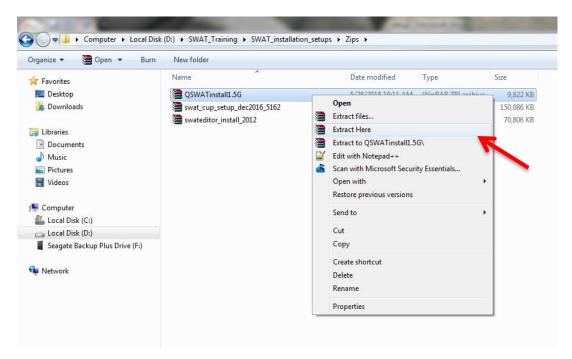


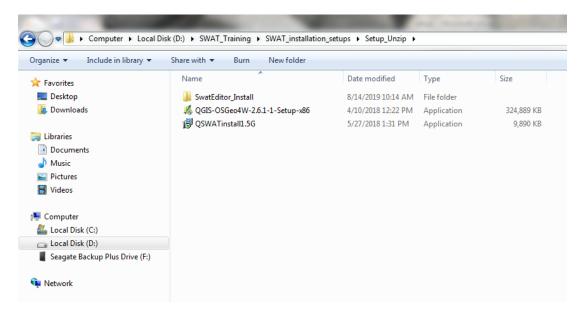
SURFACE RUNOFF MODELING USING "QSWAT"

INSTALLATION OF SOFTWARES

1. Unzip the files **QSWATinstall1.5G**, swateditor_install_2012.



2. Move the unzipped files to Setup_Unzip folder.

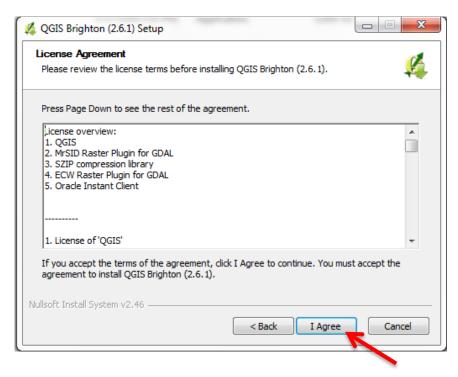




3. Run *QGIS-OSGeo4W-2.6.1-1-Setup-x86.exe* from *Setup_Unzip* folder and click *Yes* on the popup dialog box. Setup dialog box appears. Click *Next*.



4. Click I Agree button.





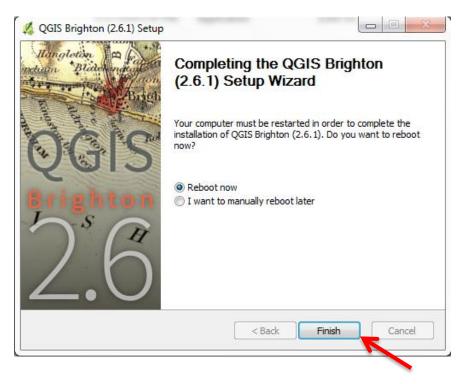
QGIS Brighton (2.6.1) Setup	
Choose Install Location Choose the folder in which to install QGIS Brighton (2.6.1).	K
Setup will install QGIS Brighton (2.6.1) in the following folder. To ins click Browse and select another folder. Click Next to continue.	tall in a different folder,
Destination Folder	
C:\Program Files\QGIS Brighton	Browse
Space required: 1.7GB Space available: 30.2GB	
Jullsoft Install System v2.46 ————————————————————————————————————	Next > Cancel

5. Click Install.

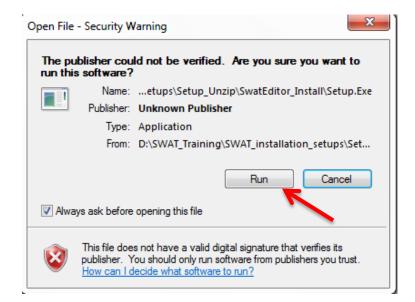
Choose Components		0
Choose which features of QGIS	S Brighton (2.6.1) you want to inst	tall. 🗸
Check the components you wa install. Click Install to start the	nt to install and uncheck the comp installation.	onents you don't want to
Select components to install:	QGIS North Carolina Data Set South Dakota (Spearfish) Alaska Data Set	Description Position your mouse over a component to see its description,
Space required: 1.7GB	4	
ullsoft Install System v2.46 ——		
	< Back	Install Cancel



6. Installation of QGIS starts and once completed Click *Finish.* This reboots the system.

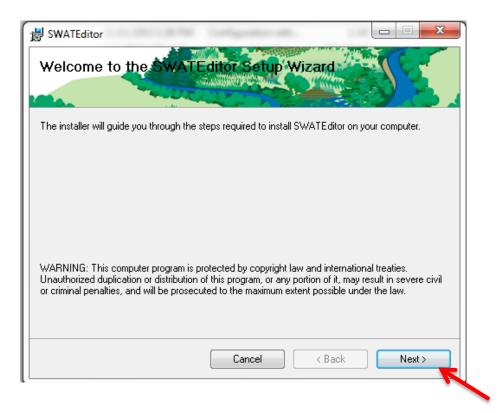


7. Run Setup.Exe in the SwatEditor_Install Folder. Click Run.

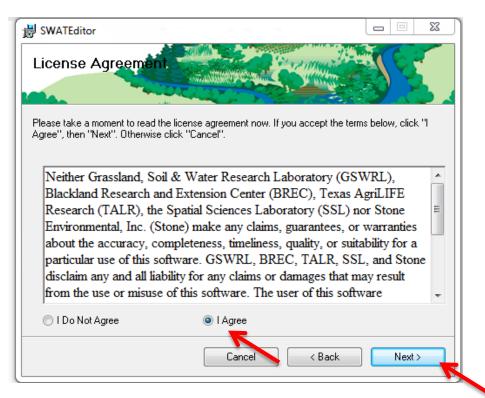




8. Click Next.



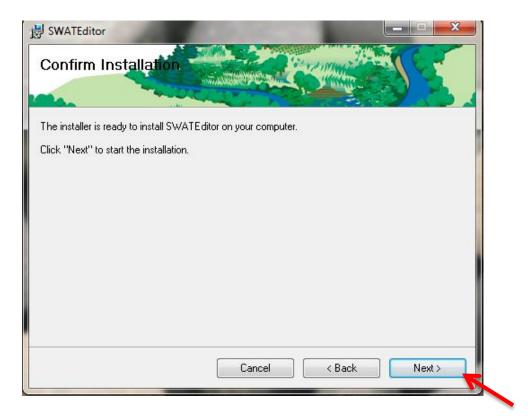
9. Click on *I Agree* radio button and click *Next*.





10. Click Next.

B SWATEditor
Select Installation Folder
The installer will install SWATE ditor to the following folder.
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
Eolder: C:\SWAT\SWATEditor\ Browse Disk Cost Install SWATEditor for yourself, or for anyone who uses this computer:
 ⊙ Everyone O Just me
Cancel < Back Next >

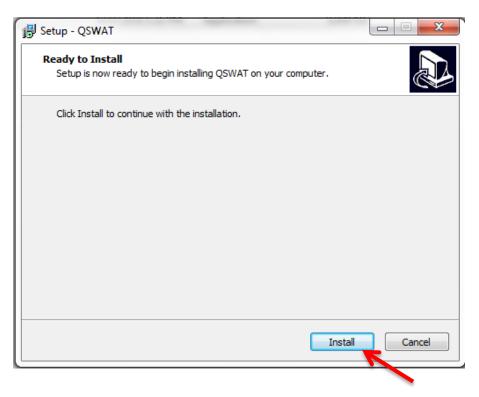




11. Click Close.

谩 SWATEditor			
Installation Interrupted			
The installation was interrupted befor installer to try again.	ore SWATEditor could b	e installed. You nee	d to restart the
	Cancel	(K Back	Close

12. Run **QSWATinstall1.5G.exe** in the **Setup_Unzip** Folder. Click **Install**.





13. Click Finish.

🐻 Setup - QSWAT	
	Completing the QSWAT Setup Wizard
	Setup has finished installing QSWAT on your computer.
	Click Finish to exit Setup.
	Finish



OVERVIEW OF SOIL AND WATER ASSESSMENT TOOL (SWAT):

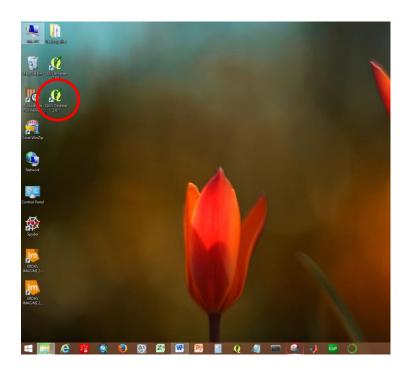
The Soil and Water Assessment Tool (SWAT) is a physically- based continuous-event model developed to predict the impact of land management practices on water, sediment, and agricultural chemical yields in large, complex watersheds with varying soil, land use and management conditions over long periods of time. For simulations, a watershed is subdivided into a number of homogenous sub basins (hydrologic response units or HRUs) having unique soil and use properties. The input information for each subbasin is grouped into categories of weather; unique areas of land cover, soil, and management within the subbasin; ponds/reservoirs; groundwater; and the main channel or reach, draining the subbasin. The loading and movement of runoff, sediment, nutrient and pesticide loadings to the main channel in each subbasin is simulated considering the effect of several physical processes that influence the hydrology. For a detailed description of the capabilities of the SWAT, refer to Soil and Water Assessment Tool User's Manual, Version 2000 (Neitsch et al.., 2002), published by the Agricultural Research Service and the Texas Agricultural Experiment Station, Temple , Texas. The manual can also be downloaded from the SWAT Web site (www.brc,tamus.edu/swat/swatdoc.htm#new)

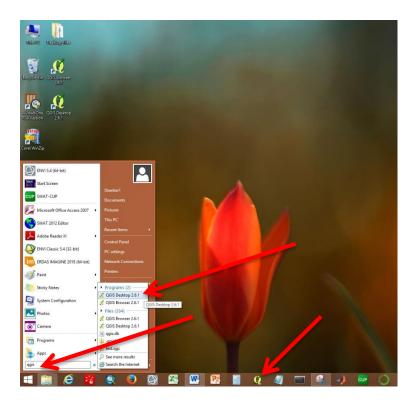
The Following are the key procedures necessary for modeling using SWAT.

- Create SWAT project
 - Delineate the designated watershed for modeling
 - Define landuse, soil, slope data grids
 - Determine the distribution of HRUs based on the landuse and soil data
 - Define rainfall, temperature and other weather data.
 - Write the SWAT input files requires access to data on soil, weather, land cover, plant growth, fertilizer and pesticide use, tillage and urban activities.
 - Edit the input files if necessary
- Setup and run SWAT
- View SWAT Output



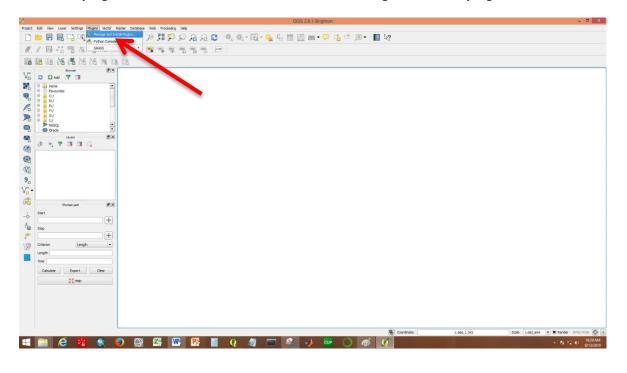
1. Open *QGIS Desktop 2.6.1* from the PC's desktop **or** Go to start and search "QGIS" and click on *QGIS Desktop 2.6.1* or Click on the QGIS icon from the taskbar.



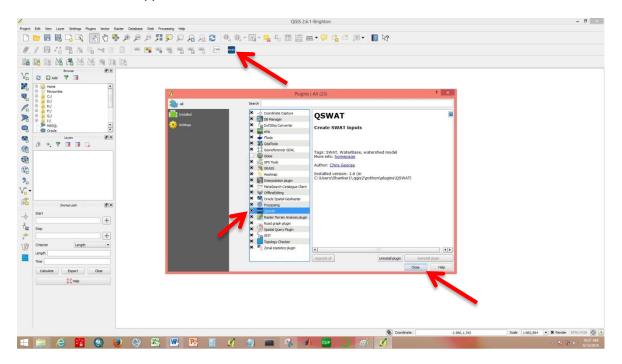




- 2. QGIS Desktop 2.6.1 opens.
- 3. Click on *plugin* in the QGIS taskbar and then click on *manage and install plugins*

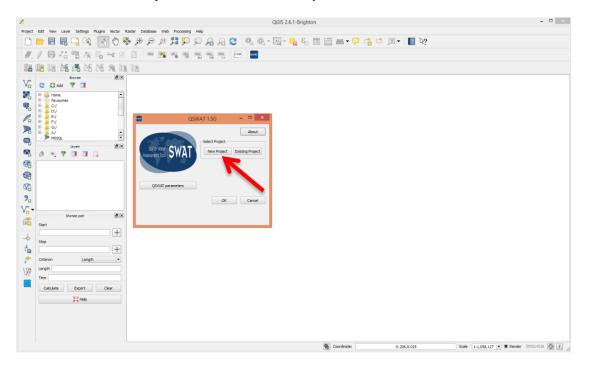


- 4. *Plugins* dialog box appears.
- 5. Check the **QSWAT icon** and **close** the dialog box.
- 6. **QSWAT tool** icon appears on the toolbar.

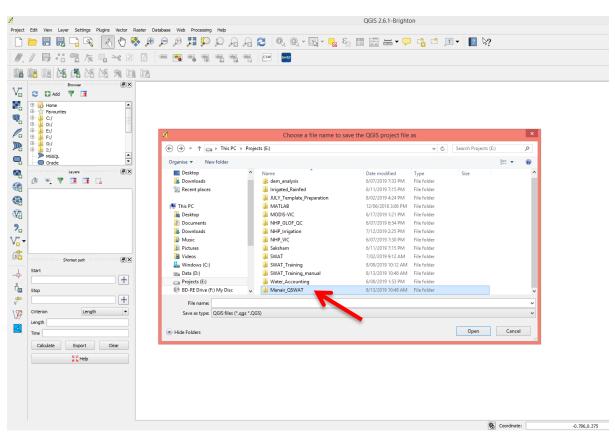




- 7. Click on the **QSWAT tool** in the tool bar to open QSWAT and **QSWAT 1.5G** dialog box appears.
- 8. Click on the New Project button to create a Project.



9. Create a folder named "Manair_QSWAT"

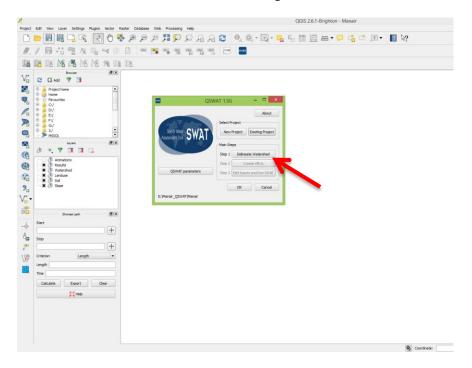




10. Save the file name as *Manair*. QSWAT 1.5G dialog box appears again. This creates a new project.

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11. The First step is the delineation of watershed. The watershed delineation tool's functions are divided into sections, namely; Select DEM, Stream Threshold Definition for creating streams, Outlet/Inlet Selection/Definition, Watershed Outlet(s) Selection/Definition. Click on delineate watershed button in the QSWAT 1.5G dialog box.



Note: Before proceeding to this step, ensure that all your three principal datasets (DEM, landuse, Soil) are in projected (Cartesian) coordinate system, preferably in an EQUAL AREA PROJECTION for better accuracy in the extraction of watershed parameters. IMPORTANT: The data should not be in Geographic Coordinates System (Decimal Degrees).



12. Delineate watershed dialog box appears. Click on the *icon* in Select DEM.

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13. Open *DEM_Albers.tif* from the following path, SWAT_Training > Data > DEM > DEM_Clip

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14. DEM loads at the background.

15. Change the *Area* in Define threshold to *1000 sq.km* and click on *Create streams* button. This creates the stream based on the threshold value provided. Click **OK** on *MPI error dialog box*.

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16. The Streams are created and click on the "V" icon from the toolbox to load a vector data.

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17. Open *Somanpally.shp* from the following path SWAT_Training > Data > Shp > Somanpally

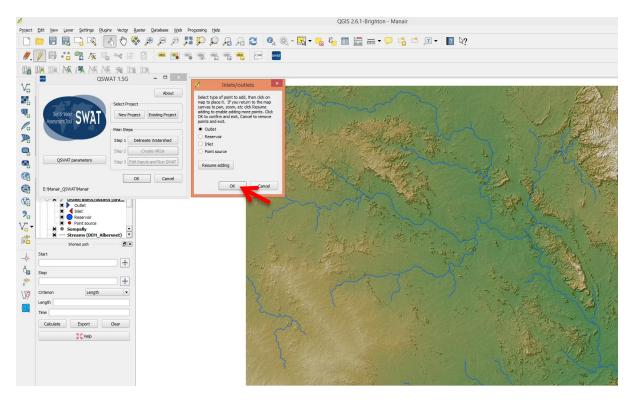
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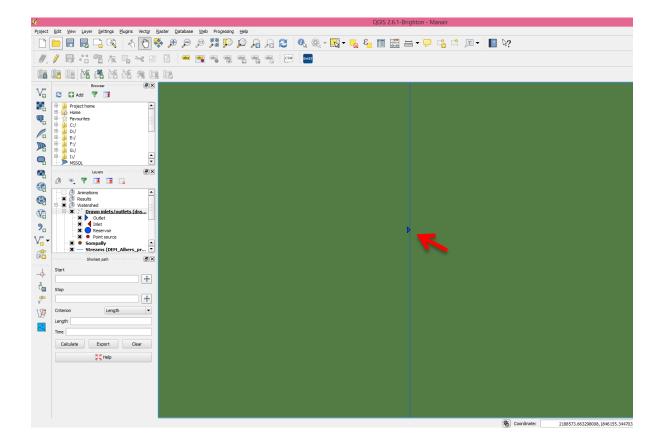
- 18. *Somanpally.shp* is added to the project.
- 19. Click on *Draw Inlets/outlets button* to add the outlet to our basin of interest.

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20. Inlets/outlets dialog box appears. Further zoom to the *Somanpally.shp* which was added already and click on the stream closer to *Somanpally.shp* at maximum zoom level and Click Ok. This adds an outlet point.







21. Click on the *Create Watershed* button to delineate the watershed.

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22. The Watershed is delineated with its Subbasins. Click *OK*. **Proceed to step 28 if reservoir is not to be provided.**

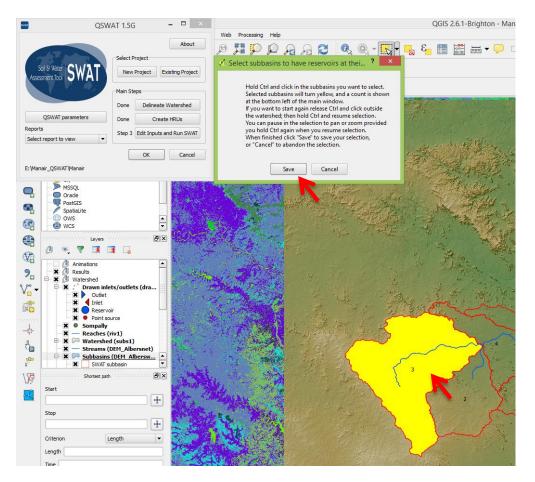
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23. Click on *Select reservoir Subbains* to add reservoir.

24. Hold Ctrl and Click on subbasin "3" and click Save.

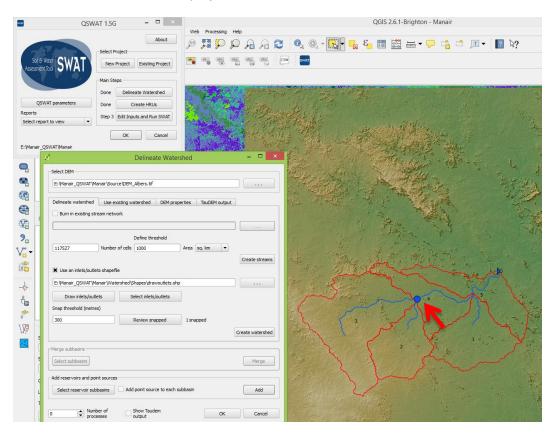




25. Click Add button.

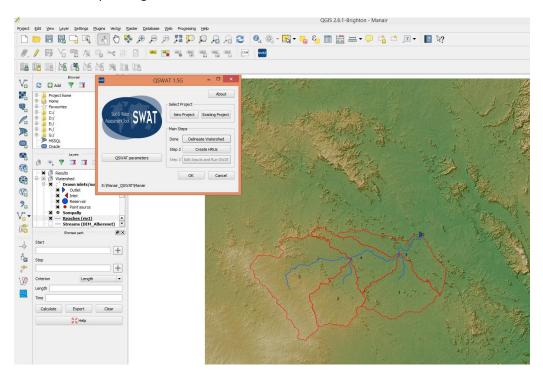
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26. This adds reservoir to the project. Click OK.





27. The corresponding Subbasins are visible.

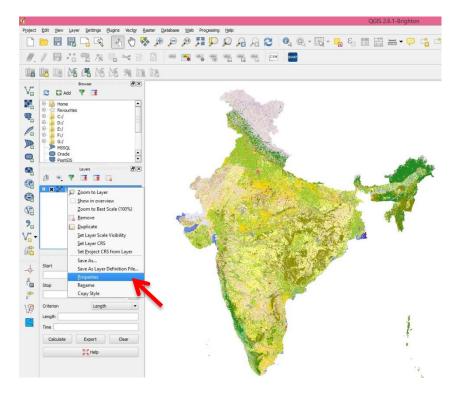


28. Open QGIS. Add the *LULC.tif* (landuse map) from the following path: *SWAT_Training > Data > Lulc*

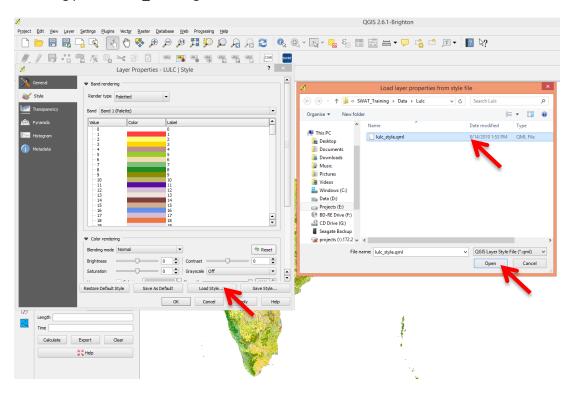
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29. Right Click on *LULC.tif* and click on properties.



30. In the Layer Properties dialog box, click on *load style* button. Select *lulc_style.qml* from the following path: *SWAT_Training > Data > Lulc*





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31. This displays the Value and its corresponding LULC class names. Click OK

32. Now Open the **QSWATRef2012.mdb** from the following path: Manair_QSWAT > Manair and open the table **crop** and **urban**. **QSWATRef2012.mdb** contains the LULC codes defined by SWAT. In order to link LULC data to SWAT database we need to create a lookup table. So, we need to define the SWAT code for the LULC classes in LULC.tif file.

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33. Open *LULC.xlsx* from the following path: SWAT_Training > Data > Lulc. Click on *sheet2*. The LULC classes of *LULC.tif* is listed.

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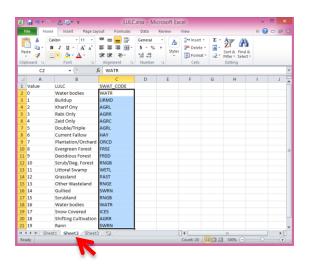
34. Copy the Value column from sheet2 to sheet1.

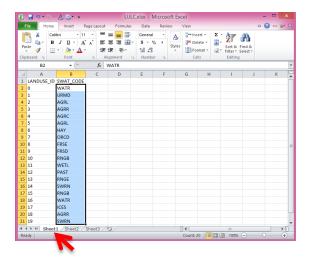
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35. Copy the *SWAT_CODE* column from *sheet2* to *sheet1*. Now the lookup table is completed.







36. Open *Manair.mdb* from the following path: Manair_QSWAT >Manair.

Click External Data, then click Excel.

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37. Import the file *LULC.xlsx* from the following path: SWAT_Training > Data > Lulc and Click Ok.

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iii chm	Specify how and where you want to store the data in the current database.	
🛄 dpd	Import the source data into a new table in the current database.	Name Date modified Type Size
ElevationBand	If the specified table does not exist, Access will create it. If the specified table already exists, Access might overwrite its contents with the imported data. Changes made to the source data will not be reflected in the database.	Pesttop
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Example1_soils	O Append a copy of the records to the table: Basin ♥	Downloads
Example1_usersoil	If the specified table exists, Access will add the records to the table. If the table does not exist, Access will create it. Changes made to the source data will not be reflected in the database.	🚡 Music
FAO_soils	Link to the data source by creating a linked table.	Pictures
GAGEDATES	Access will create a table that will maintain a link to the source data in Excel. Changes made to the source data in Excel will be	Videos Windows (C:)
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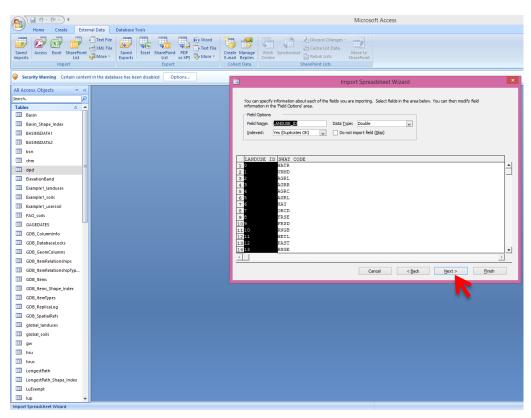
38. Click Next.

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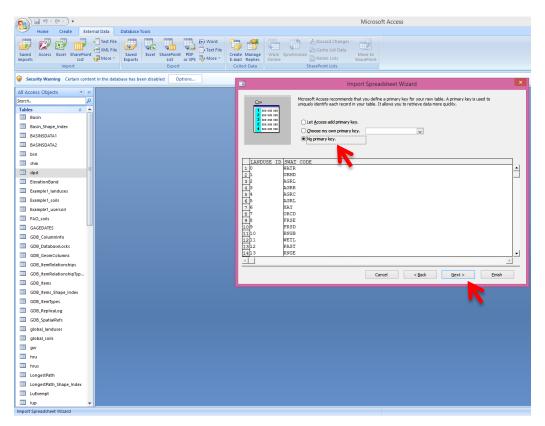
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Example1_soils	5 4 AGRC 6 5 AGRL
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FAO_soils	8 7 DRCD 9 8 FRSE
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39. Select No primary key radio button.

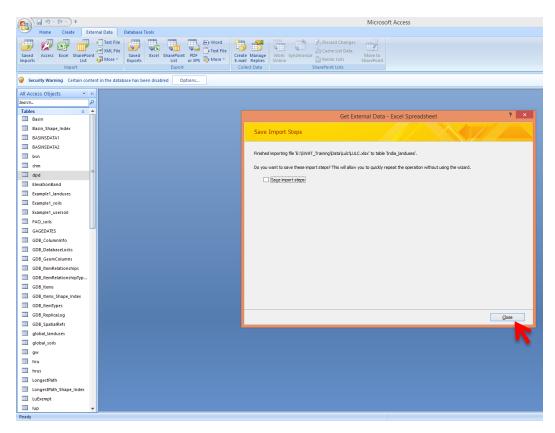




40. Rename the table as India_landuses and click Finish. (Note: Name should end with _landuses)

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41. Close the dialog box.





- 42. India_landuses Look up table is imported to the database *Manair.mdb.*
- 43. Close the database *Manair.mdb*.

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44. Click on *Create HRUs* button. The Land Use, Soil and slope Definition option in the HRU Analysis menu allows the user to specify the land use, soil and slope themes that will be used for modeling using SWAT. These themes are then used to determine the hydrologic response unit (HRU) distribution in each sub- watershed.

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National Remote Sensing Centre, ISRO, Hyderabad



45. Select and open *LULC.tif* (landuse map) from the following path: SWAT_Training > Data > Lulc

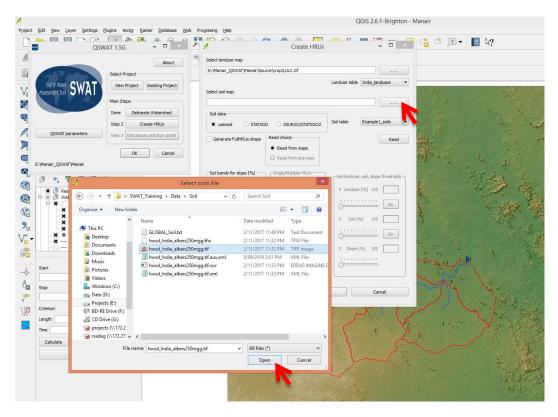
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46. From the *landuse* table dropdown, select *India_landuses*.

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47. For Soil data, select and open *hwsd_India_albers250mgg.tif* from the following path: SWAT_Training > Data > Soil. (Data Source : FAO)

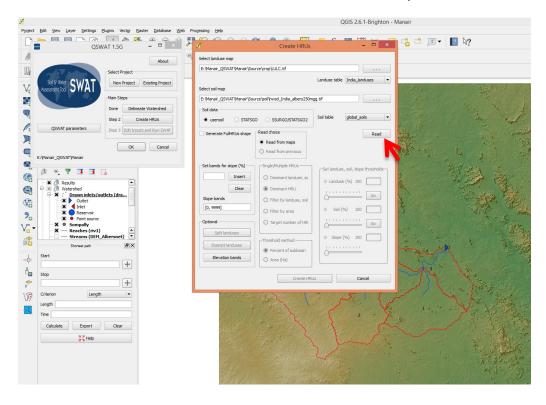


48. From the *soil table* dropdown, select *global_soils. (Note: global_soils is the lookup table for soil data)*

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49. Click on *Read* button and this reads the landuse and soil data provided.



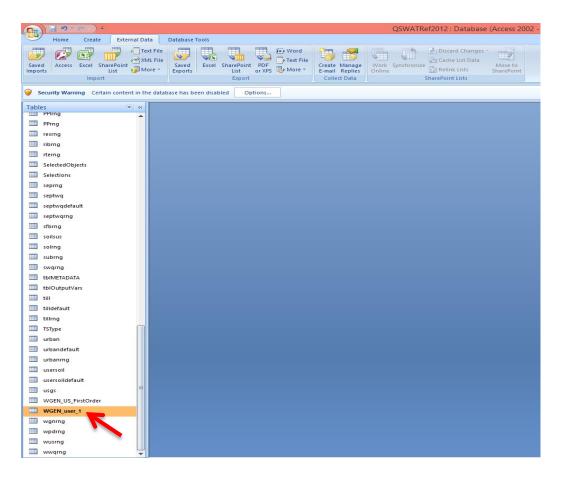
50. Select *Filter by area* radio button, then select *Area (Ha)* radio button. Set the *area threshold* as *100 ha*. Click *Create HRUs.* This creates HRUs based on the threshold value provided.

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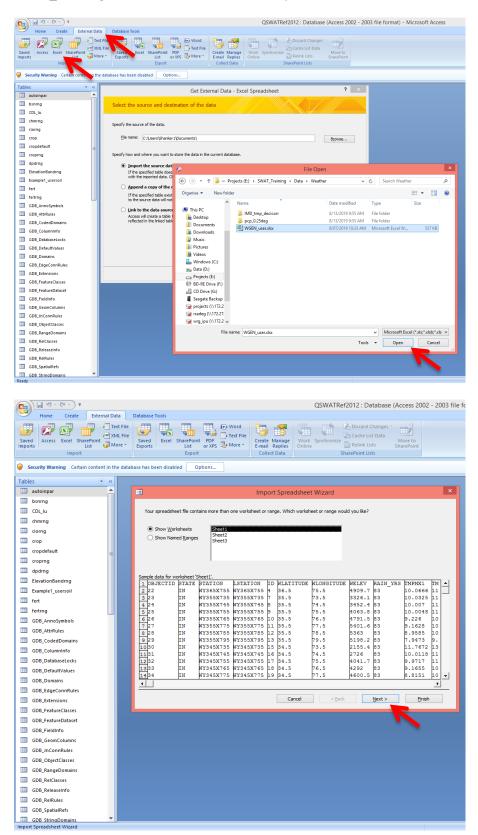
51. Open **QSWATRef2012.mdb** from the following path: Manair_QSWAT > Manair. Rename the **WGEN_user** table to **WGEN_user_1**.

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52. Click External Data, then click Excel. Import the file **WGEN_user.xlsx** from the following path: SWAT_Training > Data > Weather and Click open and then Ok.





53. Click *Next*.

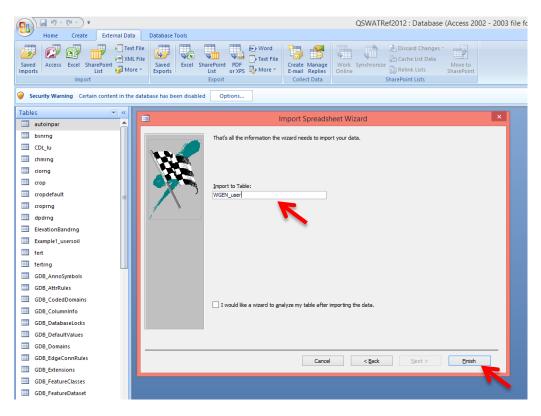
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54. Select No primary key radio button and click next.

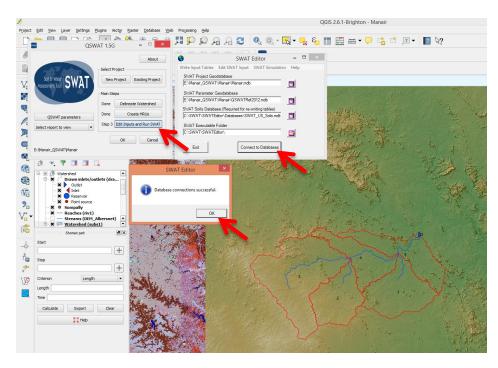
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55. Rename the table name as *WGEN_user* and click Finish and close the dialog box.

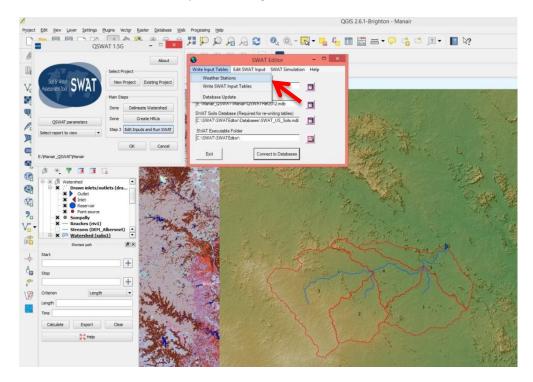




56. Go to QSWAT 1.5G dialog box and click *Edit Inputs and Run SWAT button*. *SWAT Editor* Dialog box opens. Click *Connect to Database* button. *Database connection successful* message appears. Click OK.

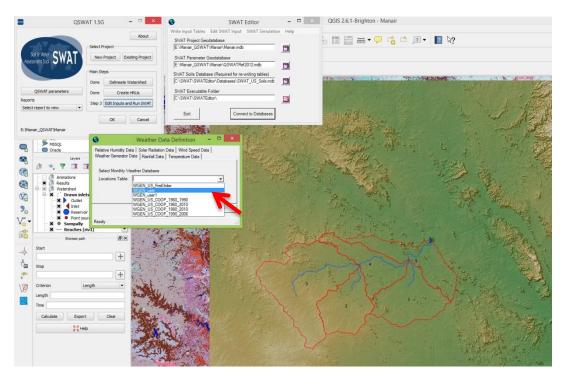


57. Click *Write Input Tables* from toolbar and from the drop down, click *Weather Stations*. This menu contains functions to build database files that include information needed to generate default input for the SWAT model. The commands on the menu need to be implemented only once for a project. However, if the user modifies the HRU distribution after building the input database files, these commands must be reprocessed again.





58. The *Weather Data Definition* dialog box opens. From the Locations Table dropdown, select *WGEN_user*. (Note: Don't click OK)



59. Click on Rainfall Data tab and select Raingages radio button.

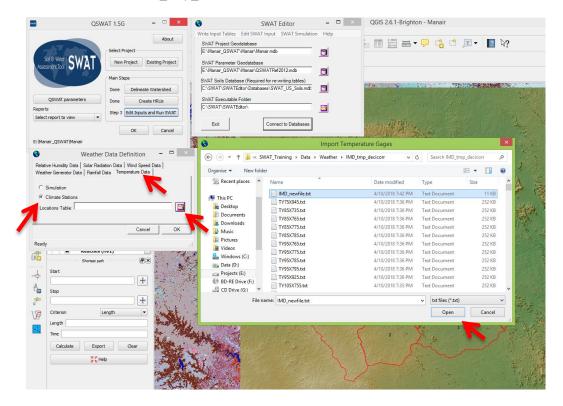
60. Import the precipitation gauges file *IMD_pcp.txt* from the following path: SWAT_Training > Data > Weather > pcp_0.25deg

CSWAT 1.5G - CARCEL Sol & Water SWAT Sol & Water SWAT CSWAT parameters Reports Select Project New Project Existing Project Main Steps Done Delineate Watershed Done Greater Holls Step 3 Edit Inputs and Run SWAT Step 3 Edit Inputs and Run SWAT Step 3 Edit Inputs and Run SWAT Et/Monar_QSWAT Menar	SWAT Editor Write layur Tables: Edit SWAT Input: SWAT Simula SWAT Project Goodshabase [E-Manair_QSWATManar/QSWATMed2012.mdb SWAT Database (Regional for re-wrining tables) [C-SWATSWATEditor/Databasee/SWAT_US_Sole md SWAT Executable Folder [C-SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATEditor/SWATSWATSWATEditor/SWATSWATSWATEditor/SWATSWATSWATSWATSWATSWATSWATSWATSWATSWAT	
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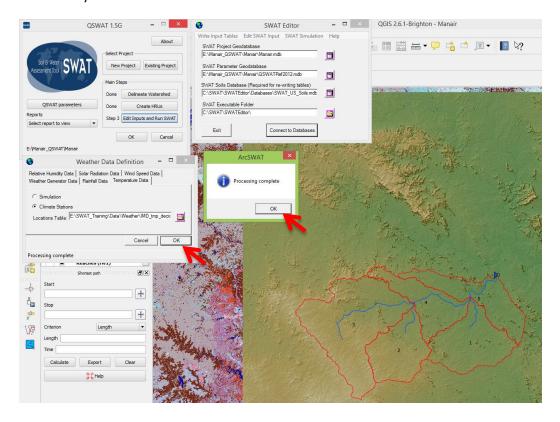


61. Click on Temperature Data tab and select Climate Stations radio button.

62. Import the Temperature gauges file *IMD_newfile.txt* from the following path: SWAT_Training > Data > Weather > IMD_tmp_decicorr

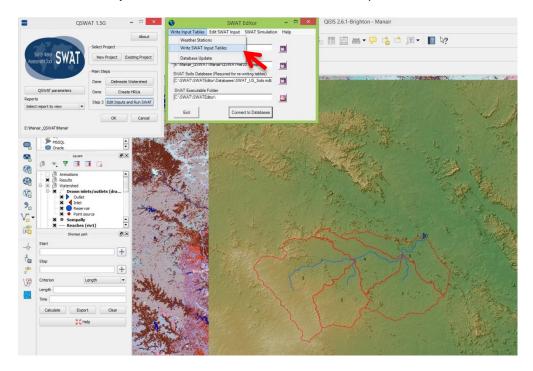


63. Click OK and close the weather data definition dialog box. The Weather files are read successfully.

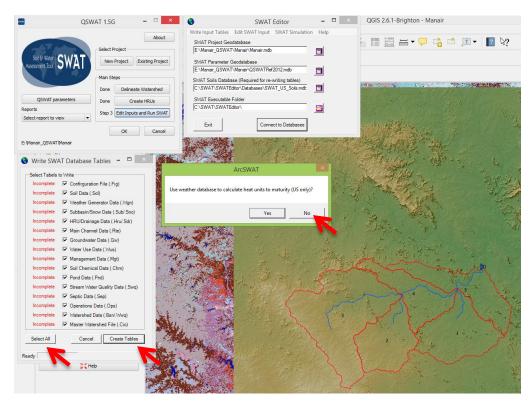




64. Click Write Input Tables from toolbar and from the drop down, click Write SWAT Input Tables.

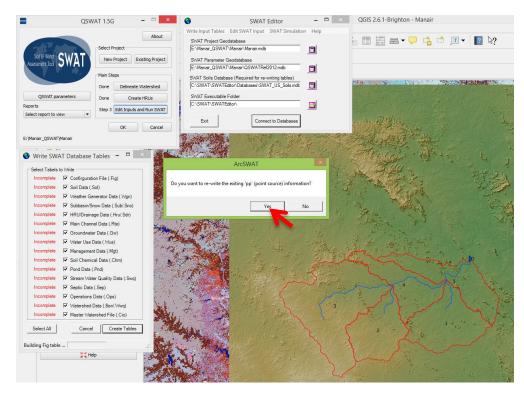


65. Write SWAT Database Tables dialog appears. Click Select All button and then click Create Tables button. Then Click No.

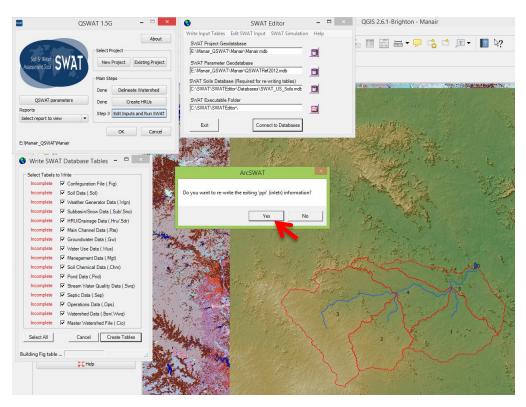




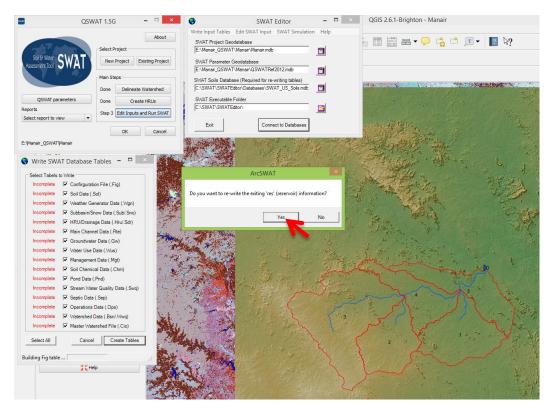
QSWAT Training Manual: Water Resources Group, RSAA



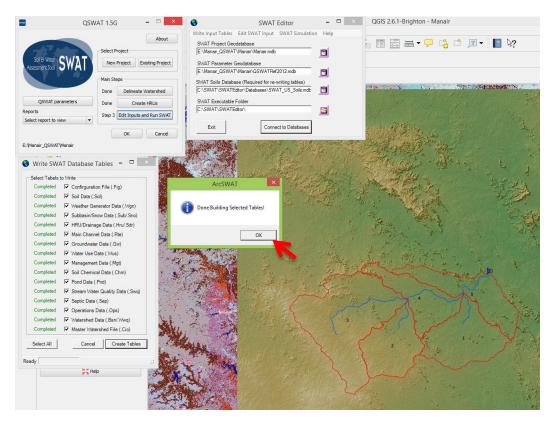
66. Click Yes.





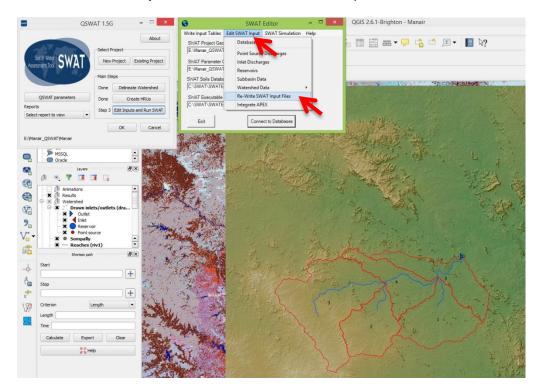


67. Click **OK** and close **Write SWAT database Tables** dialog box. This creates tables for all files to be written.





68. Click Edit SWAT Input from toolbar and from the drop down, click Re-Write SWAT Input Files.



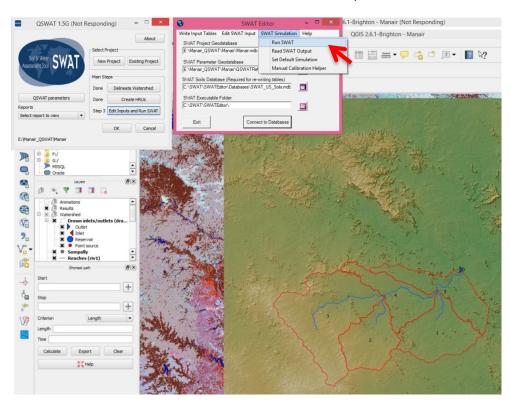
69. From the *Rewrite SWAT Input Files* dialog box, click *Select All* button and click *Write Files* button, then click *OK*. Rewriting of all tables is done successfully.

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70. Then Close Rewrite SWAT Input Files dialog box.

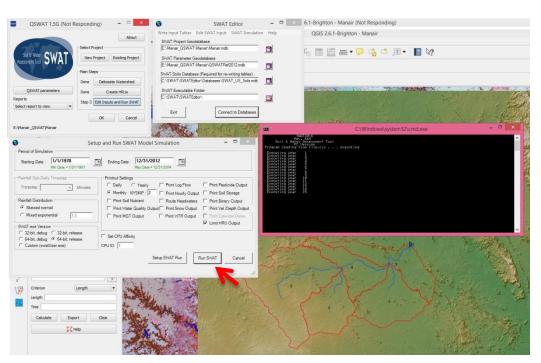
71. Click SWAT Simulation from toolbar and from the drop down, click Run SWAT.



72. *Setup and Run SWAT Model Simulation* dialog box appears. In that dialog box, Change the *starting and ending date* to 1/1/1978 and 12/31/2012 respectively. Select *64-bit release* radio button, provide *NYSKIP* value of 2. Then click *Setup SWAT Run* button. Click *OK*.

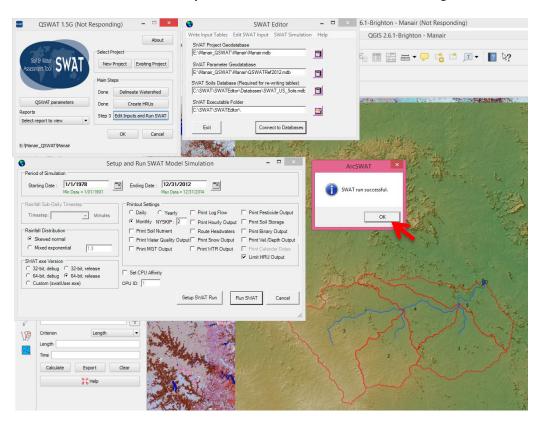
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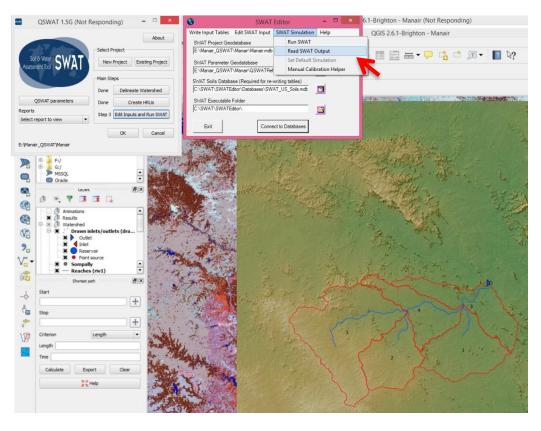


73. Click Run SWAT button. This runs the SWAT model.

74. Click OK and close the Setup and Run SWAT Model Simulation dialog box.







75. Click SWAT Simulation from toolbar and from the drop down, click Read SWAT Output.

76. Check *output.rch, output.sub, output.hru* and click on *Import Files to Databases* button. Save current simulation name as "Simulation_without_Reservoir_&_Crop_Mgt" and Save the SWAT simulation by clicking on *Save Simulation* button.

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77. The simulation results are saved in the following path: Manair_QSWAT > Manair > Scenarios > Simulation_without_Reservoir_&_Crop_Mgt > TxtInOut

→ ↑ → This PC → Projects	(E:) → Manair_QSWAT → Manair → S	Scenarios → Simulation_without_Re	servoir_&_Crop_N	/lgt → TxtInOut
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🗼 Downloads	urban.dat	8/16/2019 10:10 AM	DAT File	2 KB
📃 Recent places	Tmp1.Tmp	8/16/2019 9:51 AM	TMP File	663 KB
	till.dat	8/16/2019 10:10 AM	DAT File	7 KB
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📙 Desktop	💹 sub.dat	8/16/2019 10:12 AM	DAT File	0 KB
Documents	/// septwq.dat	8/16/2019 10:10 AM	DAT File	6 KB
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78. Open the **SWATOutput.mdb** file from the following path: Manair_QSWAT > Manair > Scenarios > Simulation_with_Reservoir_&_Crop_Mgt > TablesOut

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a binkber 2 2 3 1.537 0.3666 1.17 0 5.321E-07 5.321E-07 0.0000010 bilswoer 3 3 0.1767 0.9613 0 0.0000119 7.735 9.13 bilswoer 3 12880 2.086 1.093 0.9931 0 7.735 48.85 17.6 bilswoer 3 2.019 0.4623 0.2818 0.2004 0 2187 2186 100 bilswoer 0 0.0000119 7.735 48.85 17.6 100 <t< td=""><td>1</td><td>tblPotDef</td><td></td><td></td><td></td><td></td><td>2019</td><td>0.3448</td><td>0.1039</td><td>0.2408</td><td>0</td><td>3.545E-07</td><td>3.545E-07</td><td>0.000001655</td><td></td></t<>	1	tblPotDef					2019	0.3448	0.1039	0.2408	0	3.545E-07	3.545E-07	0.000001655	
It it/sword 3 3 0.0000119 7.735 9.13 It it/sword 4 1.138 0.1767 0.9931 0 7.735 9.13 It it/sword 4 1.280 2.086 1.093 0.9931 0 7.735 9.13 It it/sword 4 1.280 2.086 1.093 0.9931 0 7.735 9.13 It it/sword 4 1.280 2.046 0.0204 0 7.735 9.13 It it/sword 0 0.4767 0.04874 0.204 0 7.735 9.13 It it/sword 0 0.6665 0 7.735 9.13 1.018 0.2047 0.2048 0 7.735 9.13 1.018 0.2047 0.2048 0 7.735 9.13 1.018 0.2047 0.2048 0 7.735 9.13 1.018 0.2047 0.2048 0 7.735 9.13 1.018 0.2047 0.204 0.2187 2.188 2.102		tblRchDef					4657	1.537	0.3666	1.17	0	5.321E-07	5.321E-07	0.000001052	
itblsnuber 2440 0.4623 0.2618 0.2004 0 2187 2186 108 itblsnuber itblsnuber 0.757 0.744 0.228 0 75.19 72.38 itblsnuber 0K Cancel 0.4477 0.03727 1.102 0 2674 2672 2536 itblsnuber 0K Cancel 0K Cancel 1475 0.3727 1.102 0 2674 26.33 3.5 itblsnuber 0K Cancel 0K Cancel 1280 0.40197 0 0.1197 0 0.02786 24.75 3.5 itblsnuber 2 1980 4 2019 0.227 0.03109 0.1197 0 0.02787 0.448 0.1997 0 0.1997 0 0.1997 0 0.1997 0 19.44 7.98 itblsnuber 2 1980 4 4657 0.9087 0.0347 0.8374 0 5.562 13.53 itblsnuber 5 1980 4 1280 1.271 0.2009 1.07		tblRsvDef					8431	1.138	0.1767	0.9613	0	0.00000119	7.735	9.136	
iii tis/suber 2019 0.02767 0.04874 0.228 0 75.19		tblSedDef					12880	2.086	1.093	0.9931	0	7.735	48.85	17.62	
It biSnw0er 4657 1.475 0.3727 1.102 0 2674 2672 536. It biSnw0er 0K Cancel 8431 0.9496 0.3020 0.6466 0 2786 24.75 33.51 It biSnw0er 0K Cancel 2440 0.1197 0 0.1197 0 0.0278 0 0 It biVn0er 2 1980 4 2019 0.227 0.03109 0.1197 0 0.0278 0 7.98 It biVn0er 3 1980 4 4657 0.9078 0.0347 0.8309 0 152.2 5.562 133.9 It biVn0er 3 1980 4 8431 0.559 0.1281 0.4309 0 162.2 9.59 1.53 5 1980 4 1280 1.271 0.2009 1.07 0 9.59 12.02 3.06		tblSnuDef			V 5		2440	0.4623	0.2618		0		2186	1089	
it tblsubber 465 1.475 0.3727 1.102 0 2674 2672 536 it tblsubber 0K Cancel 8431 0.9496 0.3029 0.6466 0 2767 2475 3.5.5 it tblswber 0K Cancel 12880 2.043 0.9972 1.046 0 2210 59.31 16.1 it tblswber 2440 0.1197 0 0.1197 0 0.02787 0 0 it tblwqiDer 2 1980 4 2619 0.227 0.0307 0.0159 0 19.14 7.98 it blwtrDer 4 1980 4 4831 0.559 0.1281 0.4309 0 162.1 9.59 1.53 it blwtrDer 5 1980 4 1280 1.271 0.209 1.07 0 9.59 12.02 3.06	-	thiSnwDef									-			72.88	
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5 1980 4 12880 1.271 0.2009 1.07 0 9.59 12.02 3.06		tblWtrDef		4										1.538	
				5										3.062	
				1	1980	5	2440	0.08684	0.2005	0.08684	0	0.05031	0	0	
				2		5								0	



79. Copy the sheet and paste it in a new excel sheet named "Results"

hru	SUB	N	YEAR -	MON		ARFAkm2 -	FLOW INcm +	FLOW OUTC -	EVAPcms +	TLOSScms	-	SED INtons +	SED OUTton -	SEDCONCms + 0
rch		5	1980		1	12880	And a state of the		0.8272		0	82.75	Training - Indexed and	and the second
sub		5	1980		2	12880			0.9931		0	7.735		
tblDepDef		5	1980		3	12880	2.043	0.9972	1.046		0	2210	59.31	1 16.13
tblHruDef		5	1980		4	12880	1.271	0.2009	1.07		0	9.59	12.02	2 3.062
tblMgtdef		5	1980		5	12880	0.8924	0.009899	0.8825		0	2.011	0.3727	7 0.4534
tblPotDef		5	1980		6	12880	112	111.2	0.7249		0	966900	44150	0 73.46
and the second second		5	1980		7	12880			0.6556		0	2353000		
		5	1980		8	12880	547.1	546.5	0.5567		0	3213000	312300	0 177.6
tblRsvDef		5	1980		9	12880	390.2	389.4	0.7761		0	1360000	179600	0 159.1
tblSedDef		5	1980		10	12880			0.914		0	32490		
tblSnuDef		5	1980		11	12880	76.5	75.71	0.7904		0	9591		
tblSnwDef		5	1980		12	12880			0.7062		0	1834		
		5	1981		1	12880			0.7378		0	1413		
		5	1981		2	12880			1.023		0	43.18		
tblSwrDef		5	1981		3	12880			0.9006		0	8044		
tblVelDef		5	1981		4	12880			1.33		0	6.579		
tblWqlDef		5	1981		5	12880			1.235		0	69.81		
tblWtrDef		5	1981		6	12880			0.9776		0	323600		
		5	1981		7	12880			0.6503		0	1669000		
		5	1981		8	12880			0.7342		0	3895000		
		5	1981		9	12880			0.6863		0	1788000		
		5	1981		10	12880	260.9	260.1	0.8718		0	115000	97740	0 139

C.,)	• (°") =								Book1 -	Microsoft Ex	cel	
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4	А	В	С	D	E	F	G	Н	L	J	K	L	M
1	SUB	YEAR	MON	AREAkm2	.OW_INcn	DW_OUTC	EVAPcms	TLOSScms	ED_INton	D_OUTtor	CONCmg	RGN_INK	RGN_OUT
2	5	1980	1	12880	3.891	3.064	0.8272	0	82.75	199.1	23.88	0.009763	0.003183
3	5	1980	2	12880	2.086	1.093	0.9931	0	7.735	48.85	17.62	0.003203	0
4	5	1980	3	12880	2.043	0.9972	1.046	0	2210	59.31	16.13	4284	2131
5	5	1980	4	12880	1.271	0.2009	1.07	0	9.59	12.02	3.062	82.98	47.61
5	5	1980	5	12880	0.8924	0.009899	0.8825	0	2.011	0.3727	0.4534	2.678	0.6258
7	5	1980	6	12880	112	111.2	0.7249	0	966900	44150	73.46	1251000	1107000
3	5	1980	7	12880	223.7	223.1	0.6556	0	2353000	102700	116.2	2646000	2387000
Э	5	1980	8	12880	547.1	546.5	0.5567	0	3213000	312300	177.6	7286000	6745000
.0	5	1980	9	12880	390.2	389.4	0.7761	0	1360000	179600	159.1	2496000	2290000
1	5	1980	10	12880	175.1	174.2	0.914	0	32490	55770	118.3	3865	3320
2	5	1980	11	12880	76.5	75.71	0.7904	0	9591	17310	82.85	85.79	69.53
.3	5	1980	12	12880	15.39	14.68	0.7062	0	1834	1767	42.48	2060	1418
4	5	1981	1	12880	7.95	7.212	0.7378	0	1413	641	31.96	13240	8982
.5	5	1981	2	12880	4.169	3.146	1.023	0	43.18	178.1	24.65	633.3	359.4
.6	5	1981	3	12880	4.07	3.17	0.9006	0	8044	240.2	22.97	10520	6546
.7	5	1981	4	12880	1.897	0.567	1.33	0	6.579	26.59	15.83	6.258	2.992
.8	5	1981	5	12880	2.012	0.7762	1.235	0	69.81	49.77	11.76	150.4	76.08
.9	5	1981	6	12880	85.74	84.77	0.9776	0	323600	34000	48.94	849500	759100
20	5	1981	7	12880	218.1	217.5	0.6503	0	1669000	88800	120.2	2184000	1940000
1	5	1981	8	12880	589.9	589.2	0.7342	0	3895000	378100	177.8	5392000	5057000
2	5	1981	9	12880	499	498.4	0.6863	0	1788000	245900	177.6	3297000	3018000
23	5	1981	10	12880	260.9	260.1	0.8718	0	115000	97740	139	139100	123400
24	5	1981	11	12880	149.9	149.1	0.7823	0	29110	43410	110.6	203.5	174.8
25	5	1981	12	12880	43.38	42.64	0.7414	0	6067	8429	64.11	23.18	16.71
26	► N She	et1 She	et2 / She	12880	9 81/	8 996	0 8176	0	121 8	873 g	35 /12	0 00/1792	0



80. Copy only SUB, YEAR, MON and FLOW_OUTcms columns to sheet2. Also copy observed data from *Observed_Somanpally.xlsx* from the following path: *SWAT_Training > Data > Observed*

1	А	В	С	D	E
1	Year	Observed_Discharge_Monthly_Average			
2	1980	0.916419094			
3	1980	0.41302711			
4	1980	0.145295297			
5	1980	0.156525723			
6	1980	0.096140574			
7	1980	8.17132517			
8	1980	21.44573945			
9	1980	111.5774135			
10	1980	53.918855			
11	1980	15.00128677			
12	1980	10.26932333			
13	1980	1.150345416			
14	1981	0.465757013			
15	1981	0.22704515			
16	1981	0.7881349			
17	1981	0.201911783			
18	1981	0.639576581			
19	1981	13.26977733			
20	1981	38.86023			
21	1981	260.6232587			
22	1981	124.2848117			
23	1981	86.19239548			
24	1981	16.6954633			
25	1981	3.595809871			
26	1987	2.661762032 Observed Daily Raw Observed Discharge M		and a particular	tcup / 🔁

	A	B	С	D	E	F	G
1	SUB	YEAR	MON	FLOW_OUTcms	observed		
2	5	1980	1	3.064	0.916419094		
3	5	1980	2	1.093	0.41302711		
4	5	1980	3	0.9972	0.145295297		
5	5	1980	4	0.2009	0.156525723		
6	5	1980	5	0.009899	0.096140574		
7	5	1980	6	111.2	8.17132517		
8	5	1980	7	223.1	21.44573945		
9	5	1980	8	546.5	111.5774135		
10	5	1980	9	389.4	53.918855		
11	5	1980	10	174.2	15.00128677		
12	5	1980	11	75.71	10.26932333		
13	5	1980	12	14.68	1.150345416		
14	5	1981	1	7.212	0.465757013		
15	5	1981	2	3.146	0.22704515		
16	5	1981	3	3.17	0.7881349		
17	5	1981	4	0.567	0.201911783		
18	5	1981	5	0.7762	0.639576581		
19	5	1981	6	84.77	13.26977733		
20	5	1981	7	217.5	38.86023		
21	5	1981	8	589.2	260.6232587		
22	5	1981	9	498.4	124.2848117		
23	5	1981	10	260.1	86.19239548		
24	5	1981	11	149.1	16.6954633		
25	5	1981	12	42.64	3.595809871		
26	N Sheet1	Sheet2 Sheet	3 / 2 1	8 996	2 664762032		



81. Rename the column FLOW_OUT to sim_normal and select that column and observed column. Plot a 2D line graph.

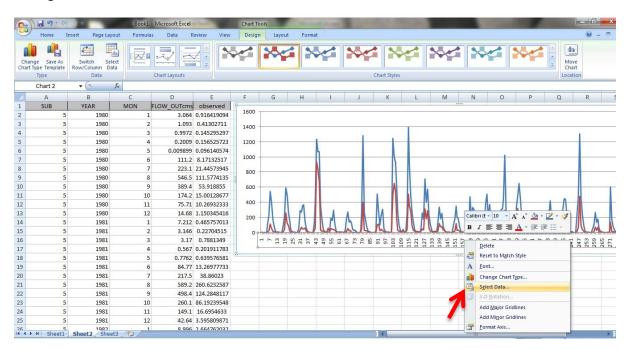
	A	В	С	D	E	F	G	Н
1	SUB	YEAR		FLOW OUTcms			J	
2	5	1980	1	3.064	0.916419094			
3	5	1980	2	1.093	0.41302711			
4	5	1980	3	0.9972	0.145295297			
5	5	1980	4	0.2009	0.156525723			
6	5	1980	5	0.009899	0.096140574			
7	5	1980	6	111.2	8.17132517			
8	5	1980	7	223.1	21.44573945			
9	5	1980	8	546.5	111.5774135			
10	5	1980	9	389.4	53.918855			
11	5	1980	10	174.2	15.00128677			
12	5	1980	11	75.71	10.26932333			
13	5	1980	12	14.68	1.150345416			
14	5	1981	1	7.212	0.465757013			
15	5	1981	2	3.146	0.22704515			
16	5	1981	3	3.17	0.7881349			
17	5	1981	4	0.567	0.201911783			
18	5	1981	5	0.7762	0.639576581			
19	5	1981	6	84.77	13.26977733			
20	5	1981	7	217.5	38.86023			
21	5	1981	8	589.2	260.6232587			
22	5	1981	9	498.4	124.2848117			
23	5	1981	10	260.1	86.19239548			
24	5	1981	11	149.1	16.6954633			
25	5	1981	12	42.64	3.595809871			
26	► N Sheet1	Sheet2 Sheet	3 / 1	<u>8 996</u>	2 664762032			

82. To plot the data, click on *Line* in *insert* toolbar and click *Line* option.

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15	5		2		3,146	0.22704515					
16	5		3	1	3.17	0.7881349	8				
17	5	1981	4		0.567	0.20191178	3				
18	5	1981	5		0.7762	0.63957658	1				
19	5	1981	6		84.77	13.2697773	3				
20	5	1981	7		217.5	38.86023					
21	5	1981	8		589.2	260.623258	7				
22	5	1981	9		498.4	124.284811	7				
23	5	1981	10		260.1	86.1923954	8				
24	5	1981	11		149.1	16.6954633					
25	5	1981	12		42.64	3.59580987	1				
26	► ► Sheet1	Sheet2 She	et3 / 🞾 🕺 1		8 996	2 66476203	2				_



83. Right click on the x-axis and click on Select Data.



84. Click on Edit button.

1	A	В	C	D	E	F	Select Data Source
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2	5	1980	1	-	0.916419094	1600	Chart data range: =Sheet2!\$D\$1:\$E\$277
3	5	1980	2	1.093	0.41302711	1400	
4	5	1980	3	0.9972	0.145295297	1400	Switch Row/Column
5	5	1980	4	0.2009	0.156525723	1200	
6	5	1980	5	0.009899	0.096140574		Legend Entries (Series) Horizontal (Category) Axis Labels
7	5	1980	6	111.2	8.17132517	1000	Add 🛛 Edit 🗙 Remove 💿 🗣 🖉 Edit
8	5	1980	7	223.1	21.44573945	800	FLOW OUTcms
9	5	1980	8	546.5	111.5774135	800	observed
10	5	1980	9	389.4	53.918855	600	3
11	5	1980	10	174.2	15.00128677		4
12	5	1980	11	75.71	10.26932333	400	
13	5	1980	12	14.68	1.150345416	200	
14	5	1981	1	7.212	0.465757013	200	Hidden and Empty Cells OK Cancel
15	5	1981	2	3.146	0.22704515	0	
16	5	1981	3	3.17	0.7881349		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
17	5	1981	4	0.567	0.201911783		
18	5	1981	5	0.7762	0.639576581		
19	5	1981	6	84.77	13.26977733		
20	5	1981	7	217.5	38.86023		
21	5	1981	8	589.2	260.6232587		
22	5	1981	9	498.4	124.2848117		
23	5	1981	10	260.1	86.19239548		
24	5	1981	11	149.1	16.6954633		
25	5	1981	12	42.64	3.595809871		
26	5	Sheet2 Shee	1	8 996	2 664762032		



85. Select the column in Axis label range.

1	A	В	С	D	E	F	G	Н	1	J		К	L		M	N
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4	5	1980	3	0.9972	0.145295297	1400										
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6	1	1980	5	0.009899	0.096140574				h							
7	5	1980	6	111.2	8.17132517	1000 -										
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4	5	1981	11	149.1	16.6954633											
25	5	1981	12	42.64	3.595809871											
26	5	1982	1	8.996	2.664762032											
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86. Click OK.

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6	5	1982	1	8.996	2.664762032														
7	▶ Sheet1	Sheet2 Sheet	3 / 22 / 21	5 02/	2 128987211											_	HIL		

This displays the comparison between observed and simulated discharge.

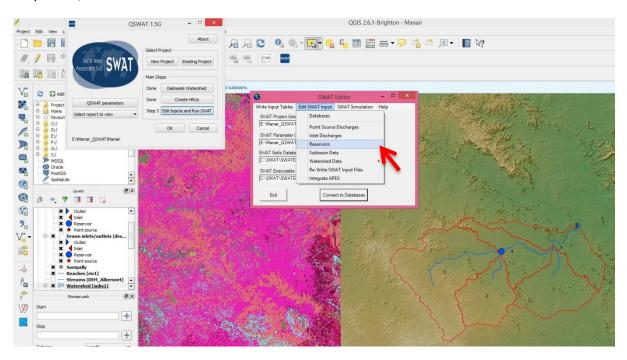


INCORPORATION OF RESERVOIR

87. Open *QSWATRef2012.mdb* file from the project and open resrng table. Change the maximum values of RES_ESA, RES_EVOL, RES_PSA, RES_PVOL and RES_VOL to *999999* and save the file.

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OpSchedulesDefault	💷 resrna							
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PPIrng	RES_PVOL	10	100	0	[10^4 m3]	FLOAT	1	Volume of w
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	RES_K	0	1	0	[mm/hr]	FLOAT	1	Hydraulic co
rterng	IRESCO	0	3	0	na	FLOAT	1	Outflow sim
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								Phosphorus

88. Go to QSWAT 1.5G dialog box and click *Edit Inputs and Run SWAT button*. *SWAT Editor* Dialog box opens. Click *Connect to Database* button. Click *Edit SWAT Input* from toolbar and from the drop down, click *Reservoirs*.





89. Select the Reservoir and click OK.

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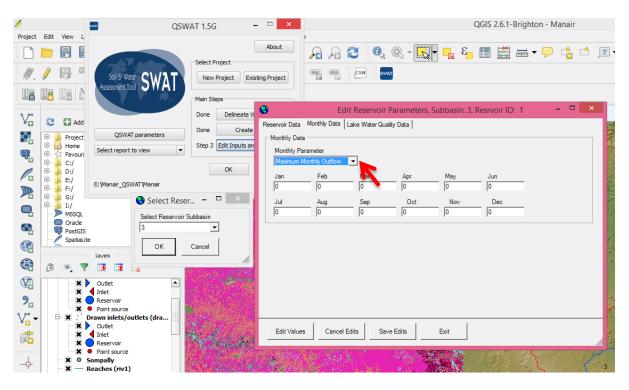
90. Click *Edit Values* to edit the parameters. (Refer SWAT Documentation)

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91. Provide the corresponding values for IYRES, RES_ESA, RES_EVOL, RES_PSA, RES_PVOL, RES_VOL, IFLOD1R, IFLOD2R, NDTARG, and STARG_FPS.



92. Click on Monthly Data tab and provide the maximum monthly outflow values. Then select minimum monthly outflow from the drop down and provide the respective values. Click on *Save Edits.*



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93. Click OK and close the dialog box. This saves the characteristics of the reservoir added.

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MANAGEMENT PRACTICES

94. Click on *Subbasin Data* in Edit SWAT Input dropdown.

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95. In the Edit Subbasin Inputs dialog box, select Management (.Mgt) from SWAT Input Table dropdown, 1 from Subbasin dropdown, respective Land Use, soils and slope. Click OK.

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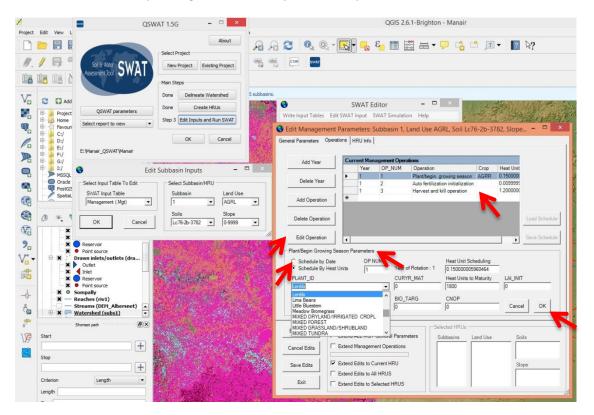
96. Click Edit Values and provide the respective values for the parameters required. **Refer SWAT Documentation**. (Note: For Rabi crop Initial Land cover should be provided)

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97. Click *Operations* tab and click *Edit Operation* button for Operations such as *Plant/begin, growing season, Auto fertilization initialization, Harvest and kill operation* that are already listed.

98. Provide the corresponding values for the parameters provided.



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99. Add a new operation by clicking on *Add Operation* button and select Auto Irrigation and click OK. Once the schedule is edited, Save the Schedule by clicking on *Save Schedule* button.

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100. Provide the corresponding values for the parameters provided. Further Extend Management Operations and Extend Edits to Selected HRUs, then select Subbasins, landuse, soils, slope and Save the edits.

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101. Click OK and close the dialog box. Similarly for each Landuse, a crop is assigned with their respective parameters.

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102. Further follow the steps to Rewrite the SWAT input files and Run the SWAT model (step 68 to 75).

103. Check the output.rsv and output.mgt to write reservoir and management operations to table. Click Run **SWAT Check button** to summarize results from SWAT simulations. Save the SWAT output as "Simulation_with_Reservoir_&_Crop_Mgt"

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104. The simulation results are saved in the following path: Manair_QSWAT > Manair > Scenarios > Simulation_without_Reservoir_&_Crop_Mgt > TxtInOut . Thus Reservoir and management operations have been incorporated.

105. Open the *SWATOutput.mdb* file from the following path: Manair_QSWAT > Manair > Scenarios > Simulation_with_Reservoir_&_Crop_Mgt > TablesOut

Open the *rsv* table from it. Copy and paste the data into a new excel sheet and plot the Volume column.

SWAT- Check

SWAT-Check is a tool used to summarize results from SWAT simulations. It can also provide warning that could help to improve the modeling skills in SWAT. SWAT- Check evaluates different processes in the landscape. It can be executed by locating the TxtInOut of a particular simulation. There are several windows in SWAT-Check namely Hydrology, Sediment, Nitrogen cycle, Phosphorous cycle, Plant growth, Landscape nutrient losses, Land use summary, Instream processes, point sources and Reservoirs. The Hydrology window summarizes the water balance both graphically and numerically. The sediment window summarizes graphically and numerically the sediment yield in the watershed – both in the upland and in-stream processes. The Land Use Summary window summarizes the different landscape process components for each land use type in the watershed.



