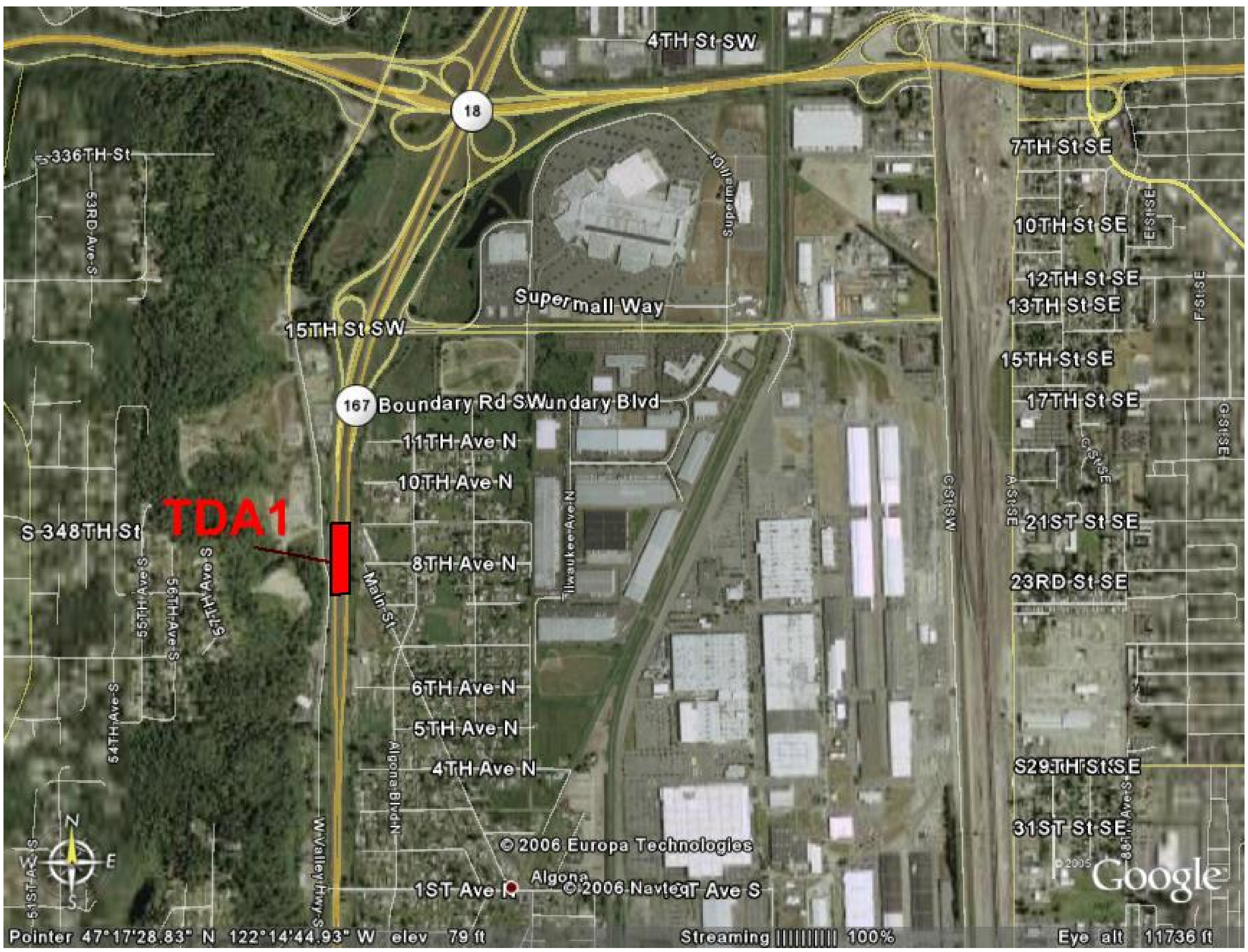
MGS Flood
CAVFS-Example Design Problems

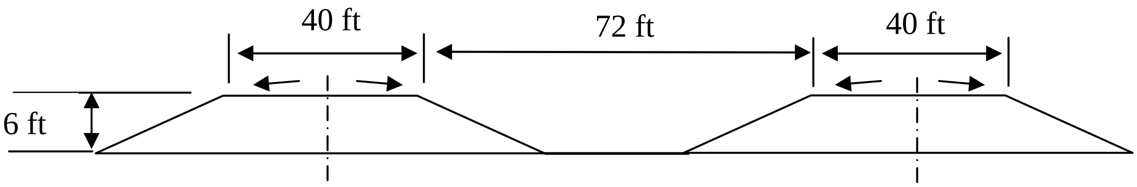
Work Session 1
Design of CAVFS for Water Quality Treatment

A TDA for a section of SR-167 highway near Auburn is to be improved with the addition of carpool lanes in each direction.



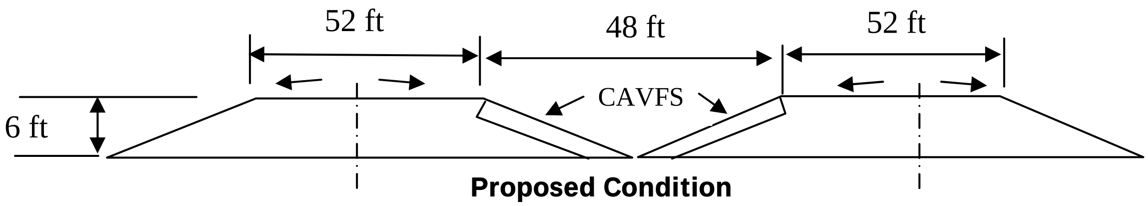
Project Location Map

The existing configuration consists of two 12-foot lanes with 8-foot shoulders in each direction separated by a 72’ wide grass median. The existing lanes are crowned so that runoff from only half of the existing impervious surface drains to the median.



Existing Condition

The project will add one 12-foot lane in each direction, while maintaining the current shoulder widths. The new lanes will be added in the freeway median.



Proposed Condition

The project is located on Alderwood soils, which are classified as SCS Hydrologic Group C.

Using this information, design a CAVFS to treat runoff from the new and existing impervious surface that drains to the median for this 1200 foot long section of roadway. The CAVFS data is as follows:

Compost Depth: 1 foot
Compost Hydraulic Conductivity: 1.7 in/hr
Compost Width: (6^2+24^2)^0.5= 25 feet (along slope)
Underlying Soil Infiltration Rate: 0.01 in/hr
Compost Slope: 4H:1V
Gravel Spreader Width: 2 ft
Gravel Spreader Porosity: 30%
Gravel Spreader Hydraulic Conductivity: 2 in/hr

- **Remember the default settings are in ft/day for the Hydraulic Conductivity. You will need to convert the values. For this example change the units to in/hr to match the example problem. The units are under: Tool- Options- 3rd tab Units.**

Note designing the CAVFS is a trial and error procedure. We’ll input the CAVFS porosity, run the model, and check the percentage of runoff treated. This process will be repeated until we achieve the 91% volume treatment criteria. Compost porosity is varied in the field by combining the compost with various types of soil until the desire properties are achieved.

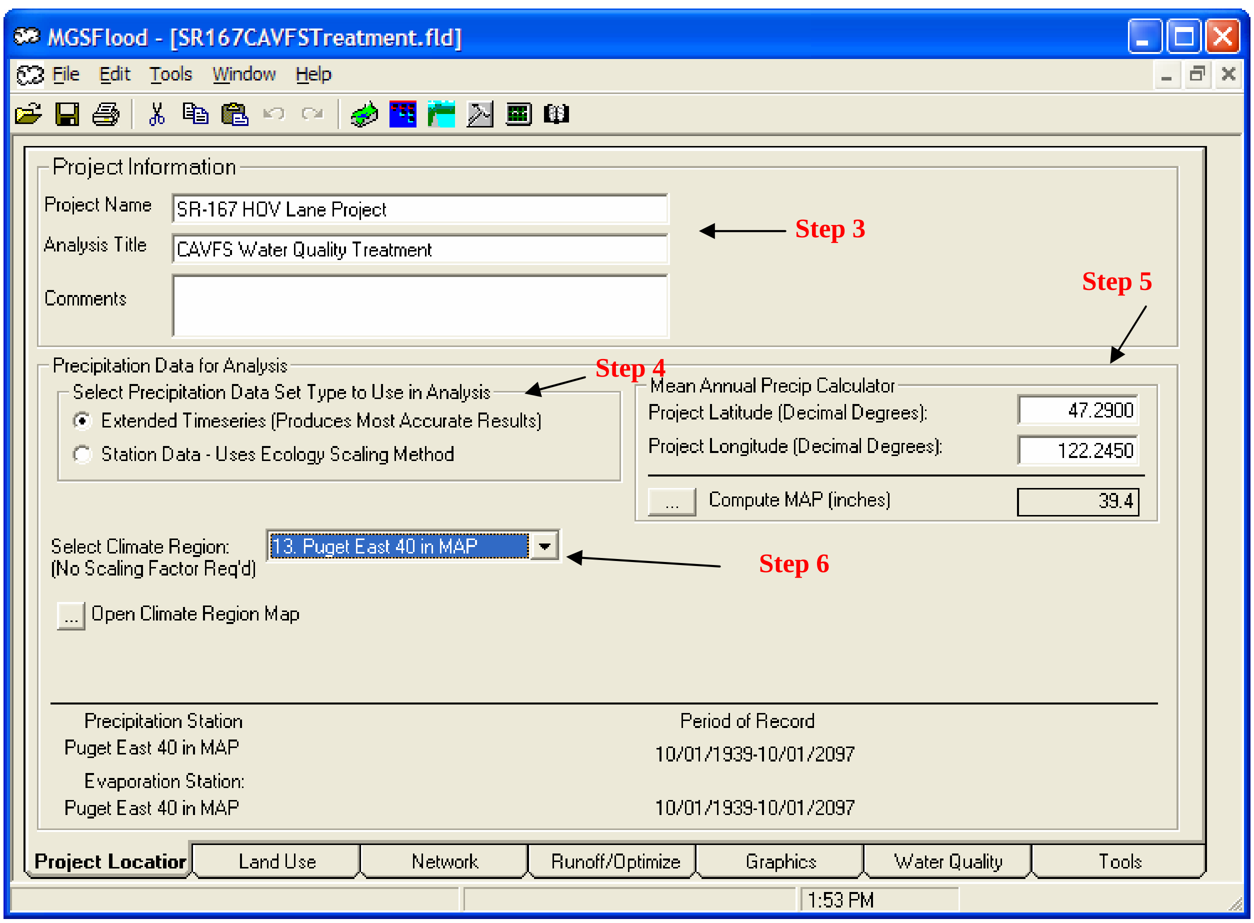
Analysis Steps

Start Program, Save Project File

1. Start program from Windows Start button
   Start-Programs-MGS Software-MGSFlood
2. Click File Save as, Enter "SR167CAVFSTreatment" for file name. Create project folder when prompted

Project Location Tab

3. Enter project name, analysis title, and comments.
4. Check the Extended Precipitation Timeseries Option Button
5. Compute the mean annual precipitation using the calculator,
   From Google Earth Map (above) or Environmental Workbench, Lat=47.29 deg, Long=122.245 deg
6. Select Climate Region 13 Puget East 40 in MAP from the drop down list box.



Land Use Tab

7. Enter Pre- and postdeveloped area. Note, we're only entering the area that drains to the median. Since the areas are identical for the Northbound and Southbound lanes, design the CAVFS using lanes from one direction and use the same design for the other direction.

Predeveloped:

Grass:
½ Median = (36')*1200' = 43,200/43560= **0.992 ac**

Impervious: Include area that drains from road crown toward center:

(12'+8')*1,200' = 24,000/43560= **0.551 ac**

Total predevelopment Area: 1.543 ac

For SCS Type C soil, use Till

Postdeveloped:

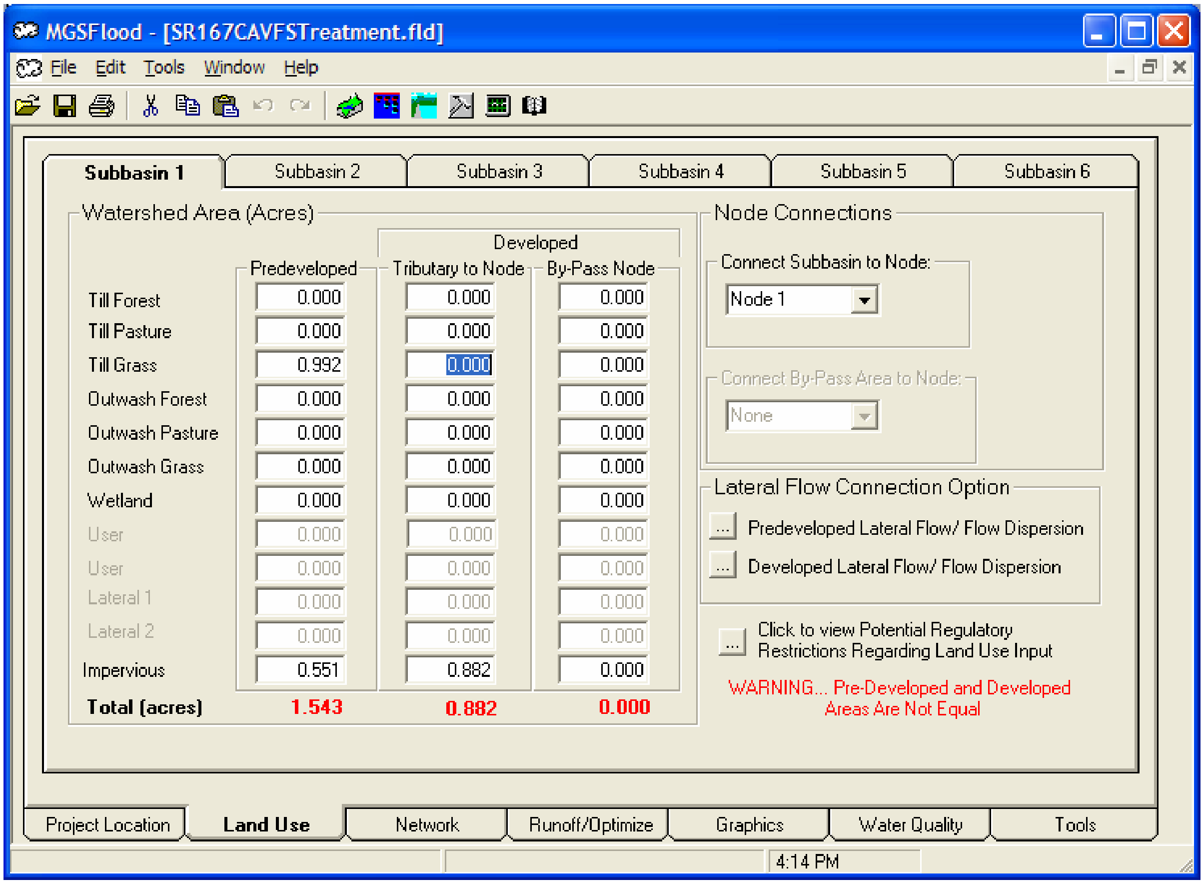
Grass:
½ Median = 24'*1,200= 28,800/43,560= **0.661 ac**
(Note the postdeveloped grass area will be all CAVFS. Precipitation will be simulated on the CAVFS by the CAVFS routine, therefore we don't need to specify this area on the Land Use tab.

Developed Impervious (Existing Lane+Shoulder+New Lane:

(12'+8+12')*1,200 = 38,400/43,560= **0.882 ac**

8. Enter land use from above. Note, don't enter the land use for the CAVFS because the precipitation will be applied using the CAVFS module (shown later)

Connect Subbasin 1 to Node 1

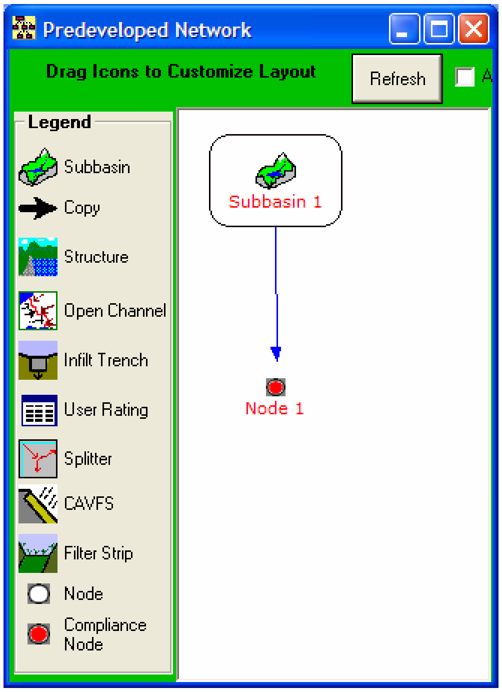


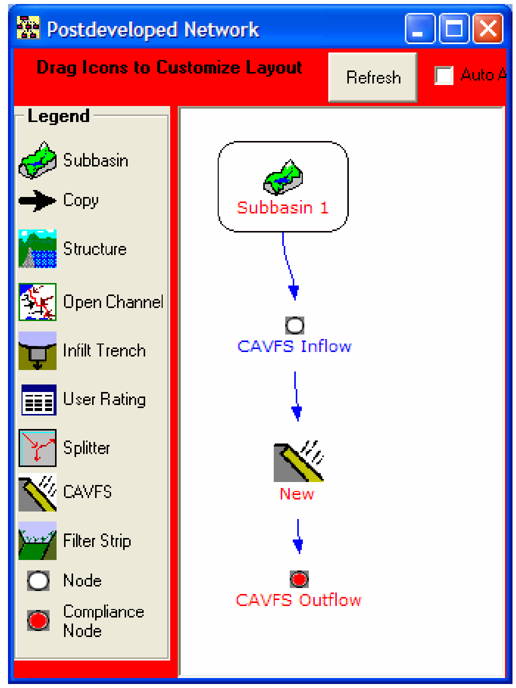
9. Click the Network Tab. No changes are needed for the Existing Condition Scenario.

10. Select the Proposed Condition Scenario. Enter Proposed Condition Node 1 and Node 2 names "CAVFS Inflow" and "CAVFS Outflow", respectively.

11. Define the link connecting Nodes 1 and 2 as a CAVFS

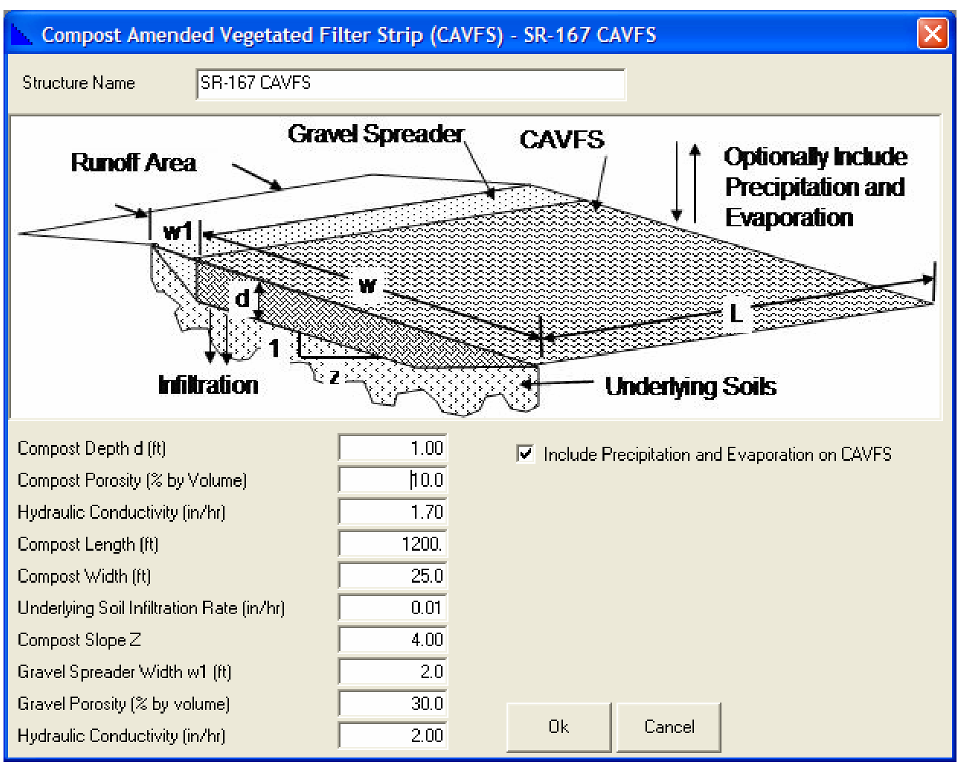
12. Click the watershed schematic button. The watershed schematic should look something like the figure below.





13. Click the Link Definition for the CAVFS to input the CAVFS data.

14. We'll try an initial CAVFS porosity of 10%. Check the option box to include precipitation and evaporation on the CAVFS. Enter the remainder CAVFS information as follows:



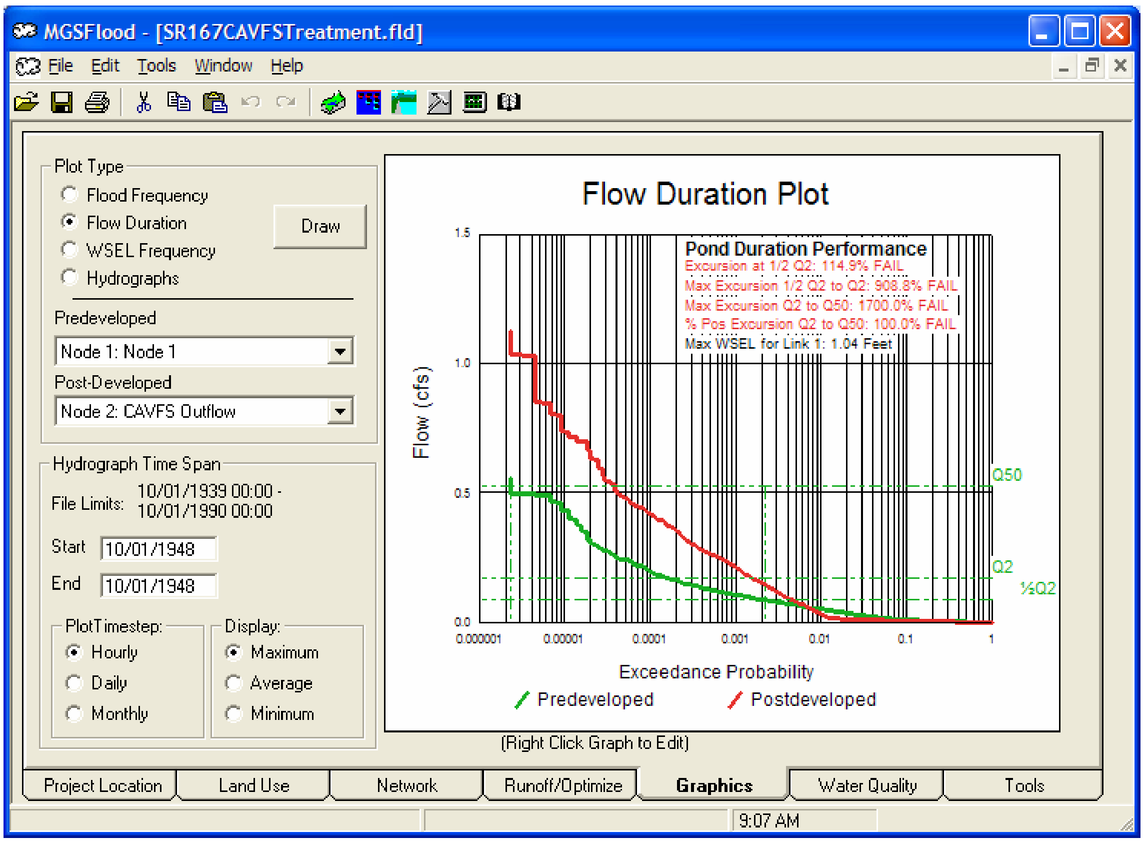
15. Click OK save your input and return to the Network tab.

Runoff/Optimize tab

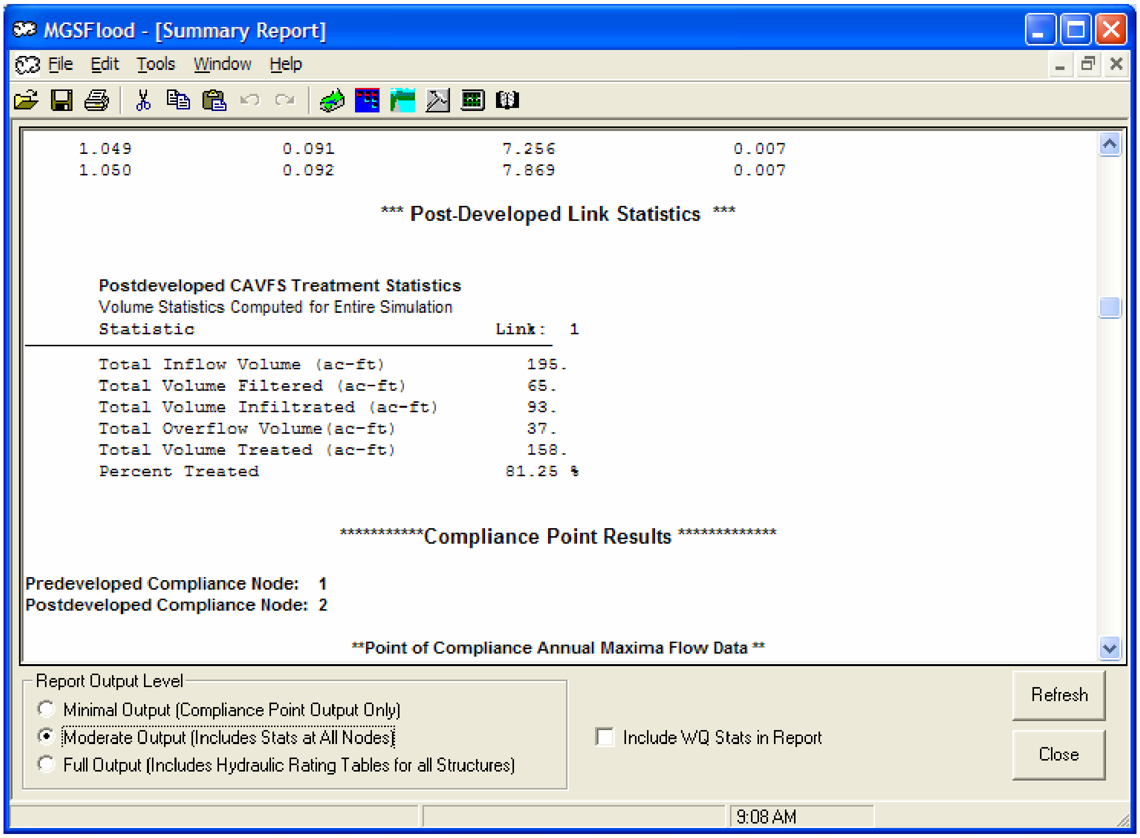
16. Because this is a trial and error solution, reduce the simulation time span by entering 1990 as the end date. Once we have a solution that is close to the 91% volume treatment, we'll run the full record through.

17. Compute runoff for the shortened period of record. Click the *Route* button.

When the simulation is complete, the duration performance will be displayed. We don't care about the duration performance now because we're sizing the CAVFS for water quality treatment only. We'll add a pond later to meet the flow control criteria.



18. Click the project report button and scroll down to the CAVFS treatment statistics. Note the treatment for 10% compost porosity is only 81% < 91%, therefore no good.



19. Repeat the process above with a CAVFS porosity of 20%:

Treatment Result: 90.5. %

20. Repeat the process above with a CAVFS porosity of 25%:

Treatment Result: 92.7 % (Good enough)

21. Rerun the design with the full 158-year record. Specify the end year as 2097:

FINAL Treatment Result: 91.3 %