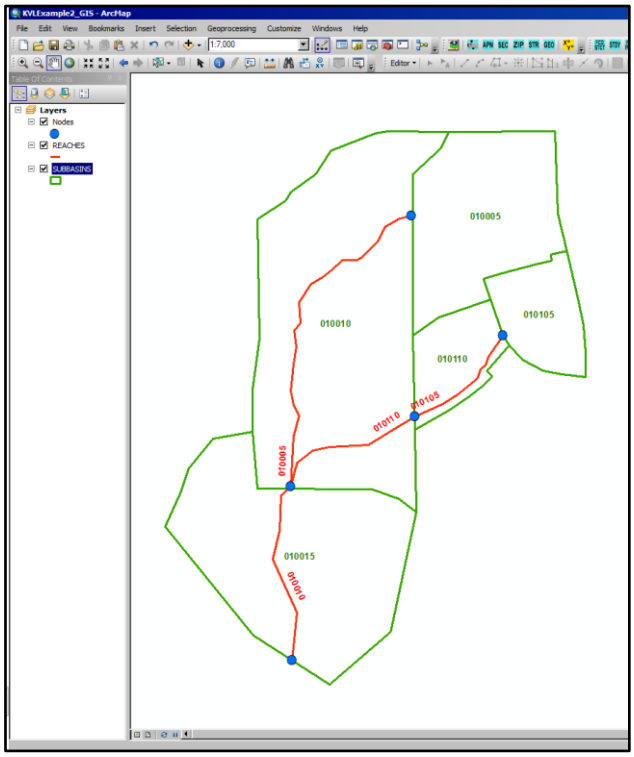
6.0 NODES AND ROUTING DATA

Digitize the Nodes and Routing data and provide Routing IDs for the routing reaches. The Nodes data shown are for cosmetic purposes only to show the location of the starting and ending points of routing reaches.



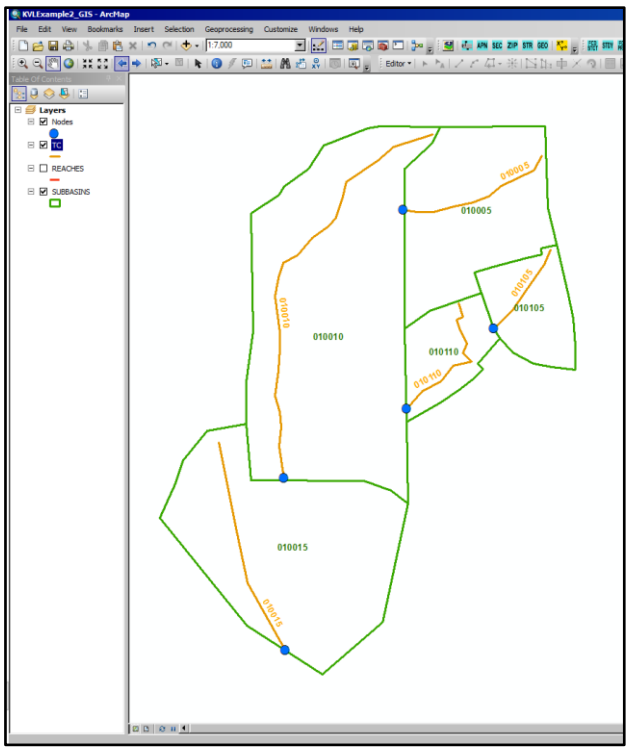
7.0 SUB BASINS

Digitize the Sub Basin areas and provide AREA IDs.



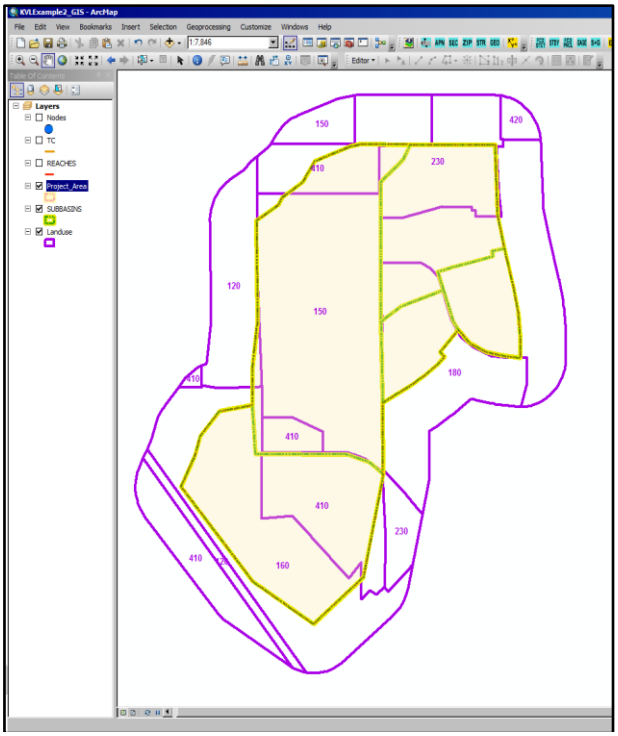
8.0 TIME OF CONCENTRATION, TC

Digitize the Reach segments for the Sub basin areas from which the Time of Concentration information are derived. Enter the Upstream Ground Elevation (USGE) and Downstream Ground Elevation (DSGE) data.



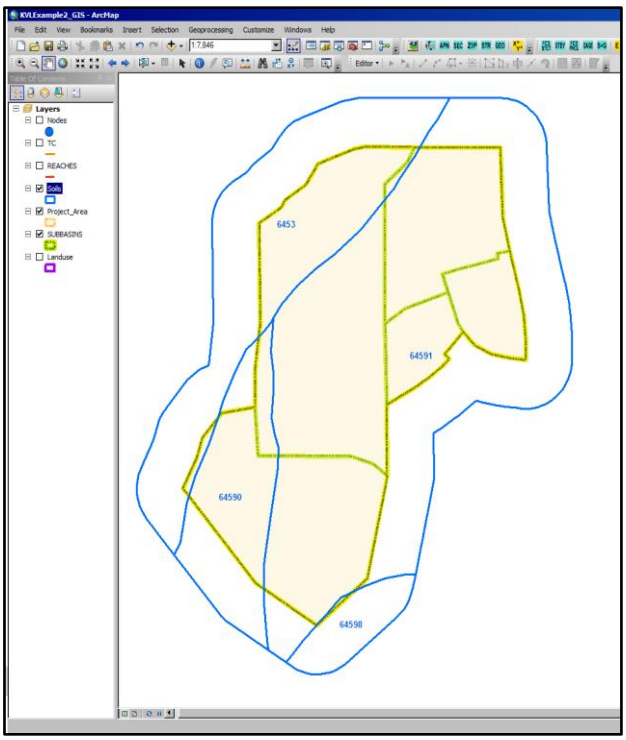
9.0 LAND USE

Obtain the Land Use Map, if it is available, or digitize the land use areas that should envelope the entire project area. Make sure that the Land Use codes used in the digitized land use maps are included in the Land Use Defaults defined in DDMSW.



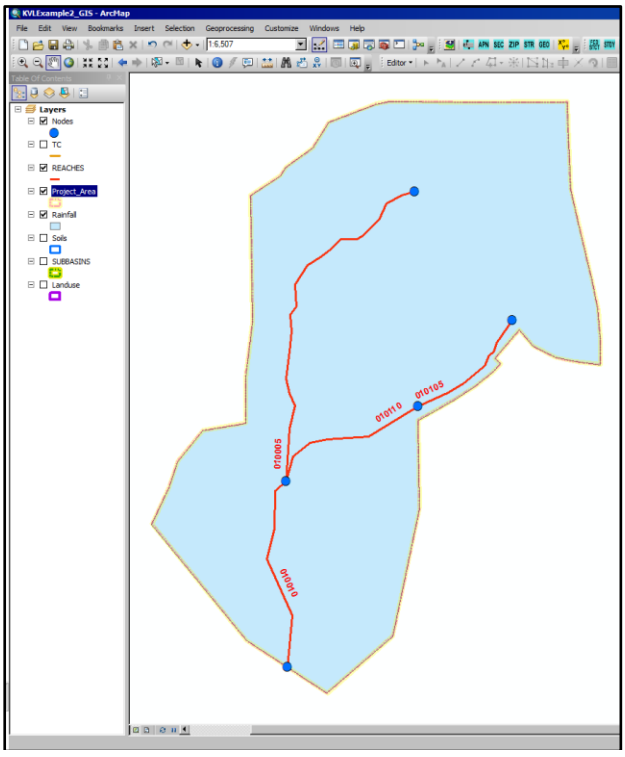
10.0 SOILS MAP

Obtain Soils dataset or if not available, to digitize using GIS from hardcopies of soils map. Make sure that Soil IDs are defined in the Soils dataset and that they should match the Soil IDs that are in the Soil Defaults in DDMSW. Also, make sure that the soils map created for the project extends beyond the entire project area (i.e., areas covered by all the sub basins).



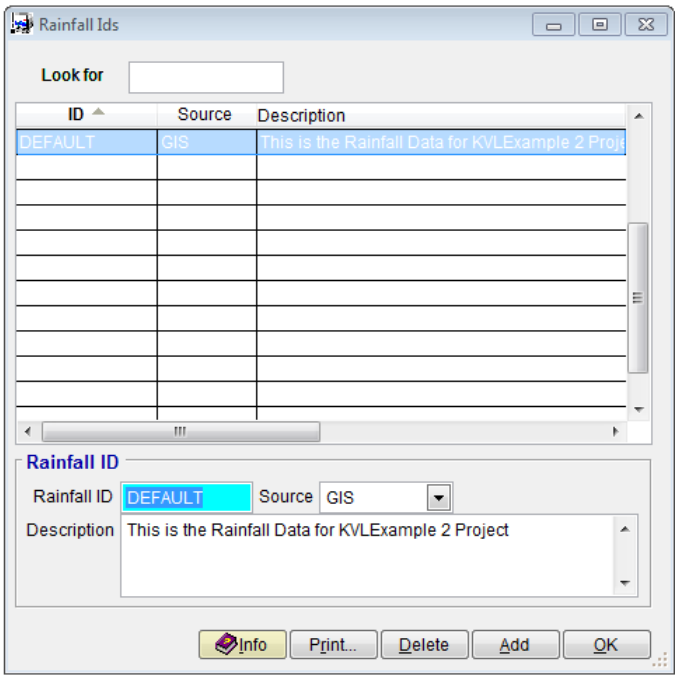
11.0 PROJECT AREA

Consolidate all the Sub Basin areas to define the extent of the Project Area. This consolidated polygon will be used to evaluate the Rainfall data for the project.

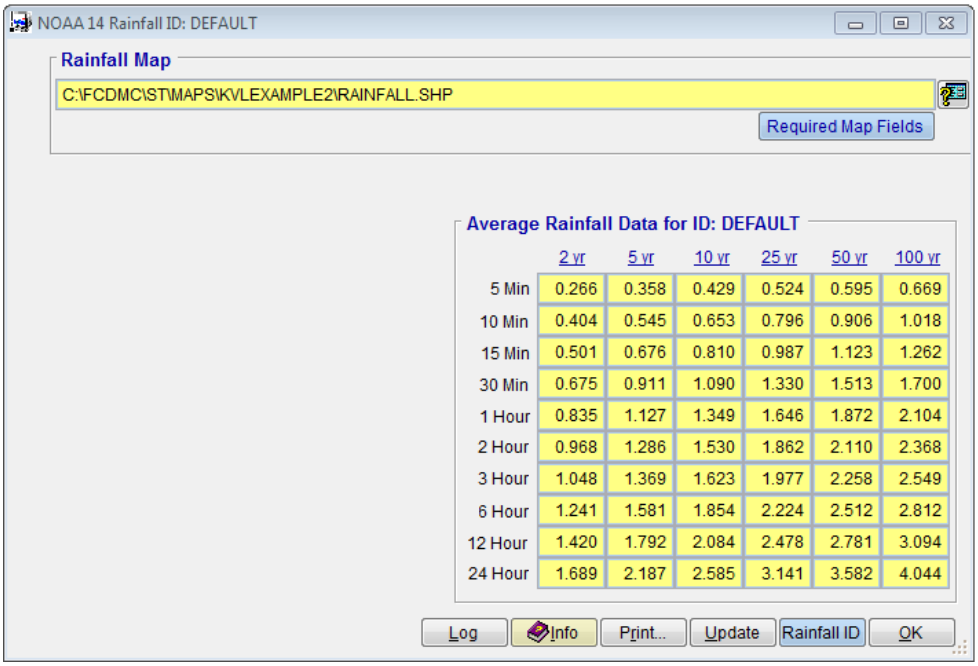


12.0 ESTABLISH RAINFALL DATA FOR PROJECT

Select *Hydrology* ➔ *Rainfall Ids* and on the *Rainfall Ids* form to select *GIS* from the drop down menu. Type *"DEFAULT"* on the Rainfall ID textbox and add a text description on the Comment Box (Optional). Click the "Save" button to save the entered data and click "OK" to close the "Rainfall Ids" form.

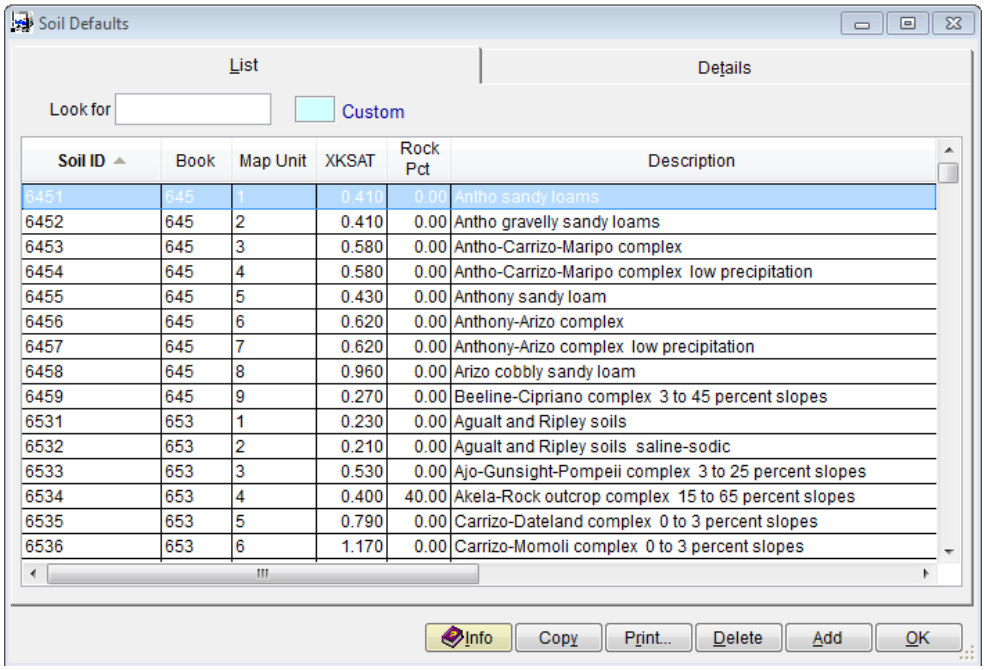


Select *Hydrology* ➔ *Rainfall* and on the NOAA14 Rainfall form, locate and select the Rainfall map (Rainfall.shp) using the button on the right side of the Rainfall Map textbox. Click "*Save*" to save data and click *Update* to populate the Average Rainfall Data table for the six (6) Return Intervals (2 yr, 5-yr, 10-yr, 25-yr, 50 yr, and 10 yr) and 10 time durations (5 Min, 10 Min, 15 Min, 30 Min, 1 Hour, 2 Hour, 3 Hour, 6 Hour, 12 Hour, and 24 Hour). Note that the file path name defined in the '*Rainfall Map'* as shown in the following figure might not be necessarily the same as the file path for individual modelers or users. The file path depends on the location of the shape files.



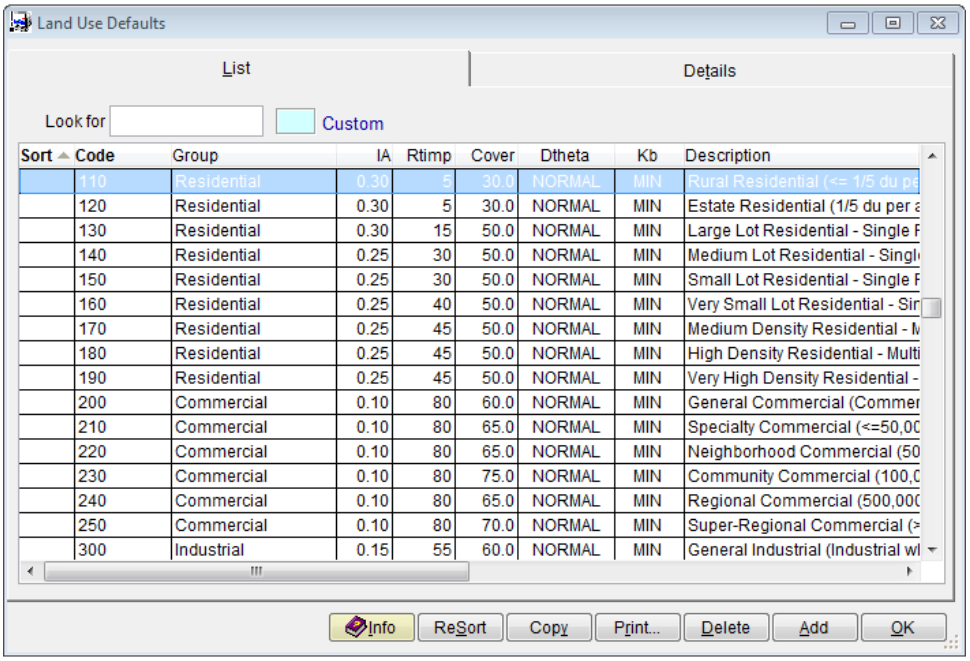
13.0 REVIEW SOIL DEFAULTS

Select *Hydrology* ➔ *Soil Defaults* to view or to modify the Agency Soil Defaults or to add 'Custom' data. For this example custom values are not required. Click on the *'OK'* button to close the form.



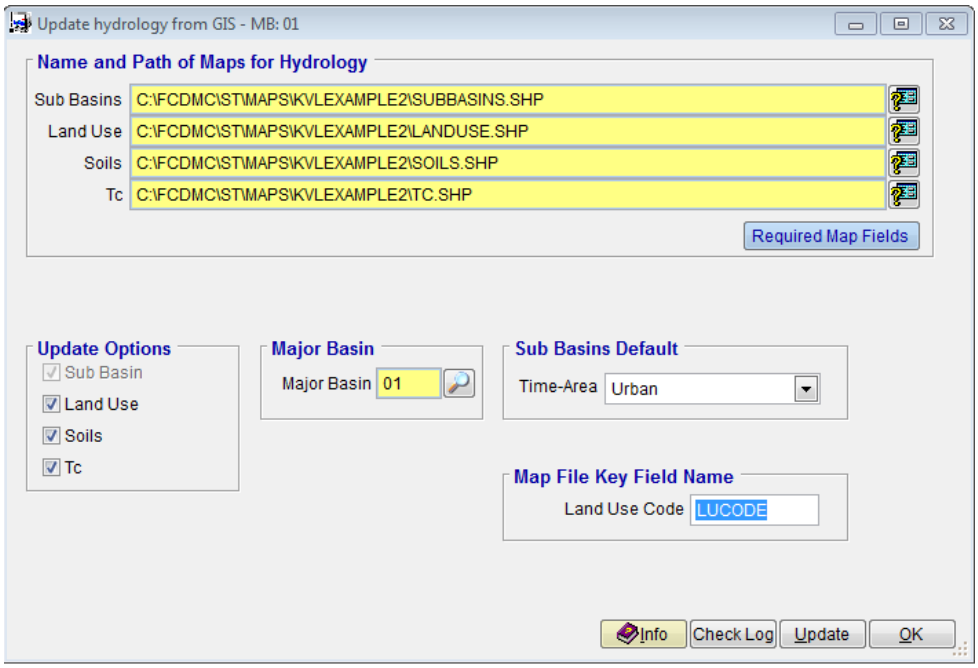
14.0 REVIEW LAND USE DEFAULTS

Select *Hydrology* ➔ *Land Use Defaults* to view or to modify Agency land use defaults or to add 'Custom' data. For this example custom values are not required. Click on the *'OK'* button to close the form.



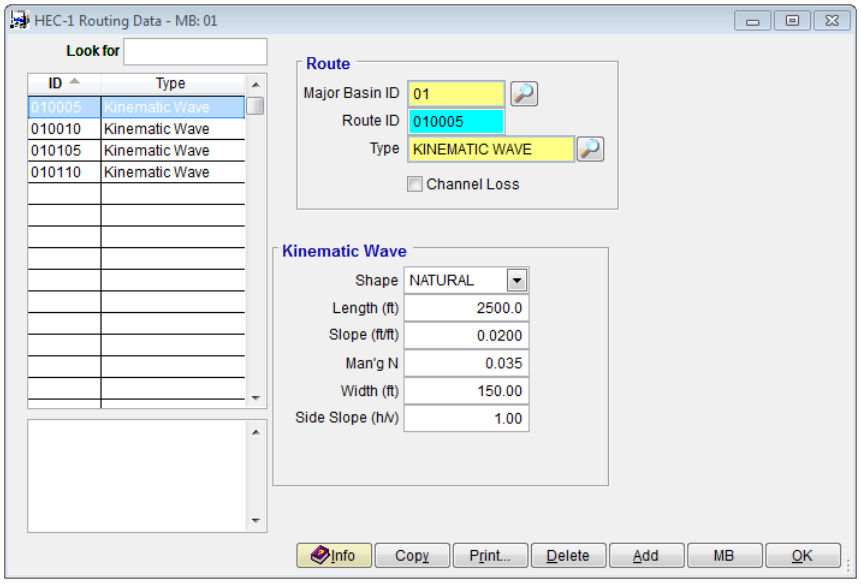
15.0 UPDATE HYDROLOGY DATA

Select *Maps* ➔ *Update Hydrology* to access the "Update Hydrology from GIS" form. Check the *Land Use*, *Soils* and *Tc* check boxes to be able to access the individual Name and Path of Maps for individual datasets that are used for updating the hydrology of the project. Locate the *Sub Basin*, *Land Use*, *Soils* and *Tc* shape files by clicking the locator button on the right side of each data text box. Once, all the Name and Path of Maps of datasets are defined, click on the *'Update' button* to establish the land use, soils, and sub basin data as well as to update the hydrologic model parameters. Note that the file path names defined in the '*Sub Basins*', '*Land Use*', '*Soils'*, and '*Tc'* fields as shown in the following figure might not be necessarily the same as those file path names from individual modelers and users. The file paths depend on the location of the shape files.



16.0 ESTABLISH ROUTING DATA

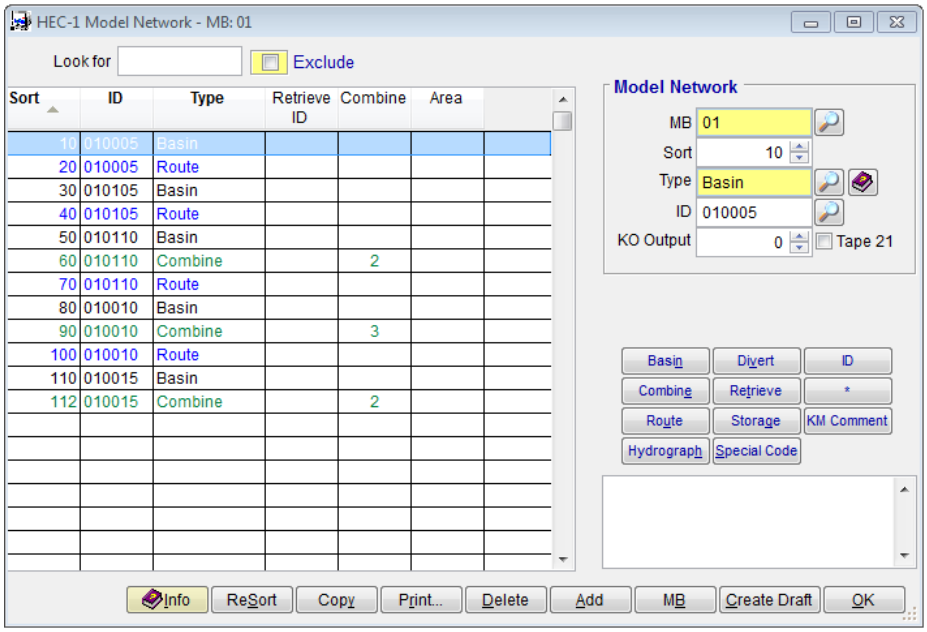
Select *Hydrology* ➔ *HEC-1* ➔ *Routing* to access the Routing data. Click on *'Add'* to add the first record. Enter the data as shown for Route ID 010005.



For this example, we will just make 3 copies (by clicking the Copy button) of this first record and change the Route ID to 010010, 010105, and 010110 each time.

17.0 ESTABLISH THE HEC-1 MODEL NETWORK

Select *Hydrology* ➔*HEC-1* ➔ *Network* to access the "HEC-1 Model Network" form.



Click "Add" and select "Basin" on the "Select Type" form. Click "OK" to close the "Select Type" form. Click the Selector button on the right side of the ID textbox, and then select "010005" as the Subbasin ID. Click "OK" to close the "Select ID" form. Click "Save" to save the first record.

Click "Add" and select "Route" on the "Select Type" form. Click "OK" to close the "Select Type" form. Click the Selector button on the right side of the ID textbox, and then select "010005" as the Route ID. Click "OK" to close the "Select ID" form. Click "Save" to save the second record.

Click "Add" and select "Basin" on the "Select Type" form. Click "OK" to close the "Select Type" form. Click the Selector button on the right side of the ID textbox, and then select "010105" as the Subbasin ID. Click "OK" to close the "Select ID" form. Click "Save" to save the third record.

Click "Add" and select "Route" on the "Select Type" form. Click "OK" to close the "Select Type" form. Click the Selector button on the right side of the ID textbox, and then select "010105" as the Route ID. Click "OK" to close the "Select ID" form. Click "Save" to save the fourth record.

Click "Add" and select "Basin" on the "Select Type" form. Click "OK" to close the "Select Type" form. Click the Selector button on the right side of the ID textbox, and then select

"010110" as the Subbasin ID. Click "OK" to close the "Select ID" form. Click "Save" to save the fifth record.

Click "Add" and select "Combine" on the "Select Type" form. Click "OK" to close the "Select Type" form. On the ID textbox, enter "010110". On the Combine textbox, enter 2, which requesting the program to combine two hydrographs. Click "Save" to save the sixth record.

Click "Add" and select "Route" on the "Select Type" form. Click "OK" to close the "Select Type" form. Click the Selector button on the right side of the ID textbox, and then select "010110" as the Route ID. Click "OK" to close the "Select ID" form. Click "Save" to save the seventh record.

Click "Add" and select "Basin" on the "Select Type" form. Click "OK" to close the "Select Type" form. Click the Selector button on the right side of the ID textbox, and then select "010010" as the Subbasin ID. Click "OK" to close the "Select ID" form. Click "Save" to save the 8th record.

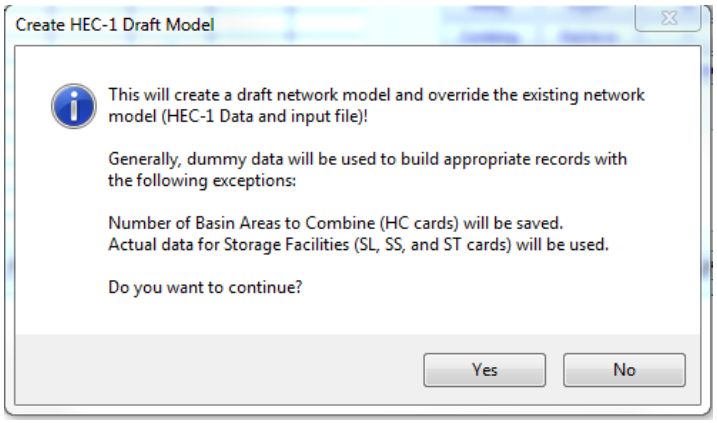
Click "Add" and select "Combine" on the "Select Type" form. Click "OK" to close the "Select Type" form. On the ID textbox, enter "010010". On the Combine textbox, enter 3, which is requesting the program to combine three hydrographs. Click "Save" to save the 9th record.

Click "Add" and select "Route" on the "Select Type" form. Click "OK" to close the "Select Type" form. Click the Selector button on the right side of the ID textbox, and then select "010010" as the Route ID. Click "OK" to close the "Select ID" form. Click "Save" to save the 10th record.

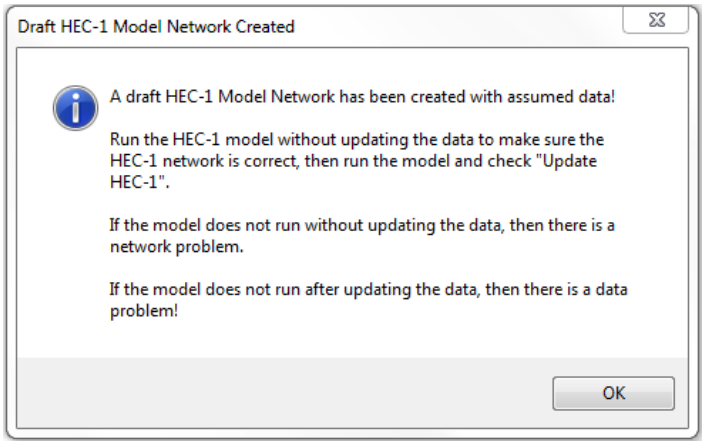
Click "Add" and select "Basin" on the "Select Type" form. Click "OK" to close the "Select Type" form. Click the Selector button on the right side of the ID textbox, and then select "010015" as the Subbasin ID. Click "OK" to close the "Select ID" form. Click "Save" to save the 8th record.

Click "Add" and select "Combine" on the "Select Type" form. Click "OK" to close the "Select Type" form. On the ID textbox, enter "010015". On the Combine textbox, enter 2, which is requesting the program to combine two (2) hydrographs. Click "Save" to save the 11th record.

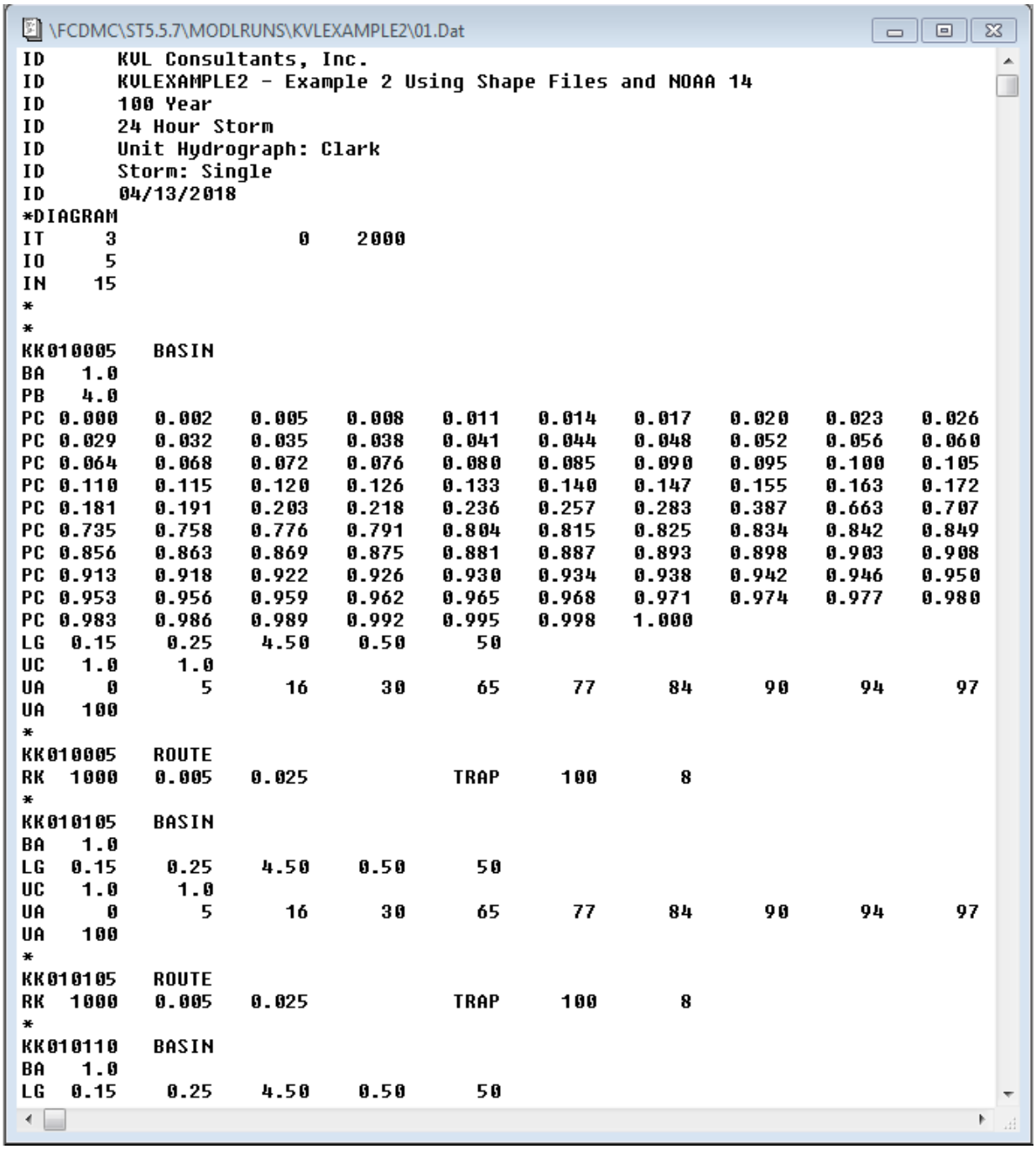
After all data has been entered click the *'Create Draft'* button.



On the “Create HEC-1 Draft Model” form, click Yes for the program to create a HEC-1 Draft Model of the project. Click OK, to close the “Draft HEC-1 Model Network Created” form.

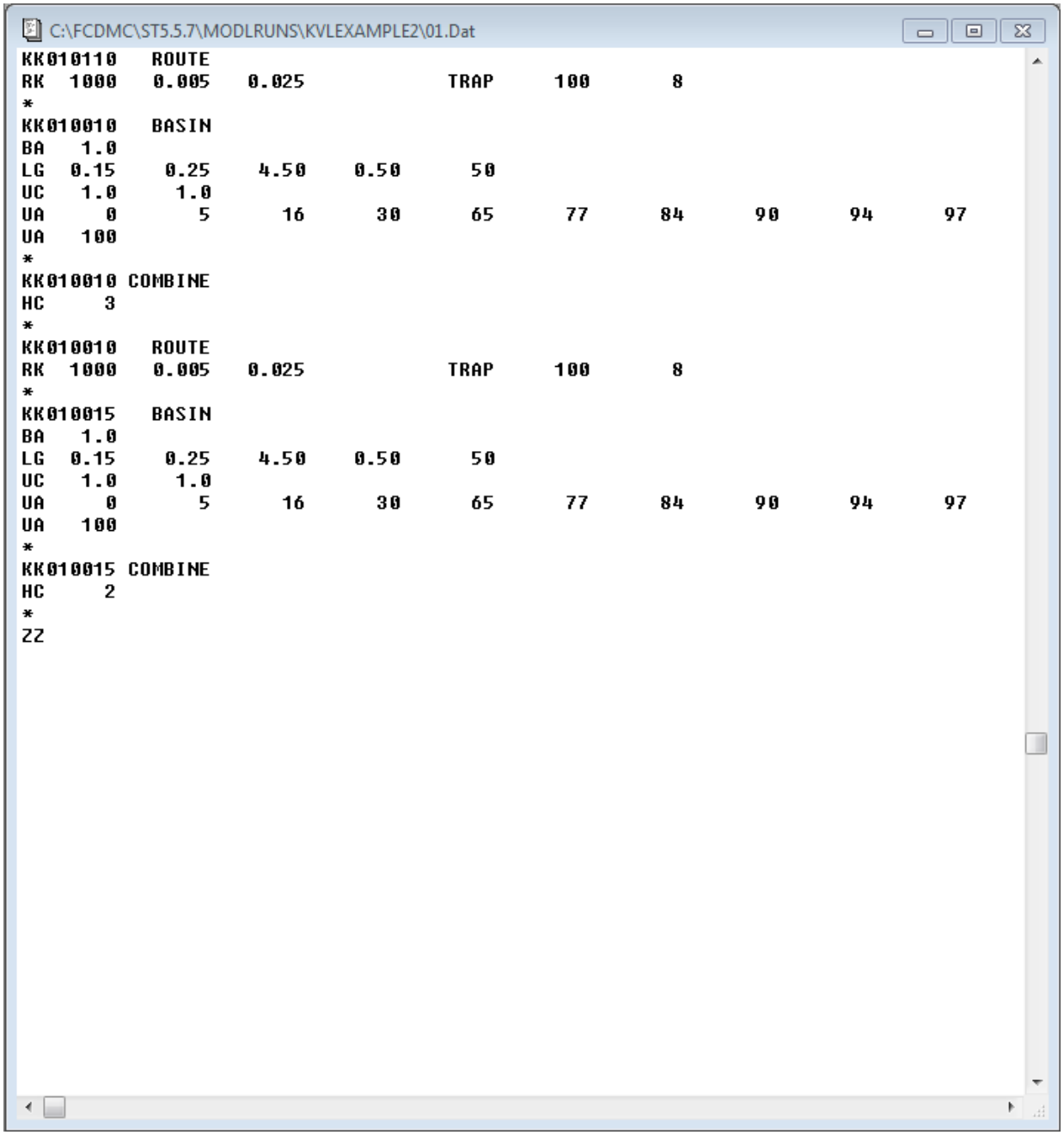


After exiting from the previous form, the program shows automatically the Draft “HEC-1 Model” file. Close the Text Editor after viewing file. Click “OK” to close the “HEC-1 Model Network” form.



\FCDMC\ST5.5.7\MODLRUNS\KVLEXAMPLE2\01.Dat

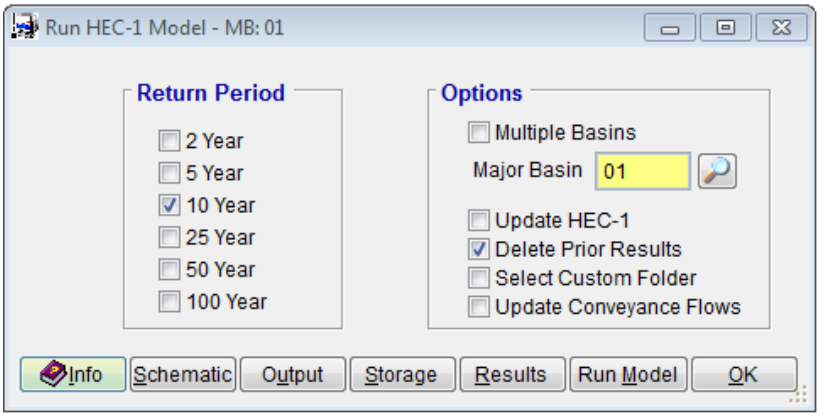
```
ID      KVL Consultants, Inc.
ID      KVLEXAMPLE2 - Example 2 Using Shape Files and NOAA 14
ID      100 Year
ID      24 Hour Storm
ID      Unit Hydrograph: Clark
ID      Storm: Single
ID      04/13/2018
*DIAGRAM
IT     3               0    2000
IO     5
IN    15
*
*
KK010005   BASIN
BA    1.0
PB    4.0
PC 0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
PC 0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
PC 0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
PC 0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
PC 0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
PC 0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
PC 0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
PC 0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
PC 0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
PC 0.983   0.986   0.989   0.992   0.995   0.998   1.000
LG  0.15    0.25    4.50    0.50      50
UC   1.0     1.0
UA     0       5      16      30      65      77      84      90      94      97
UA   100
*
KK010005   ROUTE
RK  1000   0.005   0.025           TRAP     100       8
*
KK010105   BASIN
BA    1.0
LG  0.15    0.25    4.50    0.50      50
UC   1.0     1.0
UA     0       5      16      30      65      77      84      90      94      97
UA   100
*
KK010105   ROUTE
RK  1000   0.005   0.025           TRAP     100       8
*
KK010110   BASIN
BA    1.0
LG  0.15    0.25    4.50    0.50      50
```


C:\FCDMC\ST5.5.7\MODLRUNS\KVLEXAMPLE2\01.Dat
KK010110 ROUTE
RK 1000 0.005 0.025 TRAP 100 8
*
KK010010 BASIN
BA 1.0
LG 0.15 0.25 4.50 0.50 50
UC 1.0 1.0
UA 0 5 16 30 65 77 84 90 94 97
UA 100
*
KK010010 COMBINE
HC 3
*
KK010010 ROUTE
RK 1000 0.005 0.025 TRAP 100 8
*
KK010015 BASIN
BA 1.0
LG 0.15 0.25 4.50 0.50 50
UC 1.0 1.0
UA 0 5 16 30 65 77 84 90 94 97
UA 100
*
KK010015 COMBINE
HC 2
*
ZZ

18.0 RUN THE DRAFT HEC-1 MODEL

Select *Hydrology* ➔ *HEC-1* ➔ *Model* to access the HEC-1 model.

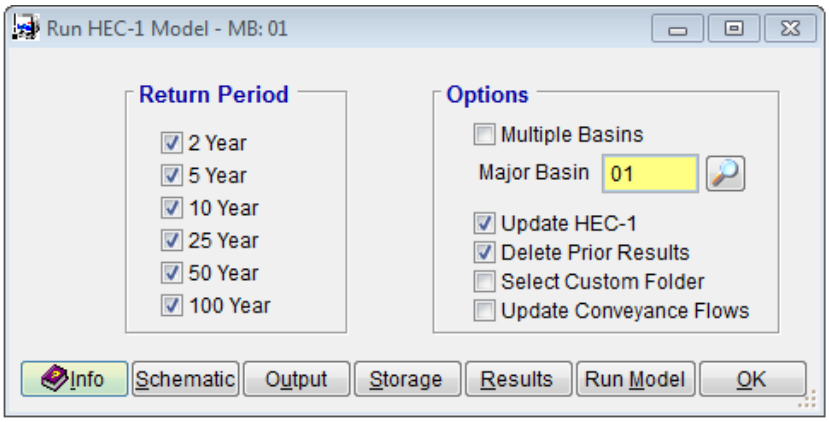
Check the '*10 Year*' Return Period and the *'Delete Prior Results*' option. Uncheck all other return periods and options. Click 'Save' to save the entered preferences.



Click *'Run Model'* to run the Draft HEC-1 Model. If the model runs without issues, it means that the HEC-1 Model Network that was built for the project is fine.

19.0 RUN THE FINAL HEC-1 MODEL

To run the model for all the return periods, click all the textboxes for the six return periods, and then check the "Update HEC-1" and "Delete Prior Results" options. Click "Save" to save the execution settings and run the model by clicking the "Run Model" button.

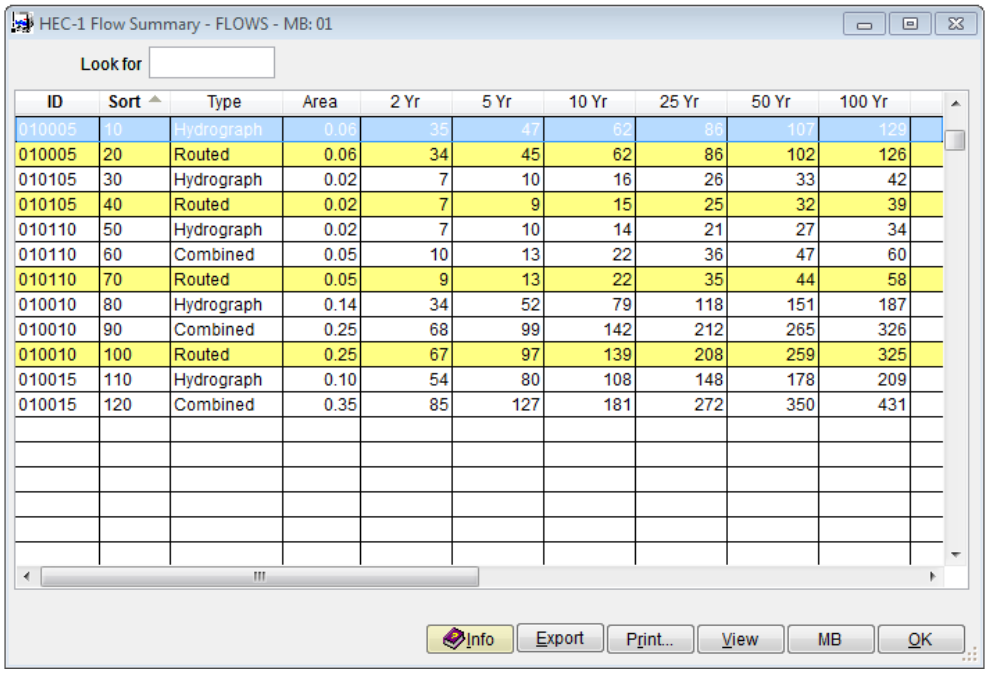


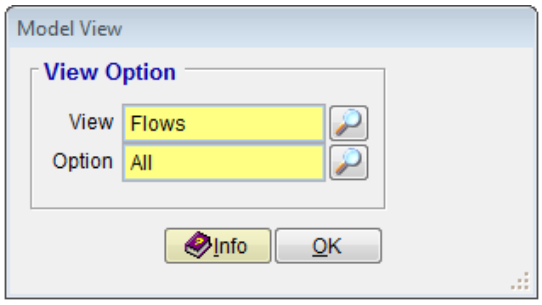
If the model runs correctly, it means the HEC-1 network and data are fine. The results can be viewed by clicking 'Results'. A full output file can be viewed with the 'Output' button, selecting the specific output file to view and pressing 'OK'. The 100-Year

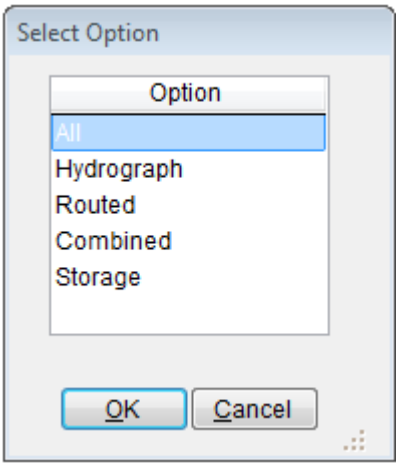
Schematic can be viewed by pressing the 'Schematic' button. Press 'OK' to close the Run HEC-1 Model form.

20.0 VIEW FLOW SUMMARY

Select *Hydrology* ➔ *HEC-1* ➔ *Flow Summary* to access the HEC-1 model results. Click '*View'* to view other summary items.

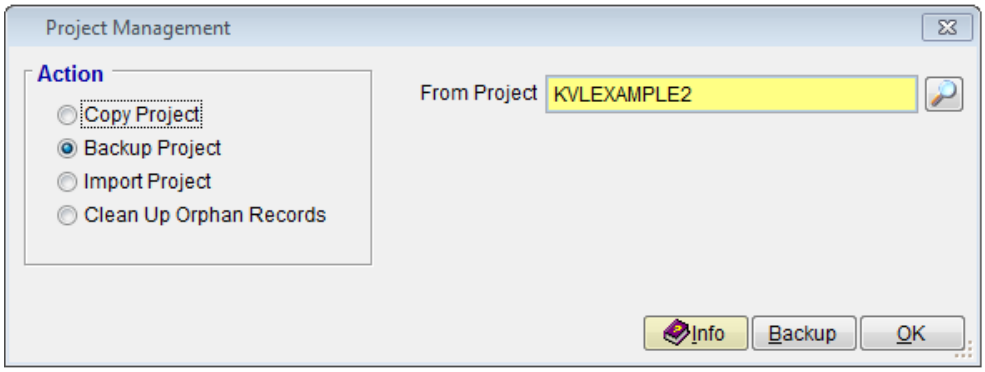


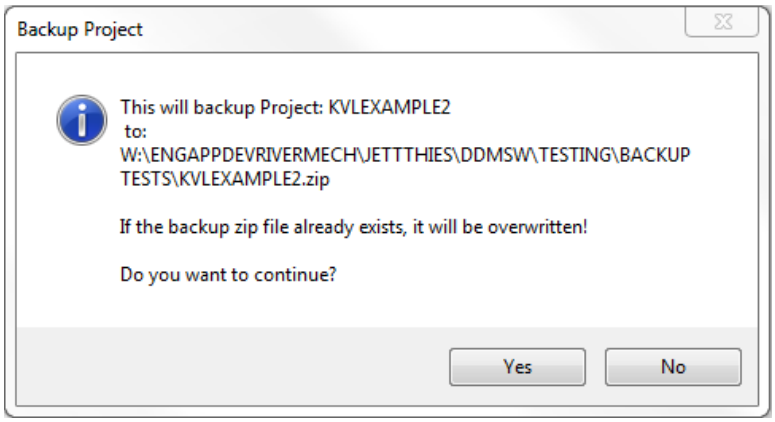


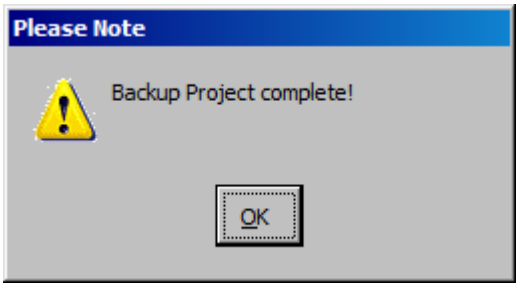


21.0 BACKUP PROJECT

Select *File* ➔ *Project Management* to access the Project Management form. Select *'Backup Project'* as the *Action* and *KVLEXAMPLE2* as the project (use the adjacent button to select). Click the *'Backup'* button to create a backup copy of the project. Select the directory where the backup file should go and finally click *'OK'* when a directory is chosen. Click "Yes" to confirm.







This ends this tutorial.