ARCSWAT INTERFACE FOR SWAT2005

USER'S GUIDE

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SECTION 1: INTRODUCTION

Purpose

The ArcSWAT ArcGIS extension is a graphical user interface for the SWAT (Soil and Water Assessment Tool) model (Arnold et al., 1998). SWAT is a river basin, or watershed, scale model developed to predict the impact of land management practices on water, sediment, and agricultural chemical yields in large, complex watersheds with varying soils, land use, and management conditions over long periods of time. The model is physically based and computationally efficient, uses readily available inputs and enables users to study long-term impacts. For a detailed description of SWAT, see Soil and Water Assessment Tool Theoretical Documentation and User's Manual, Version 2005 (Neitsch et al., 2005a; 2005b), published by the Agricultural Research Service and the Texas Agricultural Experiment Station, Temple Texas.

The SWAT model can be applied to support various watershed and water quality modeling studies. Examples of such studies include the following:

- National and regional scale water resource assessment considering both current and projected management conditions.
- Bosque River TMDL in Erath County, Texas. The project determined sediment, nitrogen and phosphorus loadings to Lake Waco from various sources including dairy waste application areas, waste treatment plants, urban areas, conventional row crops and rangeland. Numerous land management practices were simulated and analyzed (Saleh et al., 2000)
- Poteau River TMDL in Oklahoma/Arkansas. This project assessed sediment, nitrogen and phosphorus loadings to Wister Lake and dissolved oxygen, temperature, algae, and CBOD in the river. Management scenarios regarding poultry waste were analyzed (Srinivasan et al., 2000).
- DDT in the Yakima River basin, Washington. SWAT was used to simulate past and future sediment contamination by DDT in the Yakima River basin.
- The EPA office of pesticide registration is evaluating SWAT for use in landscape/watershed scale evaluation for pesticide registration.
- SWAT is being used extensively in the U.S. and Europe to assess the impact of global climate on water supply and quality (Rosenberg et al, 1999).

The ArcSWAT ArcGIS extension evolved from AVSWAT2000 an ArcView extension developed for an earlier version of SWAT (Di Luzio et al., 2001). The interface requires the designation of land use, soil, weather, groundwater, water use, management, soil chemistry, pond, and stream water quality data, as well as the simulation period, in order to ensure a successful simulation.

Application

SWAT can be used to simulate a single watershed or a system of multiple hydrologically connected watersheds. Each watershed is first divided into subbasins and then in hydrologic response units (HRUs) based on the land use and soil distributions.

Procedures

Key Procedures

- Load or select the ArcSWAT extension
- Delineate the watershed and define the HRUs
- (Optional) Edit SWAT databases
- Define the weather data
- Apply the default input files writer
- (Optional) Edit the default input files
- Set up (requires specification of simulation period, PET calculation method, etc.) and run SWAT
- (Optional) Apply a calibration tool
- (Optional) Analyze, plot and graph SWAT output

User Support

SWAT and the ArcSWAT interface are public domain software. Support is provided through the SWAT user website and several user groups and discussion forums. The following are links to SWAT related user support sites.

- SWAT user web site: http://www.brc.tamus.edu/swat/
- SWAT forums and user groups: http://www.brc.tamus.edu/swat/userforums.html
- ArcSWAT user web site: http://www.brc.tamus.edu/swat/arcswat.html
- ArcSWAT Google user group: http://groups.google.com/group/ArcSWAT

References

Arnold, J.G., R. Srinivasan, R.S. Muttiah, and J.R. Williams. 1998. Large area hydrologic modeling and assessment part I: model development. J. American Water Resources Association 34(1):73-89.

Di Luzio, M., R. Srinivasan, and J.G. Arnold. 2001. ArcView Interface for SWAT 2000.

Neitsch, S.L., J.G. Arnold, J.R. Kiniry and J.R. Williams. 2001a. Soil and Water Assessment Tool Theoretical Documentation, Version 2000.

Neitsch, S.L., J.G. Arnold, J.R. Kiniry and J.R. Williams. 2001a. Soil and Water Assessment Tool User's Manual, Version 2000.

Rosenberg, N.J., D.L. Epstein, D. Wang, L. Vail, R. Srinivasan, and J.G. Arnold. 1999. Possible impacts of global warming on the hydrology of the Ogallala aquifer region. J. of Climate 42:677-692.

Saleh, A., J.G. Arnold, P.W. Gassman, L.W. Hauck, W.D. Rosenthal, J.R. Williams, and A.M.S. McFarland. 2000. Application of SWAT for the upper north Bosque watershed. Transactions of the ASAE 43(5):1077-1087.

Srinivasan, R., J.G. Arnold, T.S. Ramanarayanan, and S.T. Bednarz. 1996. Modeling Wister lake watershed with the soil and water assessment tool (SWAT). Third International Conference/Workshop on Integrating GIS and Environmental Modeling.

SECTION 2: INSTALLING THE ARCSWAT INTERFACE

SECTION 2.1: SYSTEM REQUIREMENTS

The SWAT2005/ArcSWAT Interface requires:

Hardware:

- Personal computer using a Pentium IV processor or higher, which runs at 2 gigahertz or faster
- 1 GB RAM minimum
- 500 megabytes free memory on the hard drive for minimal installation and up to 1.25 gigabyte for a full installation (including sample datasets and US STATSGO data)

Software (ArcSWAT for ArcGIS 9.1 version):

- Microsoft Windows XP, or Windows 2000 operating system with most recent kernel patch
- ArcGIS ArcView 9.1with service pack 2 (Build 766)
- ArcGIS Spatial Analyst 9.1 extension
- ArcGIS Developer Kit (usually found in C:\Program Files\ArcGIS\DeveloperKit\)
- ArcGIS DotNet support (usually found in C:\Program Files\ArcGIS\DotNet\)
- Adobe Acrobat Reader version 8 or higher (may be downloaded for free at: http://www.adobe.com/products/acrobat/readstep2.html)
- Microsoft .Net Framework 1.1

Software (ArcSWAT for ArcGIS 9.2 version):

- Microsoft Windows XP, or Windows 2000 operating system with most recent kernel patch
- ArcGIS ArcView 9.2 with most recent patches and service packs
- ArcGIS Spatial Analyst 9.2 extension
- ArcGIS Developer Kit (usually found in C:\Program Files\ArcGIS\DeveloperKit\)

- ArcGIS DotNet support (usually found in C:\Program Files\ArcGIS\DotNet\)
- Adobe Acrobat Reader version 8 or higher (may be downloaded for free at: http://www.adobe.com/products/acrobat/readstep2.html)
- Microsoft .Net Framework 2.0

While 500 MB is adequate memory for installing the basic interface, you may need considerably more memory to store the tables generated when the interface processes the spatial datasets[1]. We have found that an additional 2-4 gigabytes of free hard drive space is desirable for many of the larger ArcSWAT projects.

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[1] The space required to create a SWAT project with the ArcSWAT interface depends on the resolution of the maps used. While testing the interface, a 10-meter resolution DEM map layer taking up only 6 MB of space was processed. At one point in the analysis of the map, the interface had filled 350 MB of storage with data.

SECTION 2.2: INSTALLING ARCSWAT

The ArcSWAT interface for SWAT2005 has been formatted to create a separate directory structure from that used by the ArcView interface for AVSWAT 2000. This allows users to keep both versions installed on their machine.

1. Before you install, make sure to check the following:

   a) You have uninstalled any previous versions of ArcSWAT using “Add or Remove Programs”

   b) You have the latest appropriate version of ArcGIS installed with all service packs for the ArcSWAT version you are installing. Note: Different versions of ArcSWAT are required for ArcGIS 9.0, 9.1, etc.

2. If you have not done so, turn on your computer. Download the archive file and extract the ArcSWAT interface installation files.

3. In the “ArcSWAT_Install” folder, double click the “setup.exe” program. The following dialog will appear:

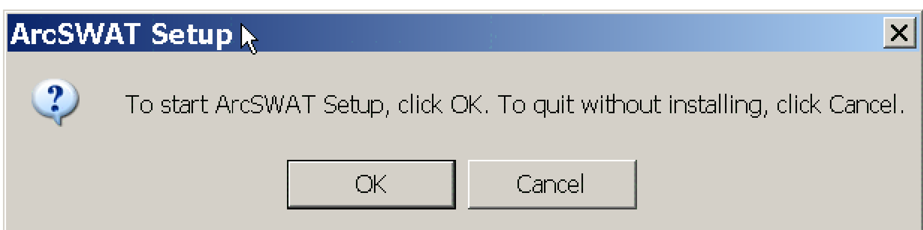


Figure 2.1

Click “OK”. The next dialog to appear will begin the installation.

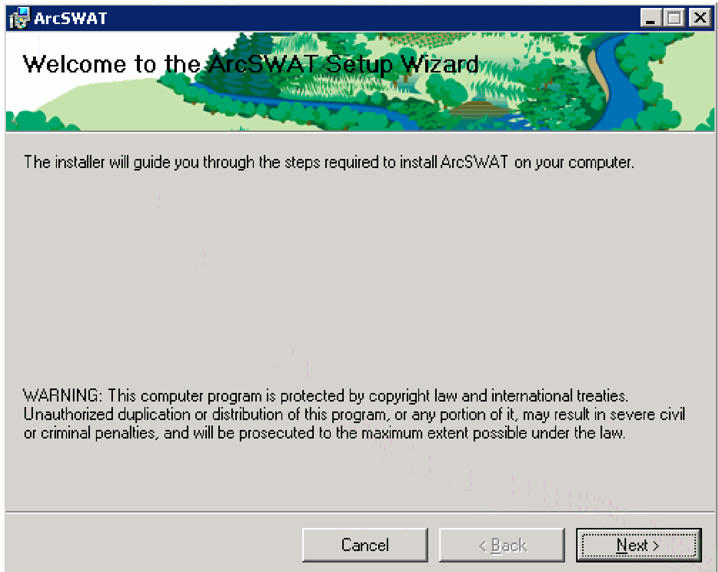


Figure 2.2

4. Click “Next”, then choose an installation folder. The default folder, “C:\Program Files\ArcSWAT\”, is recommended. Select whether you want ArcSWAT installed for “Everyone”, or “Just Me”. “Everyone” is recommended. Note: make sure that the installation folder is writeable to all. This is required, as some of the SWAT databases installed in this folder will be accessed for editing by the ArcSWAT interface.

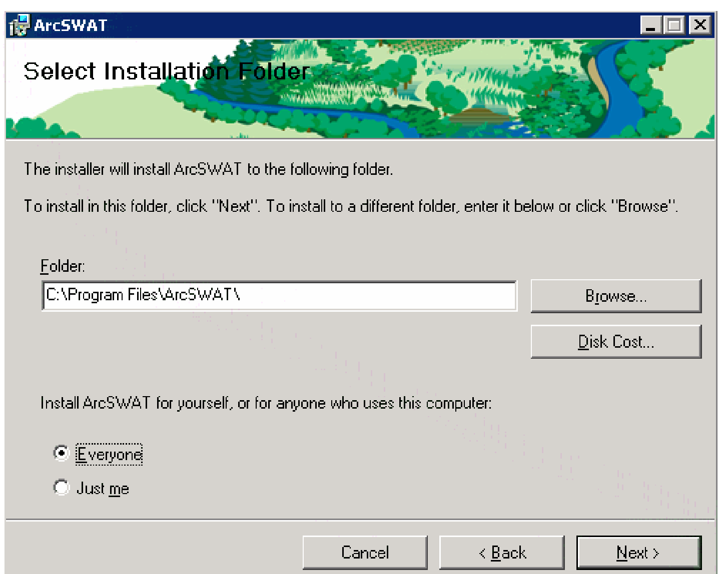


Figure 2.3

Click “Next”. You will be asked to confirm installation.

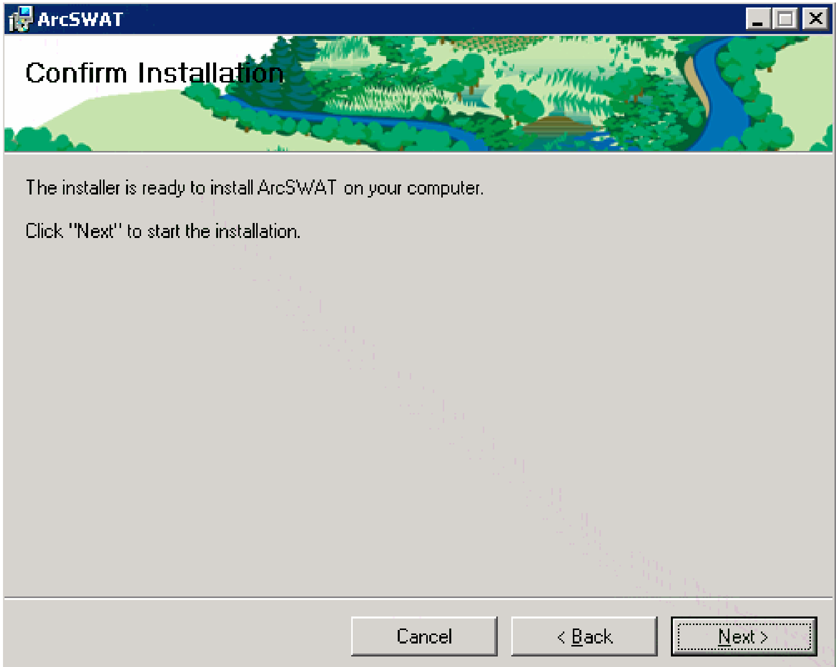


Figure 2.4

5. Click “Next”. Installation of ArcSWAT will proceed.

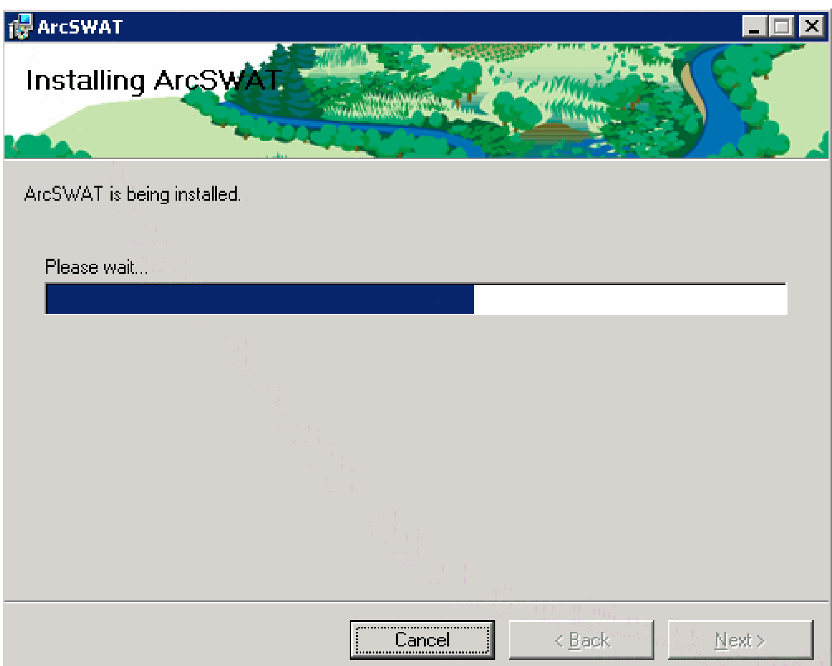


Figure 2.5

6. When completed, you will see the following message:

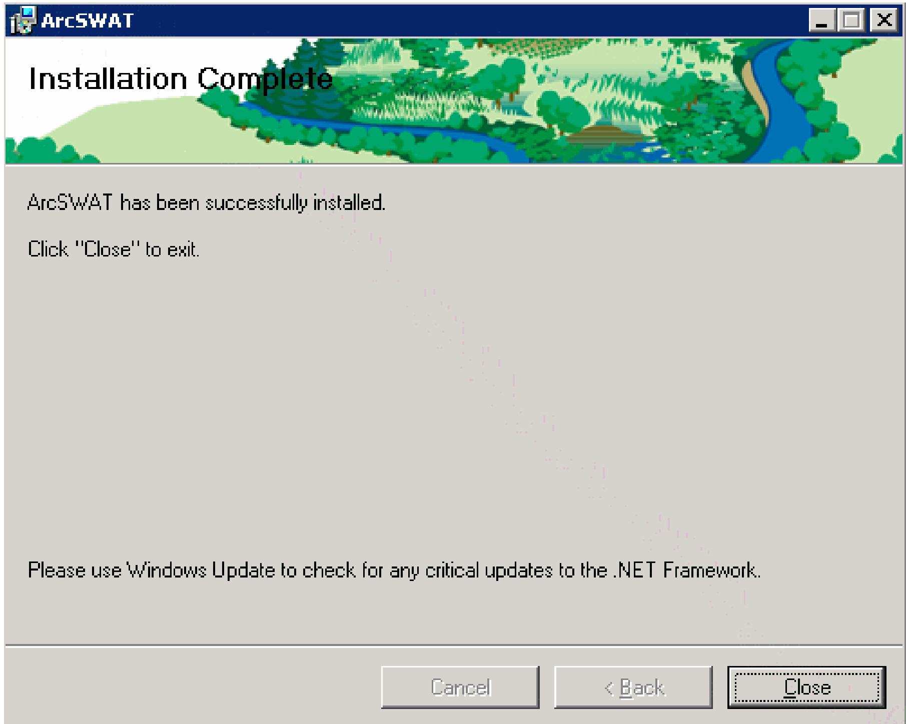


Figure 2.6

7. Click “Close”, and you are ready to begin using ArcSWAT.

SECTION 2.3: ARCSWAT INSTALLATION CONTENTS

The ArcSWAT folder created by the installation program contains the SWAT2005.exe program, the code libraries used by the ArcSWAT interface, and sub-folders containing the ArcSWAT help materials, databases, and ArcMap layer files for displaying map layers within the interface. The top level of the install directory looks as follows:

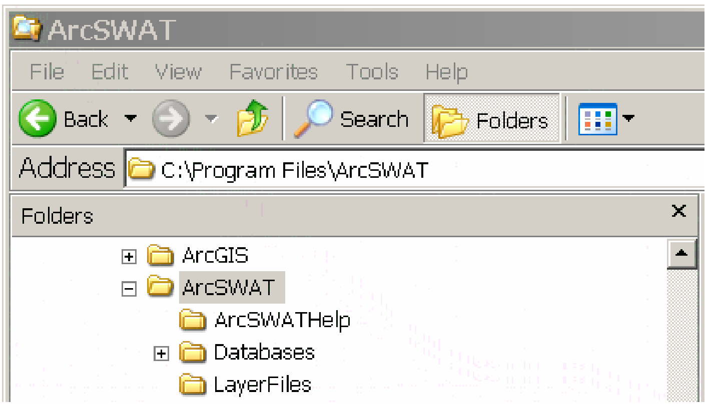


Figure 2.7

The ArcSWATHelp folder contains 3 documents:

1. ArcSWAT_Documentation.pdf: This indexed document contains the full documentation for ArcSWAT. This same document is accessed from the ArcSWAT interface when help is requested by the user.

2. ArcSWAT_FAQ.pdf: This frequently updated document reports on answers to the most frequently asked questions concerning installation, data input formatting, and possible interface errors that may be encountered.

3. ArcSWAT_VersionX.X_ReleaseNotes.pdf: This document is updated with each ArcSWAT release and contains a description of updates made with the current version, including known limitations.

The “Databases” folder contains the following:

1. Example Data Folders: The folders “Example1”, “Example2”, and “Example3” contain complete example SWAT input datasets.

2. ExInputs: This folder contains example input data file formats for weather data, point source inputs, reservoir inputs, and land use /soils lookup tables in dBase, text, and personal geodatabase format.

3. Weather: The “weather” folder contains weather data files used by the plant heat unit program that is used by the SWAT interface to estimate the heat units required for different plants to reach maturity.

4. SWAT2005.mdb: This geodatabase contains all the SWAT 2005 data tables required by the ArcSWAT interface. This includes the crop database, tillage database, user soils database, and many more. A full description of all these tables is found in Appendix 3. Note: The tables contained in SWAT2005.mdb were previously stored in the “AvSwatDB” folder in the AVSWAT 2000 interface.

5. SWAT_US_Soils.mdb: This geodatabase contains tables of the STATSGO soils parameters for all the STATSGO MUIDs within the United States. There is one table per state. In addition, this geodatabase contains a STATSGO raster dataset for the entire US. Note: This 160 MB database is distributed separately from the ArcSWAT_Install program. It may be downloaded from the SWAT web site.

6. SWAT Text Database Files: The SWAT “.dat” database files are stored in this folder. These “.dat” files represent a text version of the same database tables found in the SWAT2005.mdb database. The “.dat” files in this database will be updated as a user edits the database tables using the ArcSWAT interface. When the SWAT model is run from the ArcSWAT interface, the “.dat” files are copied into the current SWAT project just prior to executing the model.

The “LayerFiles” folder contains layer files that are used by the ArcSWAT interface during the watershed delineation process. If the user desires, he may modify these layer files to fit his/her cartographic preferences.

ArcSWAT projects are created from the ArcSWAT toolbar in ArcGIS. ArcSWAT projects may be created anywhere on the user’s file system. Starting the ArcSWAT extension and creating a new project will be covered in the section 4 of this document.

SECTION 3: PREPARING ARCSWAT INPUT

To create a SWAT dataset, the interface will need to access ArcGIS compatible raster (GRIDs) and vector datasets (shapefiles and feature classes) and database files which provide certain types of information about the watershed. The necessary spatial datasets and database files need to be prepared prior to running the interface. Examples of each of the different types of spatial datasets and tables can be viewed in the demonstration dataset.

SECTION 3.1: REQUIRED ARCSWAT SPATIAL DATASETS

- **Digital Elevation Model (DEM):** ESRI GRID Format

The interface allows the DEM to use integer or real numbers for elevation values. The units used to define the GRID resolution and the elevation are not required to be identical. For example, the GRID resolution may be in meters while the elevation may be in feet. The GRID resolution must be defined in one of the following units: meters, kilometers, feet, yards, miles, decimal degrees The elevation must be defined in one of the following units: meters, centimeters, yards, feet, inches

- **Land Cover/Land Use:** ESRI GRID, Shapefile, or Feature Class Format

The categories specified in the land cover/land use map will need to be reclassified into SWAT land cover/plant types. The user has three options for reclassifying the categories. The first option is to use a land cover/land use lookup table that is built into the ArcSWAT interface. The interface contains the USGS LULC and NLCD 1992 lookup tables in the SWAT2005.mdb database that identifies the different SWAT land cover/plant types used to model the various USGS LULC or NLCD 1992 land uses. The second option is to type in the 4-letter SWAT land cover/plant type code for each category when the land cover/land use map theme is loaded in the interface. The third option is to create a user look up table that identifies the 4-letter SWAT code for the different categories of land cover/land use on the map. The format of the look up table is described in Section 3.3.

- **Soil:** ESRI GRID, Shapefile, or Feature Class Format

> The categories specified in the soil map will need to be linked to the soil database (U.S. soils data only) included with the interface or to the User Soils database, a custom soil database designed to hold data for soils not included with the U.S. soil database. The user has four options for linking the map to the U.S. soil database.
> One method is to use the STATSGO polygon (MUID) number. Because the soils database contains information for the entire U.S., the 3-digit state STATSGO number must be prefixed with the 2-digit numeric code for the state. (The 2-digit numeric codes are listed in Appendix 2.) For every polygon, the soil database contains data for all soil phases found within the polygon.
> When the "Stmuid" option is chosen, data for the dominant soil phase in the polygon is used for the map category. The "Stmuid + Seqn" option allows the user to specify the MUID number and the soil sequence number. This allows the user to choose a soil other than the dominant within the MUID. For example, if Seqn is set to 3, data for the third most common soil phase will be used to represent the map unit. The "Name + Stmuid" option allows the user to specify a soil series within the STATSGO polygon by name. The interface will use data for the dominant phase of the soil series to represent the map category.
> The user may also link the soils map to the database via Soils5ID number. When the "S5id" option is chosen, data for the specified soil series is used to represent the map unit. In order to use the "S5id" option, the soil database for the entire US must be installed.
> The final option, "Name", is chosen when soils data from the User Soils database are to be utilized. The user will import SWAT soil files (.sol) or type the soil data into the User Soils database for each of the map categories prior to creating the project. The "Name" specified for each of the map categories is the name of the soil in the User Soils database.
> To reclassify the map categories, the information may be manually entered within the interface. Alternatively, a look up table may be loaded which has this information listed. Section 3.3 summarizes the format of the look up table used to specify the soils information.

The ArcSWAT spatial datasets may be created in any projection (the same projection must be used for all maps). The user will identify the type of projection and the projection settings within the interface when creating a new project.

SECTION 3.2: OPTIONAL ARCSWAT SPATIAL DATASETS

- **DEM Mask:** ESRI GRID, Shapefile, Feature Class Format

The interface allows a mask to be superimposed on the DEM. The interface differentiates the mask grid into areas classified as category 0 (no data) and areas classified as any category > 0. Areas of the DEM grid for which the Mask grid has a value of 0 will not be processed for stream delineation.

- **Streams:** Shapefile or Feature Class Format

The interface allows a polyline shapefile or feature class with the stream delineation to be superimposed on the DEM. The stream delineation dataset is needed for areas where the relief is so low the DEM grid is unable to accurately delineate the location of the streams.

- **User-Defined Watersheds:** Shapefile of Feature Class Format

One of the watershed delineation options is load user-defined watersheds. If this option is chosen, user-defined streams must be added as well. The watersheds and streams must be geometrically consistent, with 1 stream feature per subbasin. Outlets to subbasins will defined as small distance upstream from the end point of the stream, which requires that a stream end point fall coincident on a watershed boundary. Required fields for the user watershed file are described below.

Attribute Table Required Fields

Field Name	Field Format	Definition
GRIDCODE	Integer	An integer representing the numeric ID of the subbasin. Must be unique.
Subbasin	Integer	An integer representing the numeric ID of the subbasin. Must be unique. This is the same as the 'GRIDCODE' value

Note: An example user-watersheds shapefile is in *\Installation dir\Databases\ExInputs\UserWatersheds*

- **User-Defined Streams:** Shapefile of Feature Class Format

User-defined streams are required to accompany the user-defined watersheds The watersheds and streams must be geometrically consistent, with 1 stream feature per subbasin. Outlets to subbasins will defined as small distance upstream from the end point of the stream, which requires that a stream end point fall coincident on a watershed boundary. Streams are required to follow 'From_Node' and 'To_Node' topology representative of the streamflow network. Errors in this topology will not be picked up by the ArcSWAT interface and will lead to errors in the model structure developed! Required fields for the user watershed file are described below.

Attribute Table Required Fields

Field Name	**Field Format**	**Definition**
ARCID	Integer	An integer representing the numeric ID of the stream. Must be unique.
GRID_CODE	Integer	An integer representing the numeric ID of the subbasin that the stream belongs to. This value must be unique and correspond to the 'GRIDCODE' value in the user watersheds dataset.
FROM_NODE	Integer	The FROM_NODE of the stream. This MUST correspond to the watershed GRIDCODE that the stream drains from.
TO_NODE	Integer	The TO_NODE of the stream. This MUST correspond to the watershed GRIDCODE that the stream drains into.
Subbasin	Integer	Same ID as t he FROM_NODE
SubbasinR	Integer	Same ID as the TO_NODE

Note: An example user-watersheds shapefile is in *\Installation dir\Databases\ExInputs\UserStreams*

SECTION 3.3: ARCSWAT TABLES AND TEXT FILES

- **Subbasin Outlet Location Table** (dBase Table)

The subbasin outlet location table is used to specify the location of: additional subbasin outlet locations (for example, stream gaging locations). The use of a location table to import locations for subbasin outlets is recommended when the user plans to compare observed or measured data with SWAT results.

Table Format: Preferred (5 fields)

Field Name	Field Format	Definition
XPR	Floating point	X coordinate in the defined projection
YPR	Floating point	Y coordinate in the defined projection
LAT	Floating point	Latitude in decimal degrees
LONG	Floating point	Longitude in decimal degrees
TYPE	String 1 char	“O” should always be entered in this field

Only the subbasin outlets (Type "O") are allowed.

Note: An example outets table is in *\Installation dir\Databases\ExInputs\OutletTable.dbf*

- **Watershed Inlet Location Table** (dBase Table)

The watershed inlet location table is used to specify the location of: point sources and drainage watershed inlets.

Table Format: Preferred (5 fields)

Field Name	Field Format	Definition
XPR	Floating point	X coordinate in the defined projection
YPR	Floating point	Y coordinate in the defined projection
LAT	Floating point	Latitude in decimal degrees
LONG	Floating point	Longitude in decimal degrees
TYPE	String 1 char	“D” for Point Source “I” Draining Watershed Inlet

Only the point source (Type "D") or inlet (Type “I”) are allowed.

Note: Example point source and inlet table are in *\Installation dir\Databases\ExInputs\PntSrc.dbf and Inlet.dbf*

- **Land Use Look Up Table** (dBase or ASCII)

The land use look up table is used to specify the SWAT land cover/plant code or SWAT urban land type code to be modeled for each category in the land use map grid. Because this information can be entered manually, this table is not required to run the interface. This table may be formatted as a dBase table or as a comma delimited text table. The first row of the land use look up table must contain the field names. The remaining rows will hold the required data. An example land use look up table can be found in the included dataset.

dBase Table Format (2 fields)

Field Name[2]	Field Format	Definition
VALUE	String	Number of map category
LANDUSE	String 4 chars	Corresponding SWAT landuse or urban code

Note: Example land use lookup table is in *\Installation dir\Databases\ Example1\luc.dbf*

Personal Geodatabase (.mdb) Table Format

The PGDB table format for the land use lookup table is the same as the dBase format.

Note: An example land use lookup table is in *\Installation dir\Databases\ ExInputs\ExInputs.mdb \luc*

ASCII (.txt) Table Format

An example land use look up file is:

```
"Value","Landuse"
1,RNGE
2,PAST
3,FRSD
4,WATR
5,AGRL
6,URBN
```

[2] Specific field names must be used in all tables for the interface to properly access the information.

- **Soil Look Up Table** (dBase or ASCII)

The soil look up table is used to specify the type of soil to be modeled for each category in the soil map grid. The format of the table will vary depending on the option chosen to link the soil data to the soil map. Because this information can be entered manually, this table is not required to run the interface. The first row of the soil look up table must contain the field names. The remaining rows will hold the required data. An example soil look up table can be found in the included dataset.

dBase Table Format: **Stmuid** option (2 fields)

Field Name	Field Format	Definition
VALUE	String	Number of map category
STMUID	String 5 chars	5-digit number: digits 1-2: numeric code for state; digits 3-5: STATSGO polygon number

dBase Table Format: **S5id** option (2 fields)

Field Name	Field Format	Definition
VALUE	String	Number of map category
S5ID	String 6 chars	6-character alpha-numeric code for SOILS-5 data for the soil series

dBase Table Format: **Name** option (2 fields)

Field Name	Field Format	Definition
VALUE	String	Number of map category
NAME	String (30 chars max)	Name of the soil. The name entered into this field must correspond to the name of a soil in the User Soils database. Note: The NAME value must not contain underscore ("_") characters. This character is reserved by SWAT.

dbase Table Format: **Stmuid + Seqn** option (3 fields)

Field Name	Field Format	Definition
VALUE	String	Number of map category

STMUID	String 5 chars	5-digit number: digits 1-2: numeric code for state; digits 3-5:STATSGO polygon number
SEQN	String	Sequence number of soil within the STATSGO polygon. (2nd most dominant soil, SEQN=2; 3rd most dominant soil, SEQN=3, etc.)

dBase Table Format: **Stmuid + Name** option (3 fields)

Field Name	Field Format	Definition
VALUE	String	Number of map category
STMUID	String 5 chars	5-digit number: digits 1-2: numeric code for state; digits 3-5:STATSGO polygon number
NAME	String (30 chars max)	Name of soil within the STATSGO polygon

Note: Example soils lookup table is in *\Installation dir\Databases\Example1\soil.dbf*

Personal Geodatabase (.mdb) Table Format

The PGDB table format for the soil lookup table is the same as the dBase format.

Note: An example soils lookup table is in *\Installation dir\Databases\ ExInputs\ExInputs.mdb \soilc*

ASCII (.txt) Table Format

An example soil look up file for the Stmuid option is:

```
"Value","Stmuid"
1,48047
2,48236
3,48357
4,48619
5,48620
6,48633
```

ASCII look-up tables for other options will contain data for the joining attributes listed in the dBase format summaries for the different linkage options.

- **Weather Generator Gage Location Table** (dBase)

A database included with the interface has weather generator data summarized for 1,041 weather stations across the United States. If this database will not be used in the simulation, a location table is required to provide the location of custom weather generator stations. Custom weather generator data should be entered into the User Weather Stations database prior to creating the project (see Section 14).

dBase Table Format: Preferred (4 fields)

Field Name	Field Format	Definition
ID	Integer	Gage identification number
NAME	String max 8 chars	Corresponding gage[3] name string
XPR	Floating point	X coordinate in the defined projection
YPR	Floating point	Y coordinate in the defined projection

dBase Table Format: Alternative[4] (4 fields)

This format can be used only if the projection is defined in the project.

Field Name	Field Format	Definition
ID	Integer	Gage identification number
NAME	String max 8 chars	Corresponding gage name string
LAT	Floating point	Latitude in decimal degrees
LONG	Floating point	Longitude in decimal degrees

dBase Table Format: Alternative[4] (6 fields)

This format must be used if the projection is ***not*** defined in the project.

Field Name	Field Format	Definition
ID	Integer	Gage identification number
NAME	String max 8 chars	Corresponding gage name string
XPR	Floating point	X coordinate in the defined projection
YPR	Floating point	Y coordinate in the defined projection
LAT	Floating point	Latitude in decimal degrees

[3] The gage name must be the same as the gage name listed for the weather generator data in the User Weather Stations database.
[4] When using the alternative table format, the projection of the maps used in the interface must be defined in order for the interface to convert the latitude and longitude to the proper coordinate values.

LONG	Floating point	Longitude in decimal degrees

The user will provide a record for each station to be used: the "Name" field will contain the string used as the station name in the User Weather Stations database.

Note: Example land use lookup table is in *\Installation dir\Databases\Example1\wgnstations.dbf*

- **Precipitation Gage Location Table** (dBase)

When measured precipitation data are to be used, a table is required to provide the locations of the rain gages. The precipitation gage location table is used to specify the location of rain gages.

dBase Table Format: Preferred (5 fields)

Field Name	Field Format	Definition
ID	Integer	Gage identification number (not used by interface)
NAME	String max 8 chars	Corresponding table[5] name string
XPR	Floating point	X coordinated in the defined project
YPR	Floating point	Y coordinate in the defined projection
ELEVATION	integer	Elevation of rain gage (m)

dBase Table Format: Alternative[6] (5 fields)

This format can be used only if the projection is defined in the project.

Field Name	Field Format	Definition
ID	Integer	Gage identification number (not used by interface)
NAME	String max 8 chars	Corresponding table name string
LAT	Floating point	Latitude in decimal degrees
LONG	Floating point	Longitude in decimal degrees
ELEVATION	integer	Elevation of rain gage (m)

dBase Table Format: Alternative[6] (7 fields)

This format must be used if the projection is ***not*** defined in the project.

Field Name	Field Format	Definition
ID	Integer	Gage identification number (not used by interface)
NAME	String max 8 chars	Corresponding table name string
XPR	Floating point	X coordinated in the defined project
YPR	Floating point	Y coordinate in the defined projection
LAT	Floating point	Latitude in decimal degrees

[5] The name of the table which holds the precipitation data is "NAME".dbf or "NAME".txt.
[6] When using the alternative table format, the projection of the maps used in the interface must be defined in order for the interface to convert the latitude and longitude to the proper coordinate values.

Field Name	Field Format	Definition
LONG	Floating point	Longitude in decimal degrees
ELEVATION	integer	Elevation of rain gage (m)

The user will provide a record for each station to be used: the "Name" field will contain the string used to name the linked precipitation data table.

- **Daily Precipitation Data Table** (dBase or ASCII)

The daily precipitation data table is used to store the daily precipitation for an individual rain gage. This table is required if the raingage option is chosen for rainfall in the weather data dialog box. There will be one precipitation data table for every location listed in the rain gage location table. The name of the precipitation data table is "name.dbf" or "name.txt" where name is the character string entered for NAME in the rain gage location table. This table may be formatted as a dBase table or as a comma delimited text table.

dBase (.dbf) Table Format: (2 fields)

Field Name	**Field Format**	**Definition**
DATE	Date (mm/dd/yyyy)	Day of precipitation
PCP	Floating points (f5.1)	Amount of precipitation (mm)

Note: An example precipitation table is in *\Installation dir\Databases\ExInputs\precip.dbf*

ASCII (.txt) Table Format:

Line	**Field Format**	**Definition**
First	yyyymmdd string	Starting day of precipitation
All other lines	Floating point (f5.1) string number	Amount of precipitation (mm)

The daily records must be listed in sequential order.

Note: An example precipitation table is in *\Installation dir\Databases\ExInputs\precip.txt*

- **Sub-Daily Precipitation Data Table** (dBase)

The sub-daily precipitation data table is used to store the sub-daily precipitation for an individual rain gage. This table is required if the raingage option is chosen for rainfall in the weather data dialog box. There will be one precipitation data table for every location listed in the rain gage location table. The name of the precipitation data table is "name.dbf" where name is the character string entered for NAME in the rain gage location table. This table must be formatted as a dBase table. Note: The interval between precipitation measurements must be equal throughout the entire period of record. For example, all precipitation measurements must represent hourly totals.

dBase (.dbf) Table Format: (2 fields)

Field Name	**Field Format**	**Definition**
DATE	Date (mm/dd/yyyy)	Day of precipitation
HOUR	Integer	Ending hour of precipitation (0-23)
MINUTE	Integer	Ending minute of precipitation (0-59)
PCP	Floating point (f5.1)	Amount of precipitation (mm)

Note: An example precipitation table is in *\Installation dir\Databases\ExInputs\precip_subday.dbf*

ASCII (.txt) Table Format:

ASCII text format is not permitted for sub-daily precipitation.

- **Temperature Gage Location Table** (dBase)

When measured temperature data are to be used, a table is required to provide the locations of the temperature gages. The temperature gage location table is used to specify the location of temperature gages.

dBase Table Format: Preferred (5 fields)

Field name	Field format	Definition
ID	integer	Gage identification number (not used by interface)
NAME	string max 8 chars	Corresponding table[7] name string
XPR	floating point	X coordinate in the defined projection
YPR	floating point	Y coordinate in the defined projection
ELEVATION	integer	Elevation of temperature gage (m)

dBase Table Format: Alternative[8] (5 fields)

This format can be used only if the projection is defined in the project.

Field name	Field format	Definition
ID	integer	Gage identification number (not used by interface)
NAME	string max 8 chars	Corresponding table name string
LAT	floating point	Latitude in decimal degrees
LONG	floating point	Longitude in decimal degrees
ELEVATION	integer	Elevation of temperature gage (m)

dBase Table Format: Alternative[8] (7 fields)

This format can be used only if the projection is defined in the project.

Field name	Field format	Definition
ID	integer	Gage identification number (not used by interface)
NAME	string max 8 chars	Corresponding table name string

[7] The name of the table which holds the temperature data is "NAME".dbf or "NAME".txt.
[8] When using the alternative table format, the projection of the maps used in the interface must be defined in order for the interface to convert the latitude and longitude to the proper coordinate values.

Field name	Field format	Definition
XPR	floating point	X coordinate in the defined projection
YPR	floating point	Y coordinate in the defined projection
LAT	floating point	Latitude in decimal degrees
LONG	floating point	Longitude in decimal degrees
ELEVATION	integer	Elevation of temperature gage (m)

The user will provide a record for each station to be used: the "Name" field will contain the string used to name the linked temperature data table.

- **Temperature Data Table** (dBase or ASCII)

The temperature data table is used to store the daily maximum and minimum temperatures for a weather station. This table is required if the climate station option is chosen for temperature in the weather data dialog box. There will be one temperature data table for every location listed in the climate station location table. The name of the temperature data table is "name.dbf" or “name.txt” where name is the character string entered for NAME in the temperature gage location table. This table may be formatted as a dBase table or as a comma delimited text table.

dBase Table Format: (3 fields)

Field name	**Field format**	**Definition**
DATE	date (mm/dd/yyyy)	Day of measure
MAX	floating point (f5.1)	Daily maximum temperature (°C)
MIN	floating point (f5.1)	Daily minimum temperature (°C)

Note: An example temperature data table is in *Installation dir\Databases\ExInputs\temper.dbf*

ASCII (.txt) Table Format:

Line	**Field format**	**Definition**
First	Yyyym7mdd string	Starting day of data
All other lines	floating point (f5.1), floating point (f5.1) string numbers use comma to separate values	Daily maximum and minimum temperature (°C)

The daily records must be listed in sequential order.

Note: An example temperature data table is in *Installation dir\Databases\ExInputs\temper.txt*

- **Solar Radiation, Wind Speed, or Relative Humidity Gage Location Table** (dBase)

When measured solar radiation, wind speed, or relative humidity data are to be used, a table is required to provide the locations of the gages. The location table format described below may be used for any of these three types of records. Remember, a separate location table is used for each type of weather data.

dBase Table Format: Preferred (4 fields)

Field name	Field format	Definition
ID	integer	Gage identification number (not used by interface)
NAME	string max 8 chars	Corresponding table[9] name string
XPR	floating point	X coordinate in the defined projection
YPR	floating point	Y coordinate in the defined projection

dBase Table Format: Alternative[10] (4 fields)

This format can be used only if the projection is defined in the project.

Field name	Field format	Definition
ID	integer	Gage identification number (not used by interface)
NAME	string max 8 chars	Corresponding table name string
LAT	floating point	Latitude in decimal degrees
LONG	floating point	Longitude in decimal degrees

dBase Table Format: Alternative[10] (6 fields)

This format must be used if the projection is not defined in the project.

Field name	Field format	Definition
ID	integer	Gage identification number (not used by interface)
NAME	string max 8 chars	Corresponding table name string

[9] The name of the table which holds the solar radiation, wind speed or relative humidity data is "NAME".dbf or "NAME".txt.

[10] When using the alternative table format, the projection of the maps used in the interface must be defined in order for the interface to convert the latitude and longitude to the proper coordinate values.

Field name	Field format	Definition
XPR	floating point	X coordinate in the defined projection
YPR	floating point	Y coordinate in the defined projection
LAT	floating point	Latitude in decimal degrees
LONG	floating point	Longitude in decimal degrees

The user will provide a record for each station to be used: the "Name" field will contain the string used to name the linked solar radiation, wind speed, or relative humidity data table.

Note: An example humidity station list table is in *\Installation dir\Databases\ExInputs\hmdList.txt*

- **Solar Radiation Data Table** (dBase or ASCII)

The solar radiation data table is used to store the total daily amounts of solar radiation reaching the ground that are recorded at a specific weather station. This table is required if the Solargages option is chosen for solar radiation in the weather data dialog box. There will be one solar radiation data table for every location listed in the solar radiation location table. The name of the solar radiation data table is "name.dbf" or "name.txt" where name is the character string entered for NAME in the solar radiation gage location table. This table may be formatted as a dBase table or as a comma delimited text table.

dBase Table Format: (2 fields)

Field name	**Field format**	**Definition**
DATE	date (mm/dd/yyyy)	Day of measure
SLR	floating point (f8.3)	Daily solar radiation ($MJ/m^2/day$)

ASCII (.txt) Table Format:

Line	**Field format**	**Definition**
First	yyyymmdd string	Starting day of data
All other lines	floating point (f8.3) string number	Daily solar radiation ($MJ/m^2/day$)

The daily records must be listed in sequential order.

Note: An example solar radiation table is in *\Installation dir\Databases\ExInputs\slr.txt*

- **Wind Speed Data Table** (dBase or ASCII)

The wind speed data table is used to store the average daily wind speeds recorded at a specific weather station. This table is required if the Windgages option is chosen for wind speed data in the weather data dialog box. There will be one wind speed data table for every location listed in the wind speed location table. The name of the wind speed data table is "name.dbf" or “name.txt” where name is the character string entered for NAME in the wind speed gage location table. This table may be formatted as a dBase table or as a comma delimited text table.

dBase Table Format: (2 fields)

Field name	Field format	Definition
DATE	date (mm/dd/yyyy)	Day of measure
WND	floating point (f8.3)	Daily average wind speed (m/s)

ASCII (.txt) Table Format:

Line	Field format	Definition
First	yyyymmdd string	Starting day of data
All other lines	floating point (f8.3) string number	Daily average wind speed (m/s)

The daily records must be listed in sequential order.

Note: An example wind speed table is in *\Installation dir\Databases\ExInputs\wnd.txt*

- **Relative Humidity Data Table** (dBase or ASCII)

The relative humidity data table is used to store the fraction relative humidity recorded at a specific weather station. This table is required if the Relative Humidity gages option is chosen for relative humidity data in the weather data dialog box. There will be one relative humidity data table for every location listed in the relative humidity location table. The name of the relative humidity data table is "name.dbf" or "name.txt" where name is the character string entered for NAME in the relative humidity gage location table. This table may be formatted as a dBase table or as a comma delimited text table.

dBase Table Format: (2 fields)

Field name	**Field format**	**Definition**
DATE	date (mm/dd/yyyy)	Day of measure
HMD	floating point (f8.3)	Daily relative humidity (fraction)

ASCII (.txt) Table Format:

Line	**Field format**	**Definition**
First	yyyymmdd string	Starting day of data
All other lines	floating point (f8.3) string number	Daily relative humidity (fraction)

The daily records must be listed in sequential order.

Note: An example humidity table is in *\Installation dir\Databases\ExInputs\hmd.txt*

- **Point Discharge Data Table—Annual Loadings** (dBase or ASCII)

Point source or inlet discharge data may be summarized in one of four methods: constant daily loadings, average annual loadings, average monthly loadings, or daily loadings. If the discharge data is summarized as constant daily loadings, the data will be entered in the Point Discharges Data dialog box. For the other three methods, the interface requires a file to be previously created that contains the point discharge data. This section describes the format of the point discharge data table for annual loadings. The table may be formatted as a dBase table or as a comma delimited text table.

dBase (.dbf) Table Format: (14 fields)

Field name	**Field format**	**Definition**
YEAR	integer i4	Year of measured data
FLOYR	floating point (f12.3)	Average daily water loading for year (m3/day)
SEDYR	floating point (f12.3)	Average daily sediment loading for year (kg/day)
ORGNYR	floating point (f12.3)	Average daily organic N loading for year (kg/day)
ORGPYR	floating point (f12.3)	Average daily organic P loading for year (kg/day)
NO3YR	floating point (f12.3)	Average daily nitrate loading for year (kg/day)
NH3YR	floating point (f12.3)	Average daily ammonia loading for year (kg/day)
NO2YR	floating point (f12.3)	Average daily nitrite loading for year(kg/day)
MINPYR	floating point (f12.3)	Average daily soluble P loading for year (kg/day)
CBODYR	floating point (f12.3)	Average daily loading of CBOD for year (kg CBOD/day)
DISOXYR	floating point (f12.3)	Average daily loading of dissolved oxygen for year (kg O2/day)
CHLAYR	floating point (f12.3)	Average daily loading of chlorophyll a for year (kg/day)
SOLPYR	floating point (f12.3)	Average daily loading of soluble pesticide for year (mg ai/day)
SRBPYR	floating point (f12.3)	Average daily loading of sorbed pesticide for year (mg ai/day)
BACTPYR	floating point (f12.3)	Average daily loading of persistent bacteria for year (# bact/100ml)
BACTLPYR	floating point (f12.3)	Average daily loading of less persistent bacteria for year (# bact/100ml)
CMTL1YR	floating point (f12.3)	Average daily loading of conservative metal # 1 for year (kg/day)
CMTL2YR	floating point (f12.3)	Average daily loading of conservative metal # 2 for year (kg/day)
CMTL3YR	floating point (f12.3)	Average daily loading of conservative metal # 3 for year (kg/day)

Note: An example annual point discharge table is in *\Installation dir\Databases\ExInputs\PtSrcYearly.dbf*

ASCII (.txt) Table Format

The ASCII table format for yearly records will be a comma delimited text file with the same data reported above for the dBASE format. The first line of the file will contain the field names while the remaining lines will contain the loadings summarized on an annual basis.

Note: An example annual point discharge table is in *\Installation dir\Databases\ExInputs\pointsyearly.txt*

- **Point Discharge Data Table—Monthly Loadings** (dBase or ASCII)

Point source or inlet discharge data may be summarized in one of four methods: constant daily loadings, average annual loadings, average monthly loadings, or daily loadings. If the discharge data is summarized as constant daily loadings, the data will be entered in the Point Discharges Data dialog box. For the other three methods, the interface requires a file to be previously created that contains the point discharge data. This section describes the format of the point discharge data table for monthly loadings. The table may be formatted as a dBase table or as a comma delimited text table.

dBase (.dbf) Table Format: (15 fields)

Field name	**Field format**	**Definition**
MONTH	integer i2	Month of measured data
YEAR	integer i4	Year of measured data
FLOMON	floating point (f12.3)	Average daily water loading for month (m3/day)
SEDMON	floating point (f12.3)	Average daily sediment loading for month (kg/day)
ORGNMON	floating point (f12.3)	Average daily organic N loading for month (kg/day)
ORGPMON	floating point (f12.3)	Average daily organic P loading for month (kg/day)
NO3MON	floating point (f12.3)	Average daily nitrate loading for month (kg/day)
NH3MON	floating point (f12.3)	Average daily ammonia loading for month (kg/day)
NO2MON	floating point (f12.3)	Average daily nitrite loading for month (kg/day)
MINPMON	floating point (f12.3)	Average daily soluble P loading for month (kg/day)
CBODMON	floating point (f12.3)	Average daily loading of CBOD for month (kg CBOD/day)
DISOXMON	floating point (f12.3)	Average daily loading of dissolved oxygen for month (kg O2/day)
CHLAMON	floating point (f12.3)	Average daily loading of chlorophyll a for month (kg/day)
SOLPMON	floating point (f12.3)	Average daily loading of soluble pesticide for month (mg ai/day)
SRBPMON	floating point (f12.3)	Average daily loading of sorbed pesticide for month (mg ai/day)
BACTPMON	floating point (f12.3)	Average daily loading of persistent bacteria for month (# bact/100ml)
BACTLPMON	floating point (f12.3)	Average daily loading of less persistent bacteria for month (# bact/100ml)
CMTL1MON	floating point (f12.3)	Average daily loading of conservative metal # 1 for month (kg/day)

Field name	Field format	Definition
CMTL2MON	floating point (f12.3)	Average daily loading of conservative metal # 2 for month (kg/day)
CMTL3MON	floating point (f12.3)	Average daily loading of conservative metal # 3 for month (kg/day)

Note: An example monthly point discharge table is in *\Installation dir\Databases\ExInputs\PtSrcMonth.dbf*

ASCII (.txt) Table Format

The ASCII table format for monthly records will be a comma delimited text file with the same data reported above for the dBASE format. The first line of the file will contain the field names while the remaining lines will contain the loadings summarized on a monthly basis.

Note: An example monthly point discharge table is in *\Installation dir\Databases\ExInputs\pointsmonthly.txt*

- **Point Discharge Data Table—Daily Loadings** (dBase or ASCII)

Point source or inlet discharge data may be summarized in one of four methods: constant daily loadings, average annual loadings, average monthly loadings, or daily loadings. If the discharge data is summarized as constant daily loadings, the data will be entered in the Point Discharges Data dialog box. For the other three methods, the interface requires a file to be previously created that contains the point discharge data. This section describes the format of the point discharge data table for daily loadings. The table may be formatted as a dBase table or as a comma delimited text table.

dBase (.dbf) Table Format: (14 fields)

Field name	**Field format**	**Definition**
DATE	date (mm/dd/yyyy)	Day of measured data
FLODAY	floating point (f12.3)	Average daily water loading for the day (m3/day)
SEDDAY	floating point (f12.3)	Average daily sediment loading for the day (kg/day)
ORGNDAY	floating point (f12.3)	Average daily organic N loading for the day (kg/day)
ORGPDAY	floating point (f12.3)	Average daily organic P loading for the day (kg/day)
NO3DAY	floating point (f12.3)	Average daily nitrate loading for the day (kg/day)
NH3DAY	floating point (f12.3)	Average daily ammonia loading for the day (kg/day)
NO2DAY	floating point (f12.3)	Average daily nitrite loading for the day (kg/day)
MINPDAY	floating point (f12.3)	Average daily soluble P loading for the day (kg/day)
CBODDAY	floating point (f12.3)	Average daily loading of CBOD for day (kg CBOD/day)
DISOXDAY	floating point (f12.3)	Average daily loading of dissolved oxygen for day (kg O2/day)
CHLADAY	floating point (f12.3)	Average daily loading of chlorophyll a for day(kg/day)
SOLPDAY	floating point (f12.3)	Average daily loading of soluble pesticide for day (mg ai/day)
SRBPDAY	floating point (f12.3)	Average daily loading of sorbed pesticide for day (mg ai/day)
CMTL1DAY	floating point (f12.3)	Average daily loading of conservative metal # 1 for the day (kg/day)
CMTL2DAY	floating point (f12.3)	Average daily loading of conservative metal # 2 for the day (kg/day)
CMTL3DAY	floating point (f12.3)	Average daily loading of conservative metal # 3 for the day (kg/day)
BACTPDAY	floating point (f12.3)	Average daily loading of persistent bacteria for year

Field name	Field format	Definition
		(# bact/100ml)
BACTLPDAY	floating point (f12.3)	Average daily loading of less persistent bacteria for the day (# bact/100ml)

Note: An example daily point discharge table is in *\Installation dir\Databases\ExInputs\pointsdaily.dbf*

ASCII (.txt) Table Format

The ASCII table format for daily records will be a comma delimited text file with the same data reported above for the dBASE format. The first line of the file will contain the field names while the remaining lines will contain the loadings summarized on a daily basis.

The daily records must be listed in sequential order.

Note: An example daily point discharge table is in*\Installation dir\Databases\ExInputs\ pointsdaily.txt*

- **Reservoir Monthly Outflow Data Table** (dBase or ASCII)

One option allowed to define reservoir outflow is to provide average daily outflow values for every month of simulation. This section describes the format of the reservoir monthly outflow data table. The table may be formatted as a dBase table or as a comma delimited text table.

dBase (.dbf) Table Format: (13 fields)

Field name	**Field format**	**Definition**
YEAR	integer i4	Year of measured data
RESOUT1	floating point (f10.1)	Measured average daily outflow for January (m3/s)
RESOUT2	floating point (f10.1)	Measured average daily outflow for February (m3/s)
RESOUT3	floating point (f10.1)	Measured average daily outflow for March (m3/s)
RESOUT4	floating point (f10.1)	Measured average daily outflow for April (m3/s)
RESOUT5	floating point (f10.1)	Measured average daily outflow for May (m3/s)
RESOUT6	floating point (f10.1)	Measured average daily outflow for June (m3/s)
RESOUT7	floating point (f10.1)	Measured average daily outflow for July (m3/s)
RESOUT8	floating point (f10.1)	Measured average daily outflow for August (m3/s)
RESOUT9	floating point (f10.1)	Measured average daily outflow for September (m3/s)
RESOUT10	floating point (f10.1)	Measured average daily outflow for October (m3/s)
RESOUT11	floating point (f10.1)	Measured average daily outflow for November (m3/s)
RESOUT12	floating point (f10.1)	Measured average daily outflow for December (m3/s)

Note: An example reservoir monthly outflow table is in *\Installation dir\Databases\ExInputs\resmonthly.dbf*

ASCII (.txt) Table Format

The ASCII table format for monthly records will be a comma delimited text file with the same data reported above for the dBASE format. The first line of the file will contain the field names while the remaining lines will contain the monthly reservoir outflow.

Note: An example reservoir monthly outflow table is in *\Installation dir\Databases\ExInputs\ resmonthly.txt*

- **Reservoir Daily Outflow Data Table** (dBase or ASCII)

One option allowed to define reservoir outflow is to provide outflow values for every day of simulation. This section describes the format of the reservoir daily outflow data table. The table may be formatted as a dBase table or as a comma delimited text table.

dBase (.dbf) Table Format: (2 fields)

Field name	**Field format**	**Definition**
DATE	date (mm/dd/yyyy)	Day of measure
RESOUTFLOW	floating point (f8.2)	Water release rate for the day (m^3/s)

Note: An example reservoir daily outflow table is in *\Installation dir\Databases\ExInputs\resdaily.dbf*

ASCII (.txt) Table Format

The ASCII table format for daily records will be a comma delimited text file with the same data reported above for the dBASE format. The first line of the file will contain the field names while the remaining lines will contain the loadings summarized on a monthly basis.

The daily records must be listed in sequential order.

Note: An example daily point discharge table is in*\Installation dir\Databases\ExInputs\resdaily.txt*

- **Potential ET Data Table** (dBase or ASCII)

One option allowed to define potential evapotranspiration is to provide values for every day of simulation. This section describes the format of the potential ET daily data table. The table may be formatted as a dBase table or as a comma delimited text table.

dBase (.dbf) Table Format: (2 fields)

Field name	Field format	Definition
DATE	date (mm/dd/yyyy)	Day of measure
PET	floating point (f5.1)	Potential evapotranspiration (mm)

ASCII (.txt) Table Format

Line	Field format	Definition
First	yyyymmdd string	Starting day of data
All other lines	floating point (f5.1) string number	Potential evapotranspiration (mm)

The daily records must be listed in sequential order.

SECTION 4: GETTING STARTED WITH ARCSWAT

To start the ArcSWAT Interface

1. Start ArcMap and open an empty document
2. On the Tools menu, click Extensions
3. You wil need to enable 3 extensions for ArcSWAT to run:
    - Spatial Analyst
    - SWAT Project Manager
    - SWAT Watershed Delineator

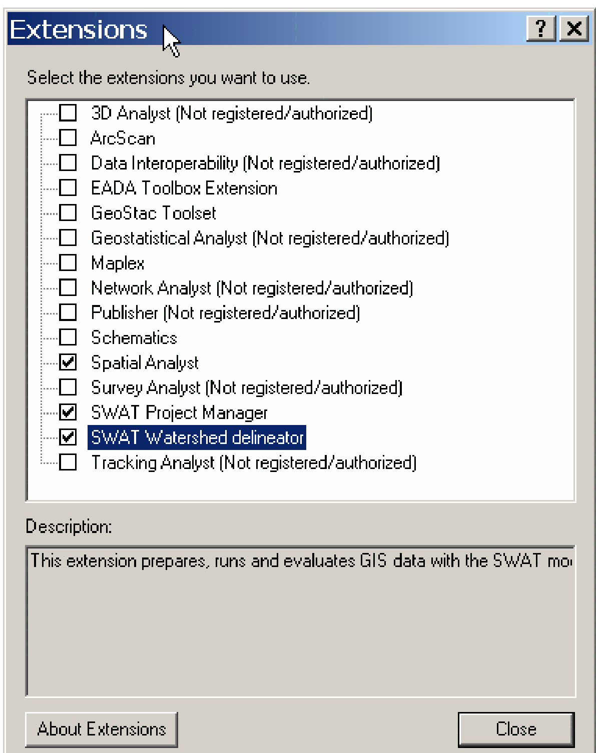


Figure 4.1

4. Next, from the View menu, click Toolbars and select the ArcSWAT Toolbar. The ArcSWAT Toolbar will appear in your ArcMap window.

Figure 4.2

SECTION 4.1: ARCSWAT TOOLBAR ITEMS

The following sections describe the functionality of the different menus available from the ArcSWAT Toolbar.

SECTION 4.1.1: SWAT PROJECT SETUP MENU

The SWAT Project Setup menu contains items that control the setup and management of SWAT projects. A SWAT project consists of a project directory which contains an ArcMap document, two geodatabases, and a subdirectory structure for storing temporary GIS datasets, and SWAT 2005 input files. Project file structure is discussed in detail in Appendix 4. Figure 4.3 shows the items on the SWAT Project Setup menu.

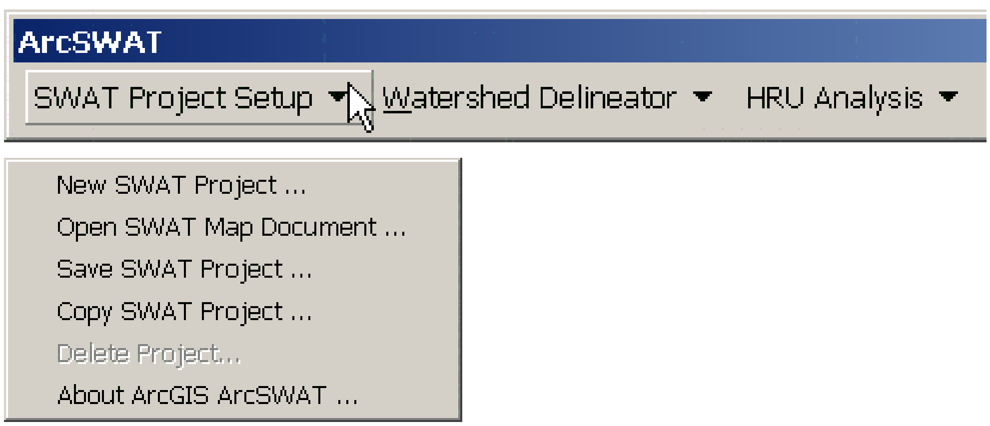


Figure 4.3

The SWAT Project Setup Menu: New SWAT Project

The **New SWAT Project** command creates a new SWAT project directory structure.

The SWAT Project Setup Menu: Open SWAT Map Document

The **Open SWAT Map Document** opens an existing SWAT project ArcMap document.

The SWAT Project Setup Menu: Save SWAT Project

The **Save SWAT Project** command saves the current SWAT project you are currently working on.

The SWAT Project Setup Menu: Copy SWAT Project

The **Copy SWAT Project** command copies the entire contents of the specified SWAT project to a new project folder.

The SWAT Project Setup Menu: Delete Project

The **Delete Project** command deletes the ArcSWAT project.

The SWAT Project Setup Menu: About ArcGIS ArcSWAT

The **About ArcGIS SWAT** command opens a dialog that describes the current version of the ArcSWAT extension being run.

SECTION 4.1.2: THE WATERSHED DELINEATOR MENU

The **Watershed Delineator** menu contains all the commands required to perform subbasin delineation and evaluate the results. Figure 4.4 displays the Watershed Delineator menu.

Figure 4.4

The Watershed Delineator Menu: Automatic Delineation

The **Automatic Delineation** command accesses the dialog box used to import topographic maps and delineate the watershed. This procedure is reviewed in Section 5.

The Watershed Delineator Menu: Watershed Reports

The **Watershed Reports** command provides access to the topographic report generated by the interface.

SECTION 4.1.3: THE HRU ANALYSIS MENU

The HRU Analysis menu contains all the commands that perform the land use, soils, and slope analysis used to generate SWAT HRUs. Figure 4.5 displays the Land Use and Soils menu.

Figure 4.5

The HRU Analysis Menu: Land Use/Soils/Slope Definition

The Land Use/Soils/Slope Definition command accesses the dialog box used to import land use and soil maps, link the maps to SWAT databases and perform an overlay. This procedure is reviewed in Section 6.

The HRU Analysis Menu: HRUs Distribution

The HRUs Distribution command accesses the dialog box used to define the number of HRUs created within each subbasin in the watershed. This procedure is reviewed in Section 6.

The HRU Analysis Menu: HRU Analysis Reports

The HRU Analysis Reports command lists various HRU analysis reports generated by the interface. To access a particular report, highlight the name of the report and click the left mouse button. The report of interest will be displayed in a text editor.

SECTION 4.1.4: **THE WRITE INPUT TABLES MENU**

The Input menu contains the commands which generate the ArcSWAT geodatabase files used by the interface to store input values for the SWAT model. Figure 4.6 displays the Write Input menu.

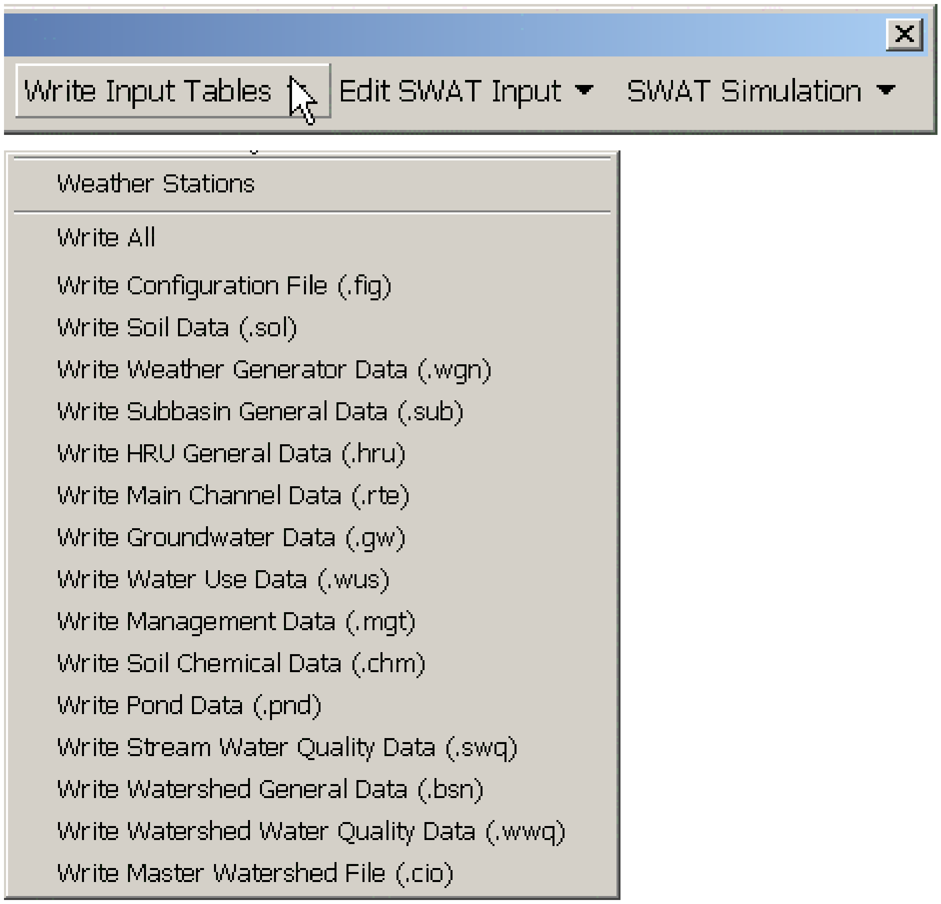


Figure 4.6

The Write Input Menu: Weather Stations

The **Weather Stations** command loads weather station locations and data for use.

The Write Input Menu: Write All

The **Write All** command creates ArcSWAT geodatabase tables that store values for SWAT input parameters. Initial SWAT ASCII input files are also generated.

The Write Input Menu: Write Configuration File (.fig)

The **Write Configuration File (.fig)** command creates the SWAT ASCII watershed configuration input file (fig.fig).

The Write Input Menu: Write Soil Data (.sol)

The **Write Soil Data (.sol)** command creates an ArcSWAT geodatabase table (sol) that stores values for SWAT soil input parameters. Initial SWAT ASCII .sol input files are also generated.

The Write Input Menu: Write Weather Generator Data (.wgn)

The **Write Weather Generator Data (.wgn)** command creates an ArcSWAT geodatabase table (wgn) that stores values for SWAT weather generator input parameters. Initial SWAT ASCII .wgn input files are also generated.

The Write Input Menu: Write Subbasin General Data (.sub)

The **Write Subbasin General Data (.sub)** command creates an ArcSWAT geodatabase table (sub) that stores values for SWAT subbasin input parameters. Initial SWAT ASCII .sub input files are also generated.

The Write Input Menu: Write HRU General Data (.hru)

The **Write HRU General Data (.hru)** command creates an ArcSWAT geodatabase table (hru) that stores values for SWAT HRU input parameters. Initial SWAT ASCII .hru input files are also generated.

The Write Input Menu: Write Main Channel Data (.rte)

The **Write Main Channel Data (.rte)** command creates an ArcSWAT geodatabase table (rte) that stores values for SWAT main channel input parameters. Initial SWAT ASCII .rte input files are also generated.

The Write Input Menu: Write Groundwater Data (.gw)

The **Write Groundwater Data (.gw)** command creates an ArcSWAT geodatabase table (gw) that stores values for SWAT groundwater input parameters. Initial SWAT ASCII .gw input files are also generated.

The Write Input Menu: Write Water Use Data (.wus)

The **Write Water Use Data (.wus)** command creates an ArcSWAT geodatabase table (wus) that stores values for SWAT water use input parameters. Initial SWAT ASCII .wus input files are also generated.

The Write Input Menu: Write Management Data (.mgt)

The **Write Management Data (.mgt)** command creates an ArcSWAT geodatabase table (mgt) that stores values for SWAT management input parameters. Initial SWAT ASCII .mgt input files are also generated.

The Write Input Menu: Write Soil Chemical Data (.chm)

The **Write Soil Chemical Data (.chm)** command creates an ArcSWAT geodatabase table (chm) that stores values for SWAT soil chemical input parameters. Initial SWAT ASCII .chm input files are also generated.

The Write Input Menu: Write Pond Data (.pnd)

The **Write Pond Data (.pnd)** command creates an ArcSWAT geodatabase table (pnd) that stores values for SWAT pond/wetland input parameters. Initial SWAT ASCII .pnd input files are also generated.

The Write Input Menu: Write Stream Water Quality Data (.swq)

The **Write Stream Water Quality Data (.swq)** command creates an ArcSWAT geodatabase table (swq) that stores values for SWAT stream water quality input parameters. Initial SWAT ASCII .swq input files are also generated.

The Write Input Menu: Write Watershed General Data (.bsn)

The **Write Watershed General Data (.bsn)** command creates an ArcSWAT geodatabase table bsn) that stores values for SWAT general watershed parameters. Initial SWAT ASCII .bsn input files are also generated.

The Write Input Menu: Write Watershed Water Quality Data (.wwq)

The **Write Watershed Water Quality Data (.wwq)** command creates an ArcSWAT geodatabase table (wwq) that stores values for SWAT watershed water quality input parameters. Initial SWAT ASCII .wwq input files are also generated.

The Write Input Menu: Write Master Watershed Data (.cio)

The **Write Master Watershed Data (.cio)** command creates an ArcSWAT geodatabase table (cio) that stores values for SWAT watershed model control input parameters. Initial SWAT ASCII .cio input files are also generated.

SECTION 4.1.5: THE EDIT SWAT INPUT MENU

The Edit SWAT Input menu allows you to edit the SWAT model databases and the watershed database files containing the current inputs for the SWAT model. Seven items are listed on the Edit Input menu (Figure 4.7).

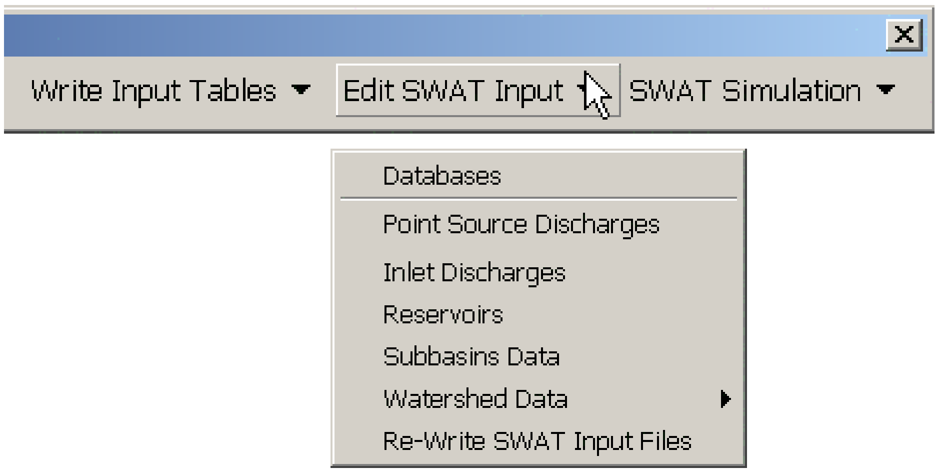


Figure 4.7

The Edit SWAT Input Menu: Databases

The **Databases** command allows the user to access the SWAT model databases from within a project. SWAT databases may be edited at any time during the development of a SWAT project. The SWAT databases MUST be edited to their desired content prior to writing the SWAT Input tables (see section 4.1.3) in order to be reflected in the model input files. Editing the SWAT database will modify the content of the SWAT2005.mdb database being used for the project. The edits made to the SWAT2005.mdb tables will be available for other SWAT projects in addition to the current project. It is good practice to make a backup copy of the SWAT2005.mdb prior to working on a SWAT project.

The Edit SWAT Input Menu: Point Source Discharges

The **Point Source Discharges** command allows the user to access/define the point source loadings for all subbasins with point source discharges. Edits made to point source discharges using the ArcSWAT interface are reflected only in the current SWAT project.

The Edit SWAT Input Menu: Inlet Discharges

The **Inlet Discharges** command allows the user to access/define loadings for upstream sections of the watershed not directly modeled in the current project. Edits made to inlet discharges using the ArcSWAT interface are reflected only in the current SWAT project.

The Edit SWAT Input Menu: Reservoirs

The **Reservoirs** command allows the user to access/edit input parameters for any reservoirs located within the watershed. Edits made to reservoirs using the ArcSWAT interface are reflected only in the current SWAT project.

The Edit SWAT Input Menu: Subbasins Data

The **Subbasins Data** command allows the user to access/edit input parameters for land areas, channels, ponds/wetlands, and groundwater systems within the watershed. Edits made to subbasin data using the ArcSWAT interface are reflected only in the current SWAT project.

The Edit SWAT Input Menu: Watershed Data

The **Watershed Data** command allows the user to access/edit input parameters that are applied to the watershed as a whole. Edits made to watershed using the ArcSWAT interface are reflected only in the current SWAT project.

The Edit SWAT Input Menu: Re-Write SWAT Input Files

The **Re-Write SWAT Input Files** command allows tore-write the ascii SWAT input files (.sub, .mgt, .hru, etc.) after the SWAT geodatabase files have been edited.

SECTION 4.1.6: THE SWAT SIMULATION MENU

The SWAT Simulation menu allows you to run the SWAT model and perform sensitivity analysis and calibration. Five items are listed on the SWAT Simulation menu (Figure 4.8).

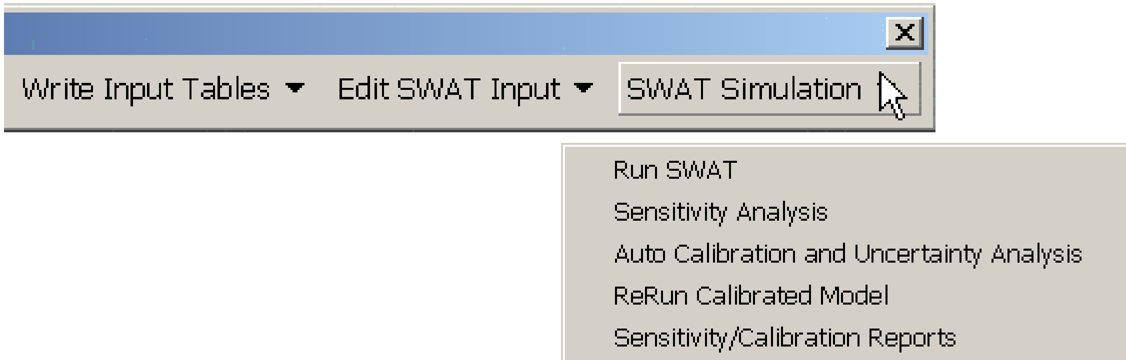


Figure 4.8

The SWAT Simulation Menu: Run SWAT

The **Run SWAT** command allows the user to modify parameters in three SWAT input files, the input control code file (.cod), the basin input file (.bsn), and the watershed water quality input file (.wwq), as well as set up and run the SWAT model.

The SWAT Simulation Menu: Sensitivity Analysis

The **Senility Analysis** command opens the sensitivity analysis dialog. This dialog allows users to choose SWAT simulations and subbasin locations to evaluate the sensitivity of model simulations to changes in parameter values.

The SWAT Simulation Menu: Auto Calibration and Uncertainty Analysis

The **Auto Calibration and Uncertainty Analysis** command opens the dialog to control the running of auto calibration. This dialog allows users to choose specific SWAT input parameters to calibrate for a specified SWAT simulation and subbasin location.

The SWAT Simulation Menu: Re-Run Calibrated Model

The **Re-Run Calibrated Model** command allows users to re-run SWAT simulation based upon the optimum parameter sets identified during auto-calibration.

The SWAT Simulation Menu: Sensitivity/Calibration Reports

The **Re-Run Calibrated Model** command lists various sensitivity analysis and auto-calibration output reports. To access a particular report, highlight the name of the report and click the left mouse button. The report of interest will be displayed in a text editor.

SECTION 4.2: MANAGING ARCSWAT PROJECTS

The following section describes how to manage ArcSWAT projects using the SWAT Project Setup menu items.

SECTION 4.2.1: NEW SWAT PROJECT

To create a new ArcSWAT project:

1. From the **SWAT Project Setup** menu, click the **New SWAT Project** command.

2. A dialog will appear and ask if you want to save the current document.

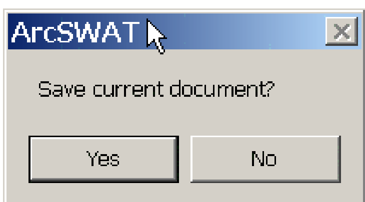


Figure 4.9

3. After choosing an appropriate response, the **Project Setup** dialog will appear. The dialog will contain initial default values for a Project Directory, SWAT Project Geodatabase, Raster Storage, and SWAT Parameters Geodatabase.

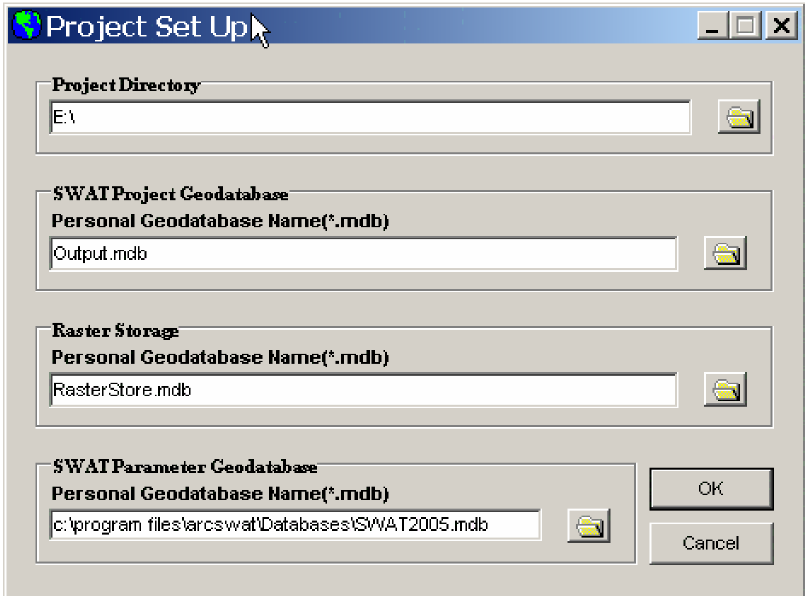


Figure 4.10

4. Choose a Project Directory by clicking on the file browse button to the right of the text box. The Project Directory will be the location that all your SWAT project files are stored.

5. Change the name for the SWAT Project Geodatabase (**Optional**). By default, the interface will set the name of the geodatabase as the same name as the project folder.

6. Change the name of the Raster Storage geodatabase (**Optional**).

7. Change the name of the SWAT Parameter Geodatabase (**Optional**). By default, the SWAT2005.mdb geodatabase in your ArcSWAT installation folder will be chosen. Some users may wish to maintain multiple version of this database, in which case they would be able to select and alternative database here.

8. The modified Project Setup Dialog looks as shown in Figure 4.11.

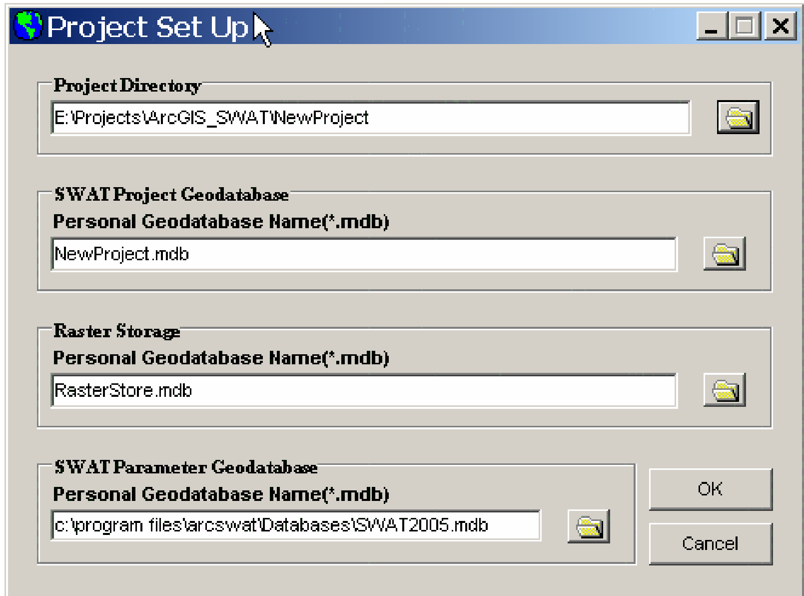


Figure 4.11

9. Click OK, and the new SWAT project will be created.

SECTION 4.2.2: OPEN SWAT MAP DOCUMENT

To create an existing ArcSWAT map document:

1. From the SWAT Project Setup menu, click the Open SWAT Map Document command.

2. A dialog will appear and ask if you want to save the current document.

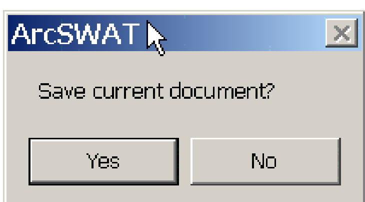


Figure 4.12

3. After choosing an appropriate response, a file browse dialog will appear .Choose the SWAT ArcMap document you wish to open.

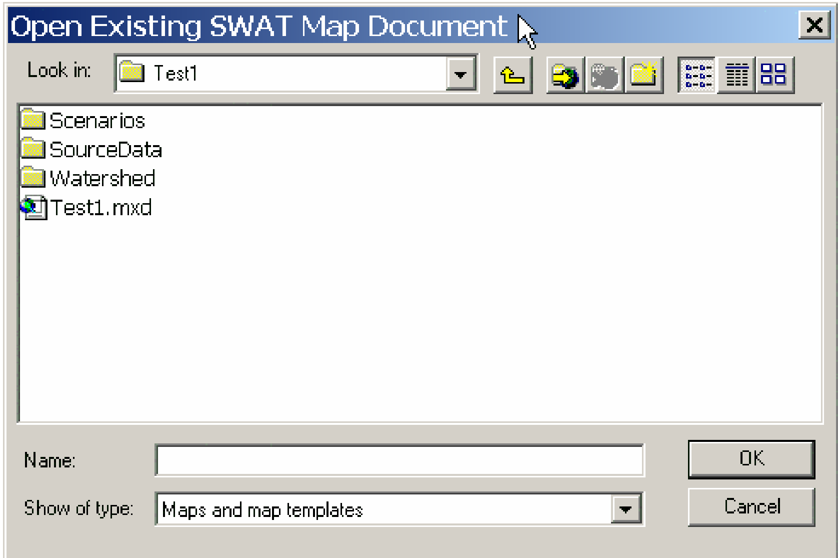


Figure 4.13

4. All ArcSWAT settings from the document you selected will be loaded into the current map.

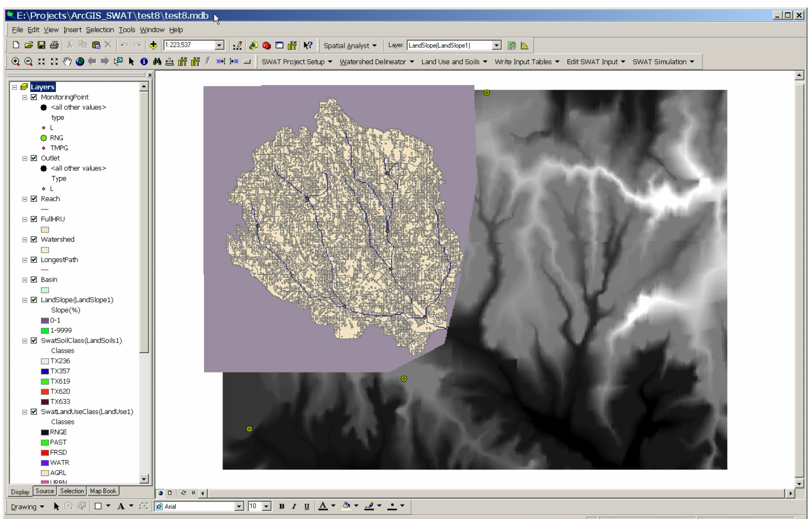


Figure 4.14

SECTION 4.2.3: **SAVE SWAT PROJECT**

To save the current ArcSWAT project:

1. From the **SWAT Project Setup** menu, click the **Save SWAT Project** command.

2. The current ArcMap document will be saved, including all links to the ArcSWAT databases.

SECTION 4.2.4: COPY SWAT PROJECT

To copy an ArcSWAT project:

1. From the **SWAT Project Setup** menu, click the **Copy SWAT Project** command.

2. The **Copy SWAT Project** dialog will appear. By default, the dialog will propose that you copy the current project that you are working on. The project is defined by the name of the project geodatabase. You may choose a different project, other than the current one to copy if you wish.

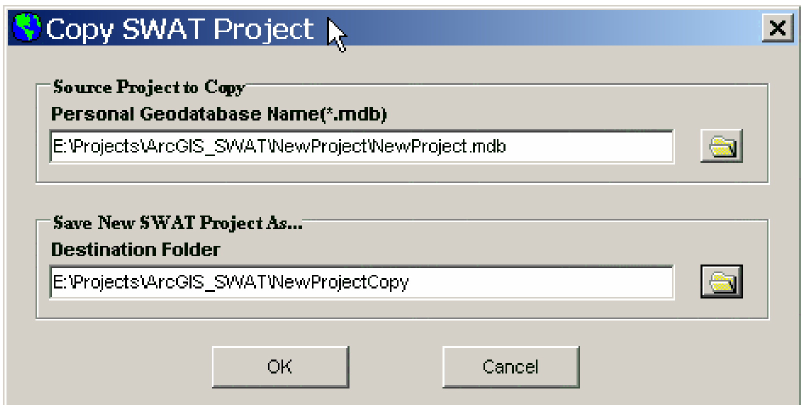


Figure 4.15

3. Define the destination folder of the new project by using the file browse button to the right of the destination folder text box.

4. Click OK and the project will be copied. All the files and folders within the project folder for your source project will be copied.

SECTION 4.2.5: DELETE SWAT PROJECT

To delete an ArcSWAT project:

1. From the SWAT Project Setup menu, click the Delete SWAT Project command.

2. The **Delete SWAT Project** dialog will appear. Use the file browse button next to the Project Directory text box to choose the project directory of the project you wish to delete. Next, use the file browse button next to the SWAT Project Geodatabase text box to choose the SWAT Project Geodatabase associated with the project.

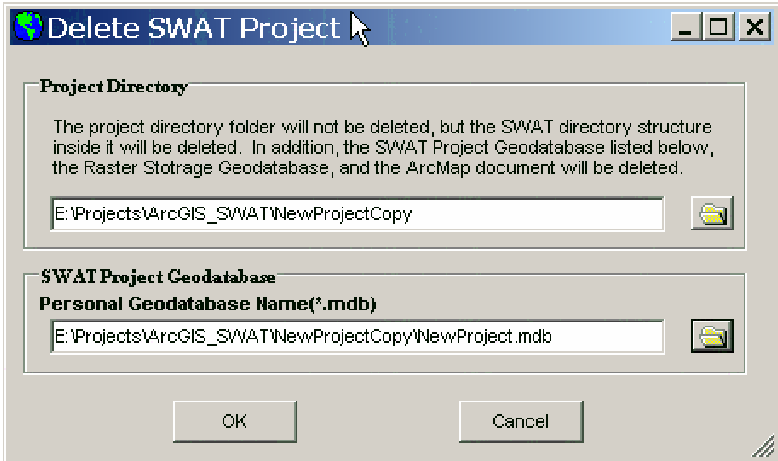


Figure 4.16

3. Click OK. The specified ArcSWAT project will be deleted. Only the SWAT directory structure, the associated geodatabases, and the ArcMap document will be removed. Other files that the user?? may have added into the project folder will not be removed.

SECTION 4.3: ARCSWAT HELP

Users of ArcSWAT may obtain help in understanding required inputs, procedures for developing a SWAT model, and contents of the ArcSWAT databases through several means.

1. Interface User's Guide: First, this document, ArcSWAT Interface for SWAT 2005 User's Guide, provides comprehensive guidance on using the ArcSWAT interface to develop SWAT model inputs. This document is distributed as an Adobe pdf file with the ArcSWAT installation package.

2. ArcSWAT Online Help: Users may access specific points in the ArcSWAT Interface for SWAT 2005 User's Guide directly from the ArcSWAT interface dialogs. A user may "right-click" a location on an ArcSWAT interface dialog to open a context menu that will offer the user the option of retrieving help for the topic corresponding to the current cursor location (Figure 4.17). Selecting the context menu item will open the ArcSWAT documentation to the requested topic and will also allow the user to continue browsing the documentation if desired.

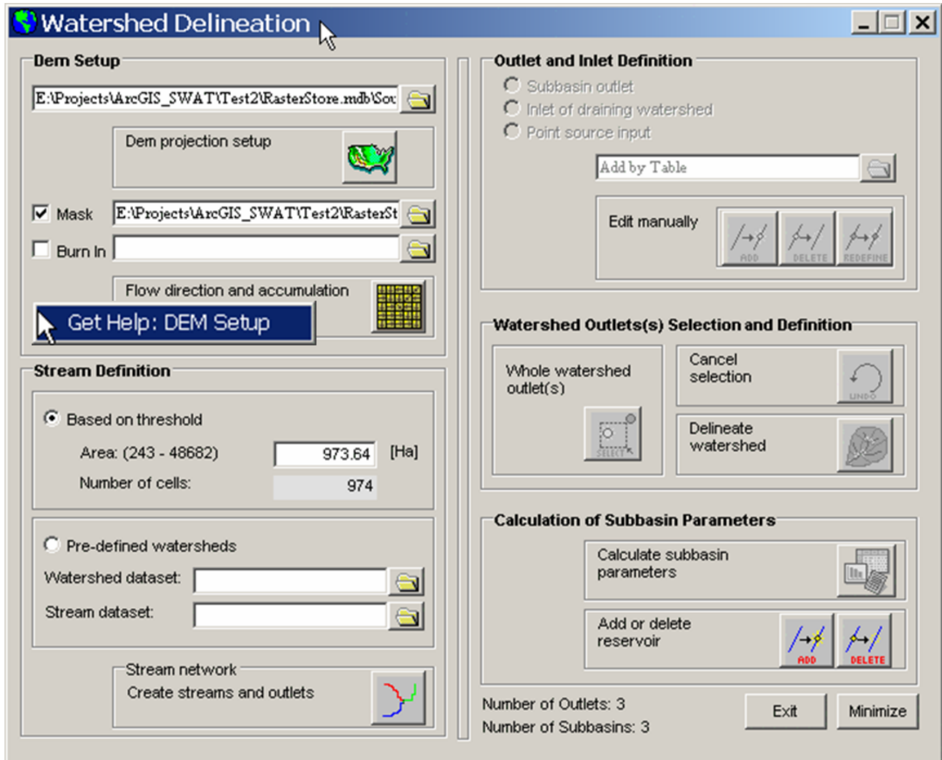


Figure 4.17

3. Tooltips: Tooltips will appear at important points throughout the ArcSWAT interface. These tooltips will appear if the mouse cursor is held over a control or input on a form. The tip will provide a brief explanation of the input and/or an indication of the suitable range for the parameter value.

4. SWAT Web Site: The official SWAT website provides software and documentation for ArcSWAT as well as additional supporting software. The SWAT web site may be accessed at: http://www.brc.tamus.edu/swat/.

5. SWAT Forums and User Group: SWAT users may communicate with one another via several discussion forums and the user group. These provide an excellent method for user to support users in their endeavors with SWAT. The forums and user group may be accessed from the SWAT web site at: http://www.brc.tamus.edu/swat/userforums.html.

SECTION 5: WATERSHED DELINEATION

This tool allows the user to delineate subwatersheds based on an automatic procedure using Digital Elevation Model (DEM) data. User specified parameters provide limits that influence the size and number of subwatersheds created. In addition, users have the option of importing pre-defined watershed boundaries and an associated stream network.

Purpose

The Watershed Delineation carries out advanced GIS functions to aid the user in segmenting watersheds into several "hydrologically" connected sub-watersheds for use in watershed modeling with SWAT.

Application

The Watershed Delineation tool uses and expands ArcGIS and Spatial Analyst extension functions to perform watershed delineations. The delineation process requires a Digital Elevation Model (DEM) in ESRI grid format. The user also has the option of importing and using a pre-defined digital stream network in ArcView shapefile or geodatabase feature class (PolyLine) format.

Once the delineation is finished, a detailed report (Topographic Report) is added to the current project and several layers will be added to the current map, including: Basin, Watershed, Reach, Outlet, and Monitoring Point. See Appendix 1: ArcSWAT Project Database Spatial Data and Tables for the content of the respective attribute tables. The topographic report describes the elevation distribution within the watershed (or "hydrologically" not connected watersheds) and within each sub-watershed unit (subbasin). The layers added to the map contain the parameters of the watershed(s) characterization.

Key Procedures

- Load the DEM
- (Optional) Define the working area (Mask)
- (Optional) Load the stream network to be used for the delineation
- Preprocess the DEM
- Specify the minimum sub-watershed area (critical source area)
- Review and edit the stream network points
- Run the calculation of the subbasin parameters
- (Optional) Locate the Reservoirs

SECTION 5.1: WATERSHED DELINEATION DIALOG BOX

When a new project is created, the Automatic Watershed Delineation command off the Watershed Delineation menu will become enabled. Clicking on the command will open the dialog (Figure 5-1).

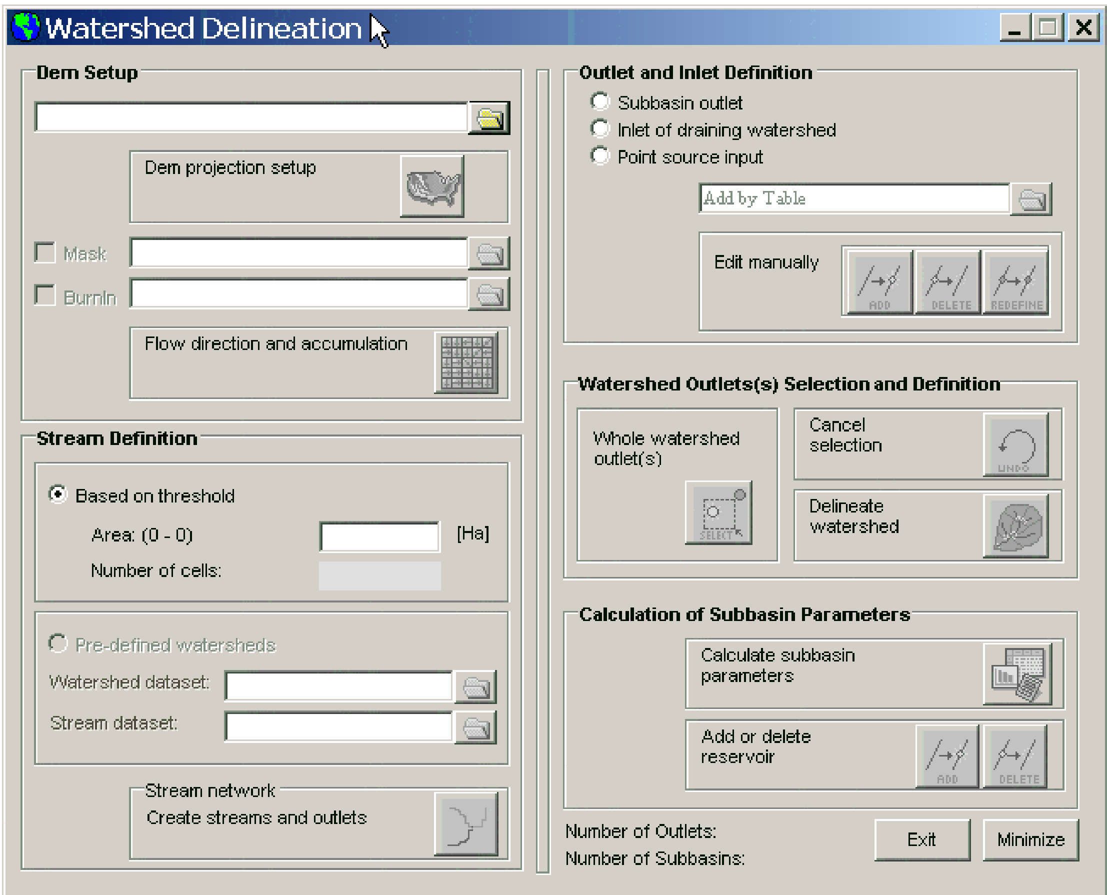


Figure 5.1

The dialog is divided into five sections: DEM Setup, Stream Definition, Outlet and Inlet Definition, Watershed Outlet(s) Selection and Definition, and Calculation of Subbasin Parameters.

SECTION 5.2: DEM SETUP

1. The DEM Setup section is shown in Figure 5.2.

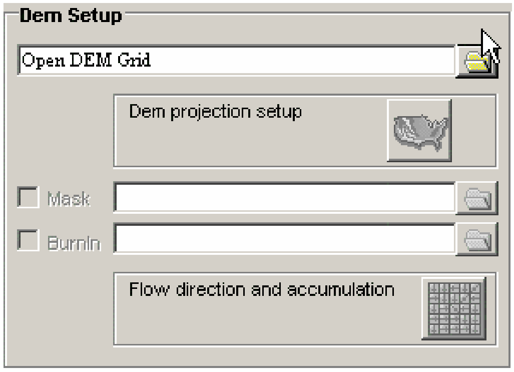


Figure 5.2

One button loads the DEM grid map used to calculate all subbasin/reach topographic parameters. Two check boxes (options) load or create a mask grid and/or load a “BurnIn” stream dataset. A “BurnIn” stream dataset is used to force the SWAT subbasin reaches to follow known stream locations.

2. To load or select the DEM grid, click the file browse button beside the text box labeled ”Open DEM grid"

3. A dialog box is opened to specify which DEM map grid to use (Figure 5.3).

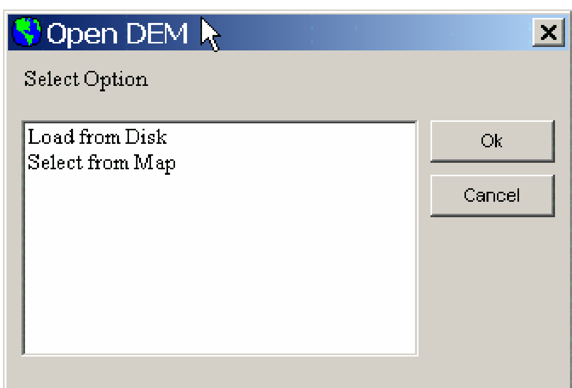


Figure 5.3

You may choose *Select from Map* to choose a DEM grid that previously has been added to the current ArcMap document.

Click **OK** after the selection. If the first option was selected, the list of the grid layers in the current map is shown (Figure 5.4) otherwise a grid dataset file browser (Figure 5.5) will appear to allow you to specify which DEM will be used.

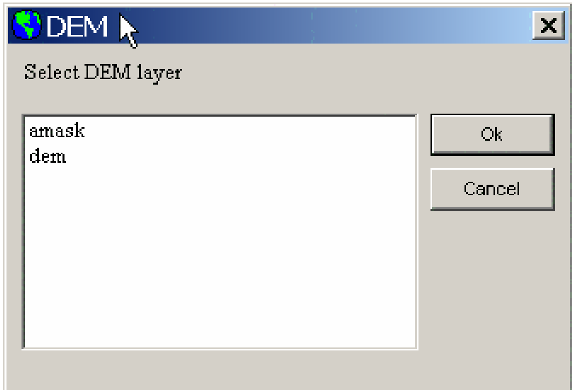


Figure 5.4

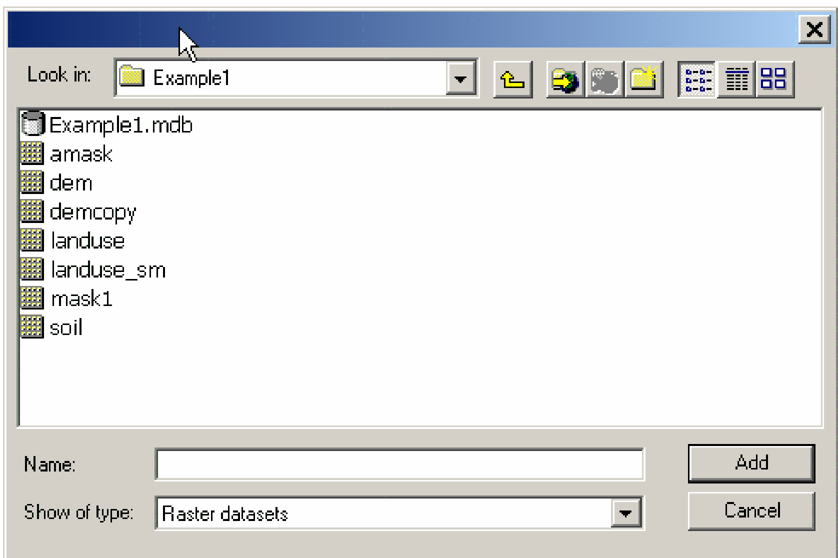


Figure 5.5

Select the name of the DEM map grid and click **OK** if the DEM was chosen from a layer in the current map. Otherwise click **Add** if the DEM was selected from disk.

4. The DEM is loaded into the ArcSWAT Raster Geodatabase and the new path to the source DEM is shown the text box. If the DEM chosen is in a geographic coordinated system defined, the message in Figure 5.6 will appear. This will indicate that you must go back and project your DEM into a projected coordinate system before proceeding. If the DEM chosen has no coordinated system defined, the message in Figure 5.7 will appear. This will indicate that you must go back and define a proper projected coordinate system for you DEM before proceeding.

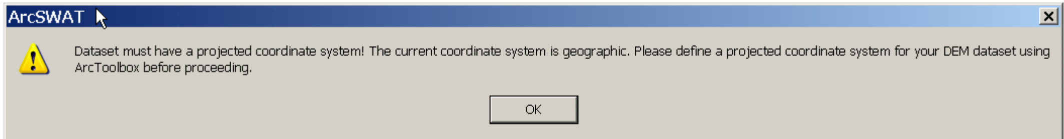


Figure 5.6

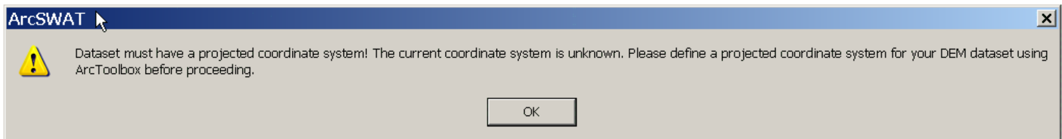


Figure 5.7

5. Once your DEM has been properly loaded, click the DEM projection setup button (Figure 5.8) to define the properties of the DEM.

Figure 5.8

6. The **DEM Properties** dialog box will open and allow the DEM vertical and horizontal units of measure and the projection to be verified (Figure 5.9).

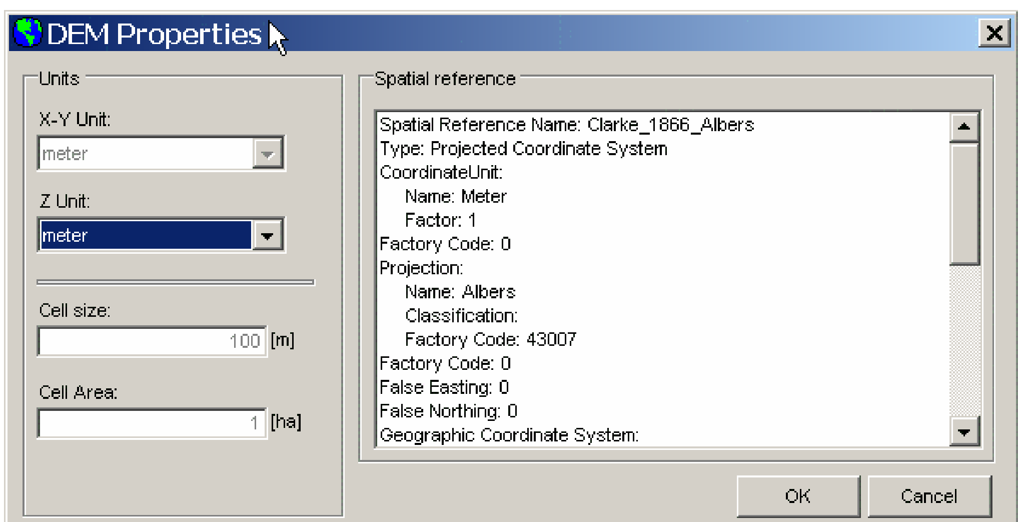


Figure 5.9

The DEM X-Y units and the spatial reference cannot be edited from this interface. You must define these parameters of your DEM during projection definition prior to using ArcSWAT. The Z unit can be changed using the drop-down box provided.

Note: Careful!! The DEM properties dialog should correctly report the horizontal and vertical units. Incorrect settings will affect the results of the watershed geomorphic parameterization. If the user does not select Z-units, the interface will use z-units of meters by default.

7. Once the DEM properties have been set, click **OK**. This will close the **DEM Properties** dialog box.

8. **Define Mask** ***(optional)***

The first option in the DEM setup section allows you to import or create a dataset that masks out a part of the DEM grid. Only the portion of the DEM covered by the mask will be processed by the interface. This map is not required but will reduce the processing time of the GIS functions.

Click the check box beside **Mask**, then, click on the file browse button next to the **Mask** text box. A prompt dialog will open (Figure 5.10)

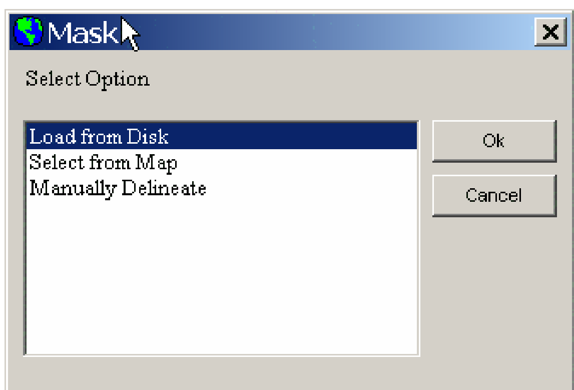


Figure 5.10

The user has three options for masking an area of the DEM map. To activate one option, highlight the option and click **OK**.

a. The first option, **Load from Disk**, allows the user to import a grid map from a disk drive. If this option is selected, a grid data set browser is opened (Figure 5.11).

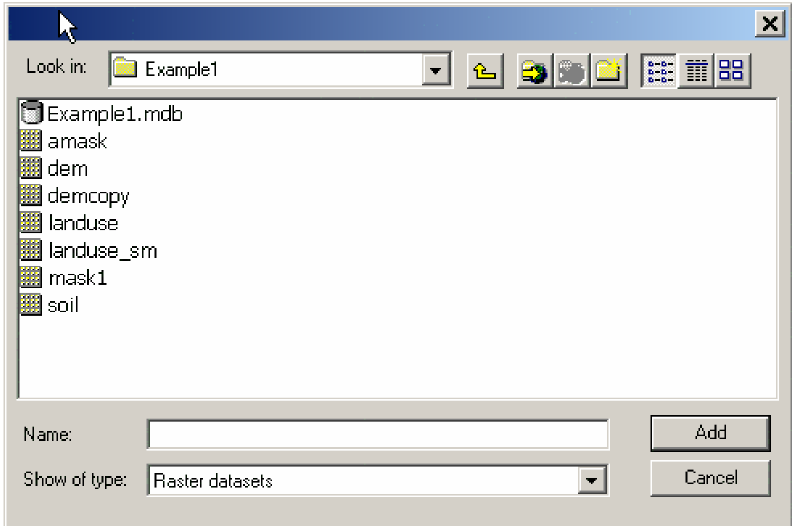


Figure 5.11

Select the name of the mask grid and click **Add**. The mask is loaded into the ArcSWAT Raster Geodatabase and the new path to the Mask grid is shown the text box.

b. The second option, **Select from Map**, allows a raster dataset already loaded in the current map document to be selected as the mask.

A prompt box appears with a list of all raster loaded in the Watershed View (Figure 5.12).

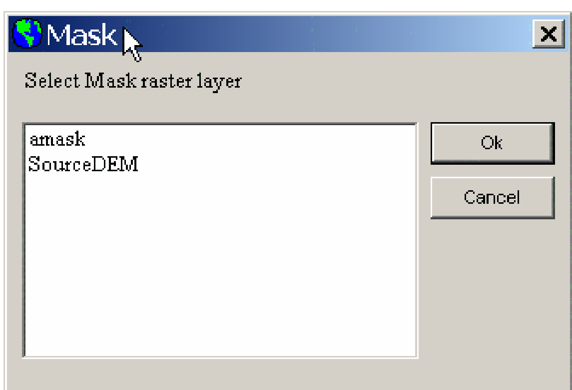


Figure 5.12

Select the name of the mask raster and click **OK.** The mask is loaded into the ArcSWAT Raster Geodatabase and the new path to the Mask grid is shown the text box.

c. The third option, **Manually Delineate**, allows the user to draw and edit a polygon mask using the manual delineation tool. (Figure 5.13)

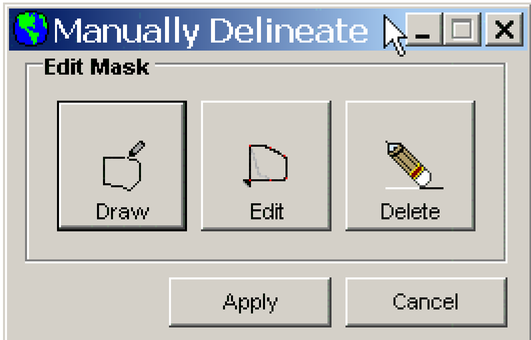


Figure 5.13

While delineating the mask, the standard ArcGIS zoom-in and zoom-out tools can be used without closing the dialog.

To begin delineating a mask, click the draw button . A message box will appear, letting you know that you can begin drawing the mask.

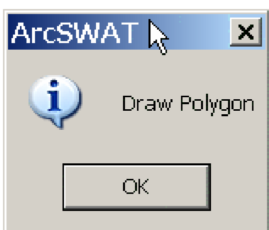
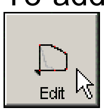


Figure 5.14

Click on the map to begin defining the polygon boundary. Click at each corner boundary, or vertex, of the polygon. Double-click the final vertex. The shape of the polygon will be displayed (Figure 5.15)

Figure 5.15

To add a new vertex to a polygon or move a vertex, click the **Edit** button 

. Move the cursor over the mask polygon and double click. This will highlight the vertices for the polygon. To add a new vertex, move the cursor to the position on the line where the new vertex will be located. Right-click and select Insert Vertex (Figure 5.16).

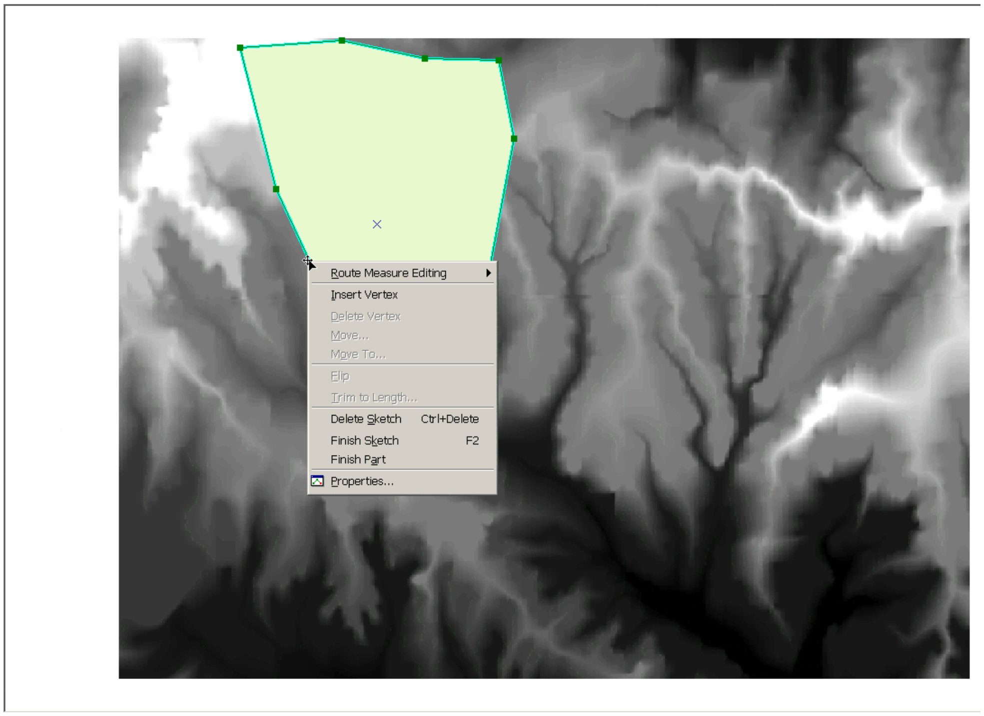


Figure 5.16

To delete a vertex, move the cursor over the vertex to be deleted. The cursor will become a crosshair. Next, right-click and select Delete Vertex (Figure 5.17).

Figure 5.17

To move an existing vertex, place the cursor on the vertex to be moved. When the cursor symbol changes to a crosshair, hold down the left mouse button and drag the vertex to the new position (Figure 5.18).

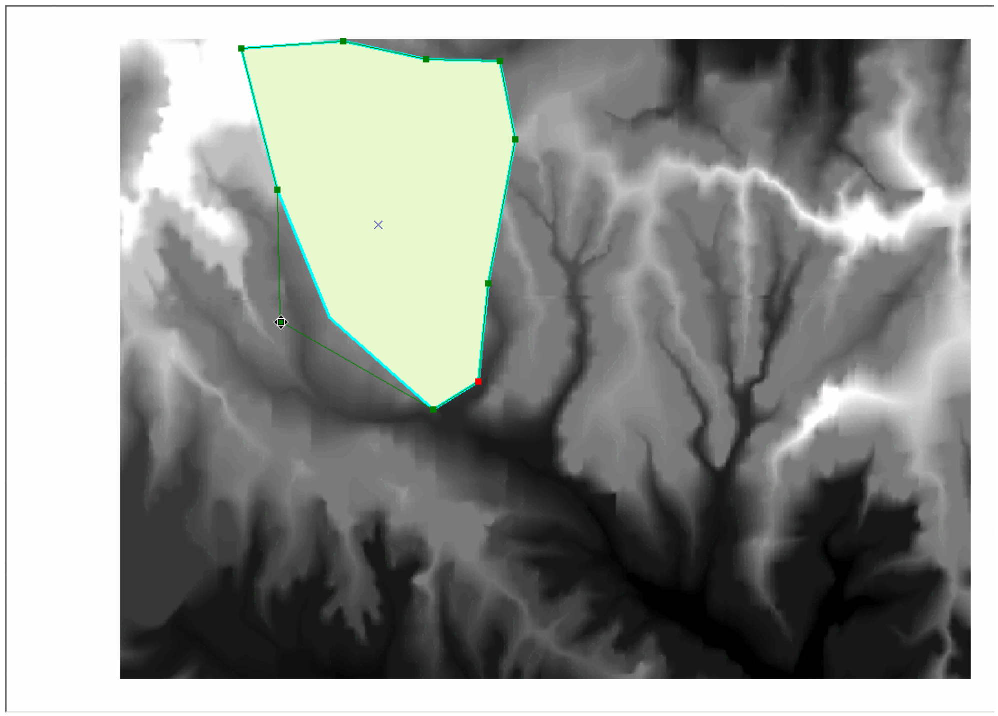


Figure 5.18

To stop editing the mask polygon, right click outside the polygon and select **Stop Editing**.

Figure 5.19

To delete a mask polygon, click the **Delete** button 

. The current mask polygon will be removed from the map.

Once all drawing and editing on the grid mask is completed, click the **Apply** button. This will convert the mask polygon to a grid dataset that will be stored in the project Raster Storage Geodatabase.

d. Once the mask grid is loaded, the grid data set path will be shown in the text box labeled "Mask" in the Watershed Delineation dialog box and a layer called "Mask" will be added to the map.

Note: The Analysis Mask of Spatial Analyst Properties is now set. Applications of Spatial Analyst commands will be limited to the mask zone.

9. **Burn in a stream network** ***(optional)***

A stream network dataset can be superimposed onto the DEM to define the location of the stream network. This feature is most useful in situations where the DEM does not provide enough detail to allow the interface to accurately predict the location of the stream network. Burning in a stream network improves hydrographic segmentation and sub-watershed boundary delineation. The theme must be a polyline shapefile or feature class.

Tip: Prior to loading Burn In streams, you should edit your stream dataset to provide a continuous set of stream lines (e.g. draw lines through lakes and ponds, remove isolated reaches). For this task, you can start an editing session in ArcMap and property modify the stream network if necessary

Note: Other than outlet lines, the stream lines should not cross the edge of the DEM (or the Mask Area if a mask was set). Lines crossing the edge can affect the resulting flow direction.

To load a streams dataset, click the check box beside **Burn In**, then, click on the file browse button next to the **Burn In** text box. A prompt dialog will open (Figure 5.20).

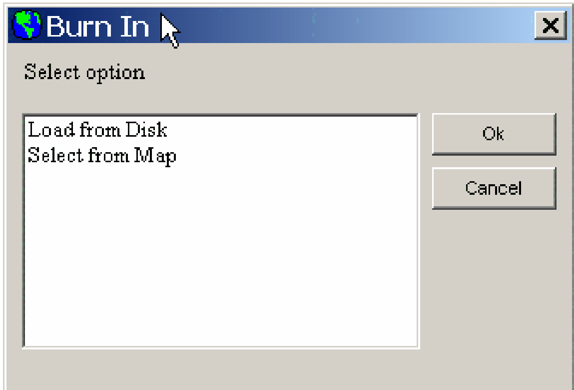


Figure 5.20

You may select a polyline layer that previously has been added to the current map or load a polyline dataset from disk.

Click **OK** after the selection. If the first option was selected, the list of the polyline layers in the map is shown (Figure 5.21) otherwise, a polyline dataset file browser (Figure 5.22) will appear to allow you to specify which dataset will be used.

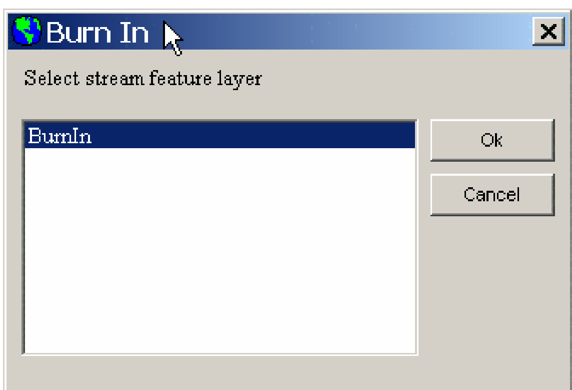


Figure 5.21

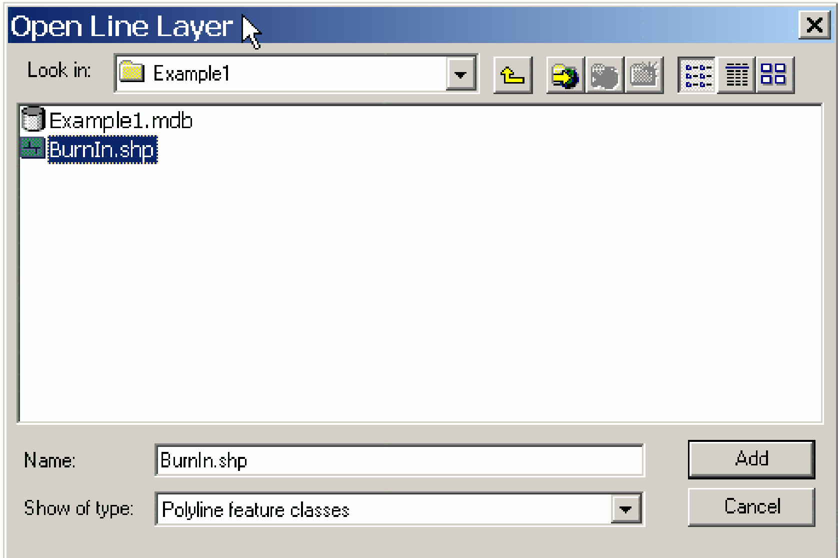
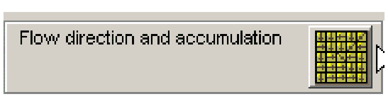


Figure 5.22

Select the name of the stream network dataset (hold the `Shift` key for multiple selections) and click **OK**. The burn in streams dataset will be converted to a raster and imported into the project Raster Storage geodatabase. When importing is completed, the new dataset path will be shown in the text box labeled **Burn In**. The new stream raster will be added to the current map and will be named "DigitStream".

10. **DEM Preprocessing**

Once the DEM grid is loaded, the properties have been reviewed, and optional datasets are set, click the **Flow direction** and **flow accumulation**.



The interface will process the DEM map grid to remove all the non draining zones (sinks).

While processing the DEM, a prompt box will appear

A prompt box is displayed when DEM preprocessing is complete (Figure 5.23). Click **OK**.

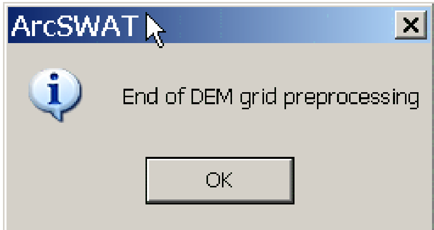


Figure 5.23

SECTION 5.3: STREAM DEFINITION

In this section of the Watershed Delineation dialog box, the initial stream network and subbasin outlets are defined. The user has the option of defining streams based on a drainage area threshold, or, importing pre-defined watershed boundaries and streams. The Stream Definition section is shown in Figure 5.24.

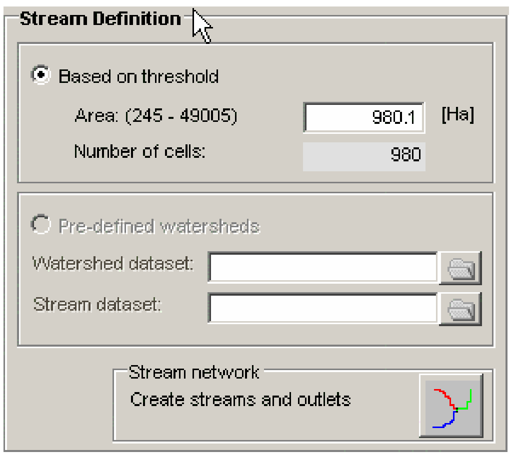


Figure 5.24

SECTION 5.3.1: THRESHOLD-BASED STREAM DEFINITION

The user selects threshold stream definition by clicking the **Based on threshold** radio button. The interface lists a minimum, maximum, and suggested sub-watershed area in hectares (Figure 5.24).

The user has the ability to set the minimum size of the subbasins. This function plays an important role in determining the detail of the stream network and the size and number of sub-watersheds. The threshold area, or critical source area, defines the minimum drainage area required to form the origin of a stream.

1. In the text box to the right of the "Area" label, type the upstream drainage area (in hectares) required to define the beginning of a stream. The

smaller the specified number of hectares, the more detailed the drainage network delineated by the interface.

2. Click the button to create the stream network, as shown in Figure 5.25.

Figure 5.25

3. Two layers are now added to the map and displayed over the DEM layer grid: Reach (the current synthetic drainage network) and MonitoringPoint (the respective stream junction points) (Figure 5.26).

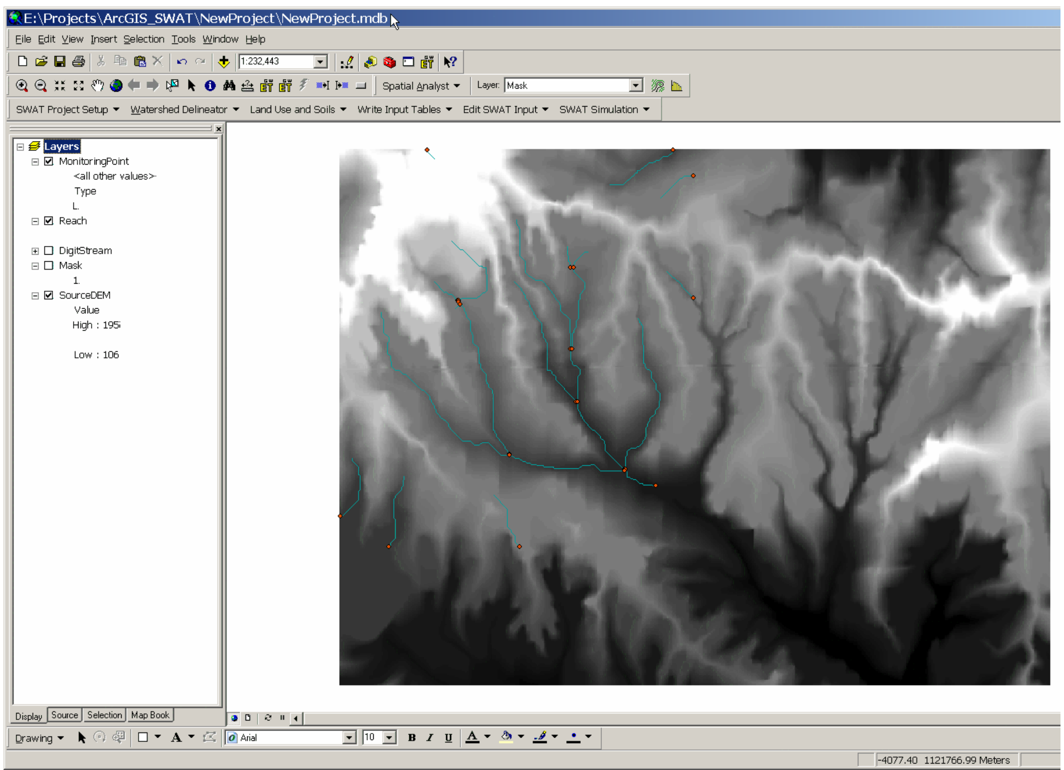


Figure 5.26

4. The user can change the threshold value and re-run the stream and outlet definition routine or proceed with the next section.

SECTION 5.3.2: PRE-DEFINED WATERSHEDS AND STREAMS

The user selects pre-defined watershed option by clicking the **Pre-defined watersheds** radio button.

1. After selecting the **Pre-defined watershed** button, the user watersheds and user streams input boxes becomes activated (Figure 5.27)

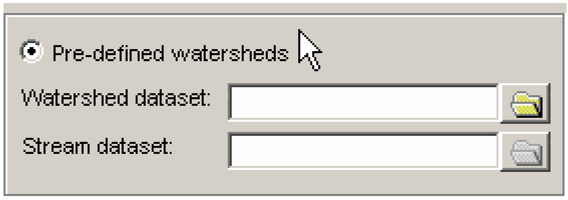


Figure 5.27

2. Select a pre-defined watershed dataset by clicking on the file browse button adjacent to the Watershed dataset text box. A dialog box will appear allowing the user to specify if the dataset is to be loaded from disk or from the map (Figure 5.28). Once the user watershed dataset is selected, its path will appear within the text box and the "Watershed" layer will be added to the map.

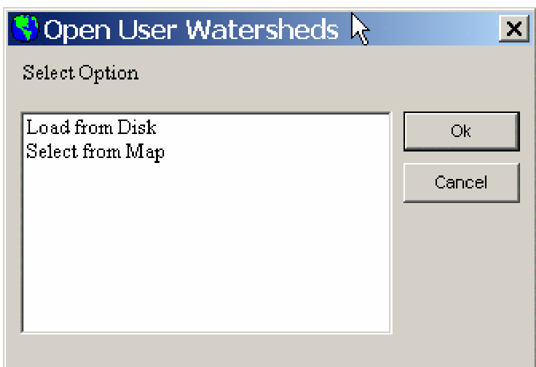


Figure 5.28

3. Select a pre-defined stream dataset by clicking on the file browse button adjacent to the Stream dataset text box. A dialog box will appear allowing the user to specify if the dataset is to be loaded from disk or from the map (Figure 5.29). Once the user stream dataset is selected, its path will appear within the text box and the "Reach" layer will be added to the map.

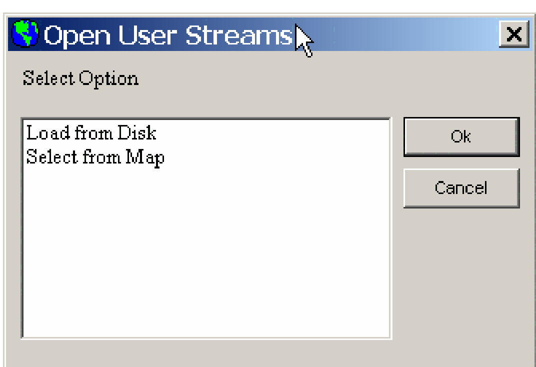


Figure 5.29

Note: Examples of properly formatted user-defined watersheds and user-defined streams may be found in *\Installation dir\Databases\ExInputs\UserWatersheds* and *\Installation dir\Databases\ExInputs\UserStreams* respectively

4. Having selected the user-defined watersheds and the user-defined streams, now click the **Create streams and outlets** button to generate the ArcSWAT subbasin, streams and outlets feature classes (Figure 5.30).

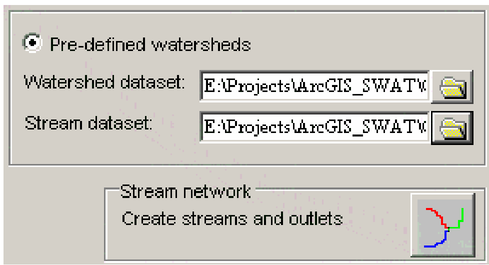


Figure 5.30

5. Once completed, the "MonitoringPoint" layer will be added to the map. This layer contains the subbasin outlets generated from the user-defined watersheds and streams. Users may now add point sources (see section 5.4) or proceed directly calculation of subbasin parameters (see section 5.6)

Note: Additional subbasin outlets or draining watershed inlets may not be added when the user-defined watersheds/streams option is chosen. Only point sources may be added.

SECTION 5.4: OUTLET AND INLET DEFINITION

In this section of the Watershed Delineation dialog box, the stream network and outlet configuration may be refined by the user. Drainage inlets and sub-watershed outlets may be added, deleted, or redefined (Figure 5.31)

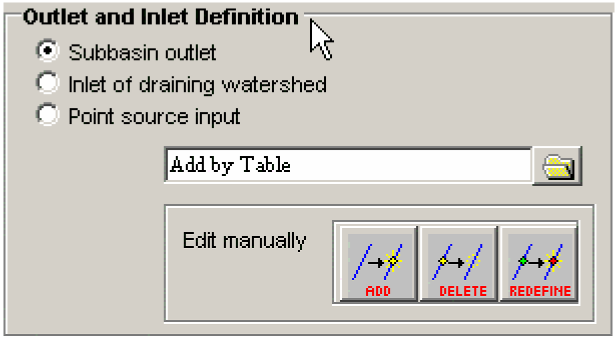


Figure 5.31

Sub-watershed outlets are the points in the drainage network of a sub-watershed where streamflow exits the sub-watershed area. Adding outlets at the location of monitoring stations is useful for comparison of measured and predicted flows and concentrations.

There are two types of drainage inlets: a point-source discharge or the outlet of a draining watershed. The second type of inlet is used when a portion of the watershed area is not directly modeled with SWAT. For both types of inlets, the user provides discharge data records. The inlet discharge is routed through the stream network.

Inlets and outlets may be added to the stream network by importing a predefined table or manually clicking the mouse over the map on the screen. Three radio buttons allow you to switch the current definition between subbasin outlets, inlets of draining watersheds, and point sources.

Outlets inlets are stored in the "MonitoringPoints" layer. The legend for the MonitoringPoints layer (Figure 5.28) distinguishes the types of inlets/outlets added to the MonitoringPoint feature class.

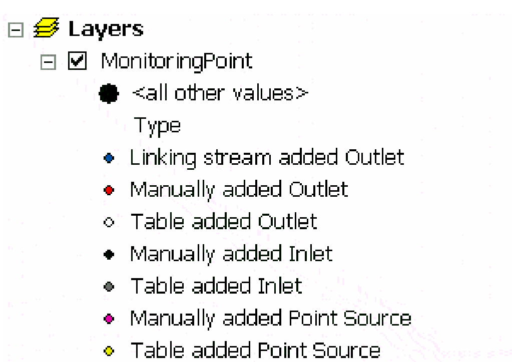


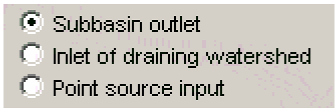
Figure 5.28

The following sections describe the different methods used to add inlets and outlets.

Adding Outlets by Table

Outlet point locations (subbasin outlets) can be imported in the project using a dBASE table and the following steps:

1. Make sure the radio button labeled "Subbaisn outlet" is selected.



2. Click on the file browse button next to the text box below the radio buttons. A file browser will appear (Figure 5.32) allowing you to select a dBASE table. Select the file name and click **Add** (or double click the selection).

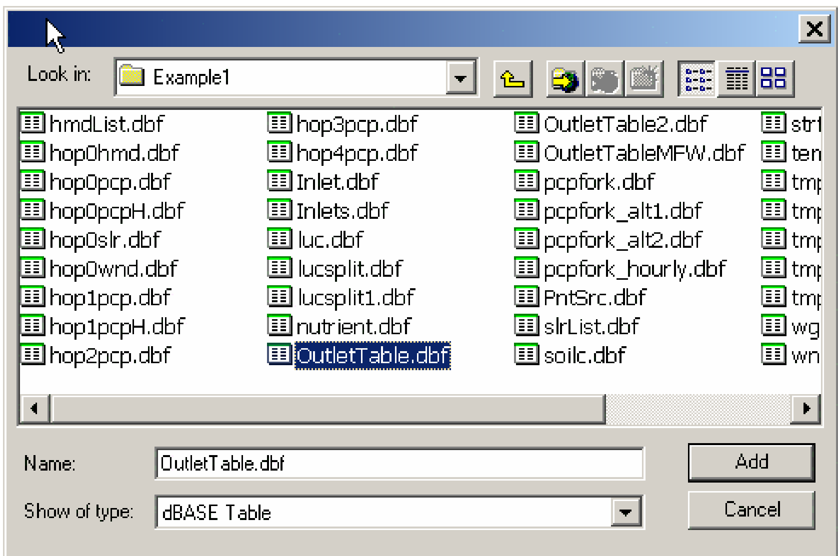


Figure 5.32

3. This table must have the same fields specified in Section 3.3 for Subbasin Outlet Location Table. All locations listed in the table must be outlet Type “O”. If a different "Type" value is specified, a dialog box will report an error like the one reported in Figure 5.33 and the loading process will stop.

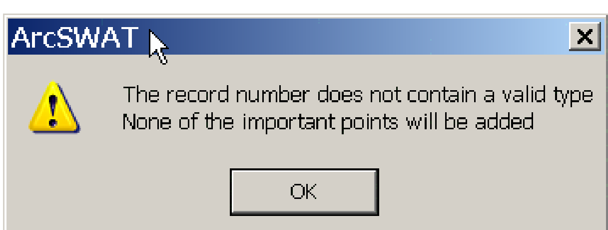


Figure 5.33

4. Once geocoded, the outlet locations will snap automatically to the closest reach of the Streams theme.

Note: Xpr and Ypr field data values have priority over the Lat and Long field data value for the definition of the point location on the map.

When completed, a message will appear signaling that the outlets were successfully added.

Figure 5.34

5. This message will be followed by a second message containing the following information:

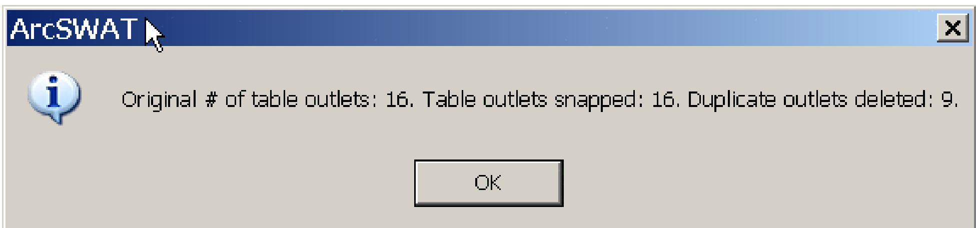


Figure 5.35

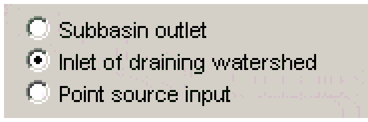
- Original # of outlets: This is the number of outlets in the raw table.
- Table outlets snapped: Not all the outlets will necessarily be snapped. Outlets that at distance greater than 100* the DEM cell size from nearest stream will not be snapped.
- Duplicate outlets deleted: It is possible that some outlets added from a table will be snapped to the same location on a stream (typically the stream's end point if outlets points are far from the nearest stream). Any duplicate locations on streams will be removed.

6. The new outlets will appear in the "MonitoringPoint" layer in the map.

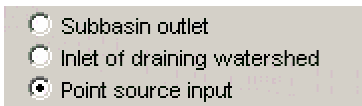
Adding Point Sources or Inlets of Draining Watersheds from Tables

Inlet or point source point locations can be imported in the project using a dBASE table and the following steps:

1. For importing inlets of a draining watershed, make sure the "Inlet of draining watershed" radio button is selected.



2. For importing point sources, make sure the "Point source" radio button is selected.



3. Click on the file browse button next to the text box below the radio buttons. A dialog box will appear, as was the case when selecting subbasin outlets (Figure 5.29). Select a table containing X, Y locations of either inlets or point sources.

4. This table must have the same fields specified in Section 3.3 for Watershed Inlet Location Table. All locations listed in the table must be Type “D” (Point Sources) or Type “I” (Draining Watershed Inlets). If a different "Type" value is specified, a dialog box will report an error like the one reported in Figure 5.30 and the loading process will stop.

5. Information messages reporting on the success of the table import similar to those reported when adding subbasin outlets will appear when the table import is complete.

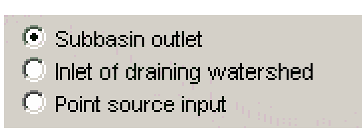
6. The new inlets and/or point sources will appear in the “MonitoringPoint” layer in the map.

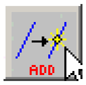
Manually Editing Outlets and Inlets

Outlets and inlets may be manually edited using the following steps.

Adding Outlets, Inlets or Point Sources

1. In the Outlet and Outlet Definition section of the Watershed Delineation dialog box, select the type of point you want to add.



2. Click the  button.

3. The Watershed Delineation dialog will be minimized. Move the cursor to the desired location(s) and click the left mouse button. An outlet point will automatically snap to the closest stream line and the feature will be added to the "Outlets" theme.

4. When all desired outlets have been added, right click, and choose “Stop Editing”.

5. You will be prompted to indicate if your edits should be saved. Choose “Yes” to save the edits or “No” to discard them.

Figure 5.36

When adding and deleting points: **Do not insert an inlet or outlet point in a junction cell.** A close-up view of stream juncture points created by the interface is shown on the DEM map grid in Figure 5.37. The points are placed in the first cell of each branch of the stream. If these points are removed and replaced with one point in the junction cell (Figure 5.38), the interface will not be able to understand which branch of the stream is the correct stream line and will be unable to delineate the subbasins properly for the two stream branches.

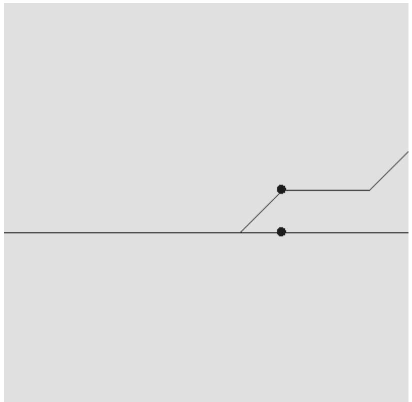
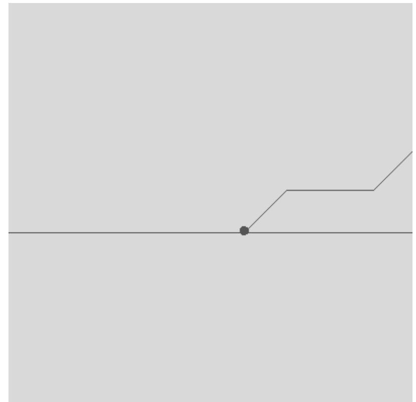
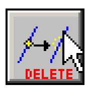
 

Figure 5.37 *Figure 5.38*

Deleting Outlets, Inlets or Point Sources

1. If necessary, zoom in on the inlet or outlet points to be deleted.

2. Click the  button.

3. The Watershed Delineation dialog will be minimized. Move the cursor to the location(s) you wish to remove.

4. Hold down the left mouse button and move the mouse to draw a box around the point(s) you wish to remove. Release the left mouse button.

5. A prompt box will appear, asking you to verify removal of the selected point(s).(Figure 5.39)

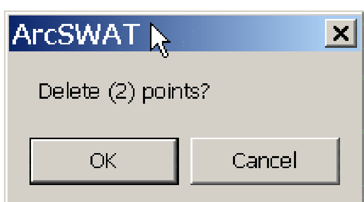
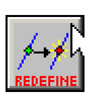


Figure 5.39

6. When all desired outlets have been added, right click, and choose "Stop Editing".

Redefining Outlets, Inlets or Point Sources

1. Click the  button.

2. The *Watershed Delineation* dialog will be minimized. Move the cursor to the desired location(s) and left click. Hold down the left mouse button and draw a box around the point(s) you wish to redefine. Release the left

mouse button. A prompt box will open (Figure 5.40). Click the **Cancel** button to exit.

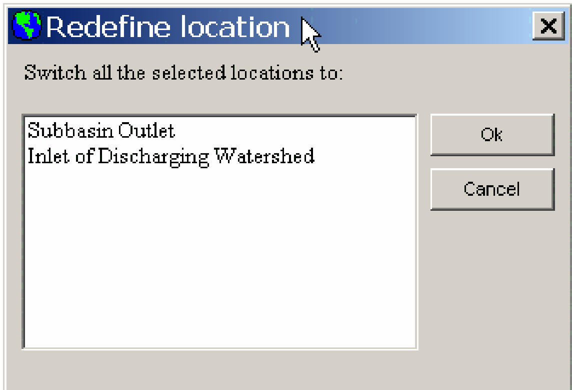


Figure 5.40

You may redefine one or more outlets to drainage watershed inlets and vice versa. Point Source inlets can not be redefined. If one of these points is selected, a dialog box will report an error (Figure 5.41 and the process will stop.

Figure 5.41

SECTION 5.5: WATERSHED OUTLET(S) SELECTION AND DEFINITION

Sub-watershed delineation is completed in this section (Figure 5.42) of the Watershed Delineation dialog box.

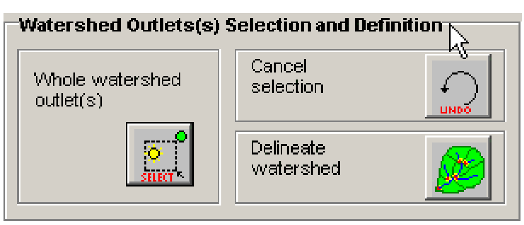
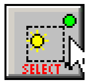


Figure 5.42

The interface will allow more than one watershed to be delineated at the same time.

1. Click the  button.

2. The *Watershed Delineation* dialog will minimize.

3. To select watershed outlets, position the cursor close to the point(s) chosen to be the watershed outlet. Hold down the left mouse button and move the mouse to form a box on the screen around the selected outlet. Release the left mouse button.

4. If a Point Source or Inlet of Draining Watershed was among the selected points, a dialog box will report an error and the points will be unselected (Figure 5.43).

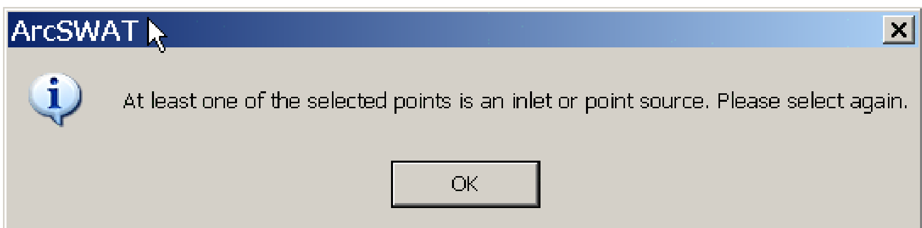


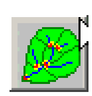
Figure 5.43

Otherwise a confirmation prompt pops up (Figure 5.44)

Figure 5.44

5. Click **OK** to proceed.

6. If you wish to cancel the selected outlets, click the  button. The selected watershed outlet(s) will be unselected.

7. To start the watershed delineation, click the  button. Make sure that at least one outlet is selected.

8. The watershed delineation process will run, and when completed a message indicating successful completion will appear (Figure 5.45).

Figure 5.45

9. A *Watershed* and *Basin* layer will be added to the map. The *Watershed* layer will contain all the subbasins and the *Basin* layer will contain the full watershed boundary (Figure 5.46).

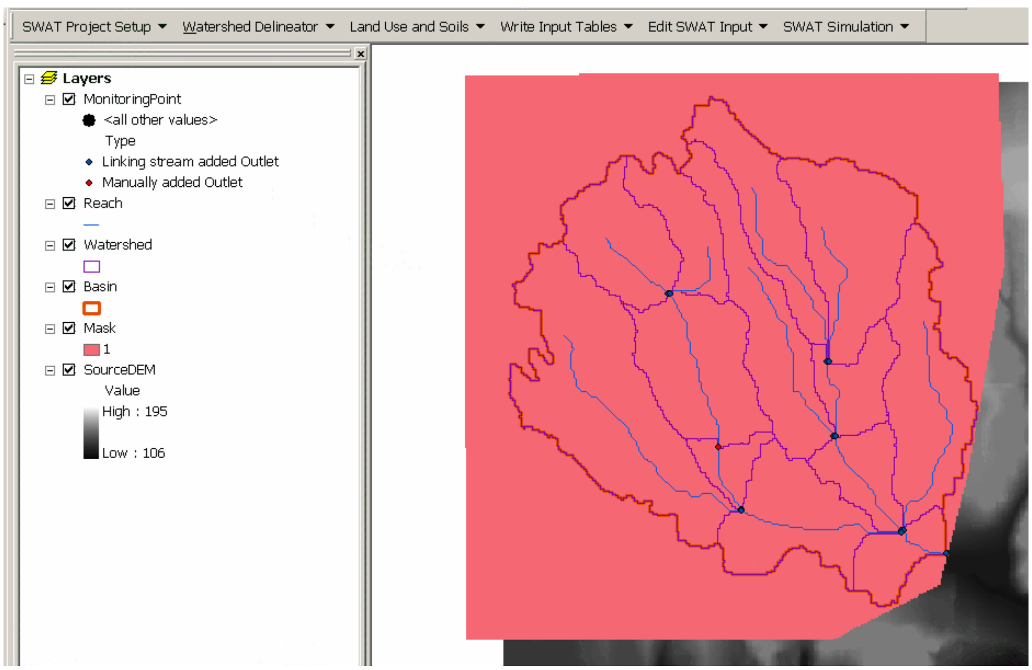


Figure 5.46

If one or more "Inlet of watershed" points are set on the stream network, the *Inlet Draining Watershed* theme is also added to the Watershed View (Figure 5.47).

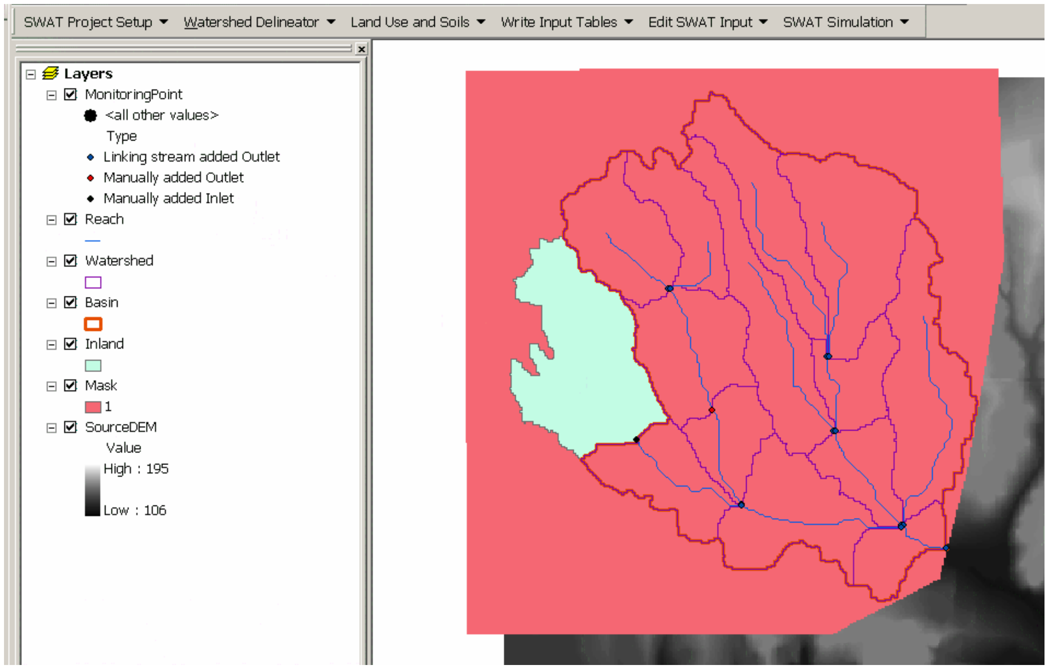


Figure 5.47

SECTION 5.6: CALCULATION OF SUBBASIN PARAMETERS

The Calculation of Subbasin Parameters section contains functions for calculating geomorphic characteristics of the subbasins and reaches, as well as defining the locations of reservoirs within the watershed. This section is shown in Figure 5.48.

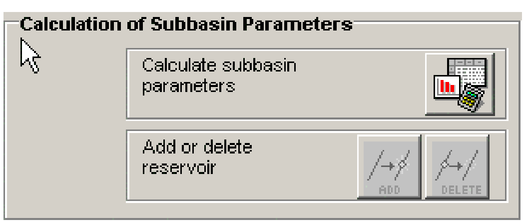


Figure 5.48

Calculating Subbasin Parameters

1. Click the  button to begin subbasin parameter calculation. This function calculates geomorphic parameters for each subbasin and the relative stream reach. The results of the calculations are stored in the table of attributes of the updated *Watershed* and *Reach* themes. (See *Appendix 1: ArcSWAT Project Database Spatial Data and Tables* for a description of the stored data.) The interface may take a significant

amount of time to complete this operation, as it requires a large amount of analysis. It is not uncommon for this task to take longer than one hour when the number of subbasins is greater than 1000.

2. When all parameters are calculated, a dialog box appears (Figure 5.49).

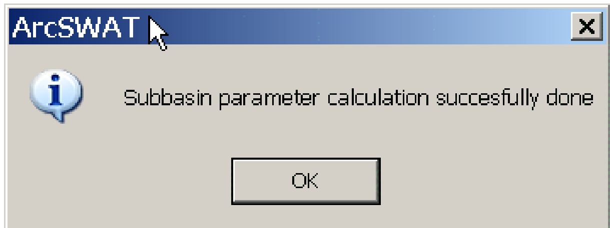
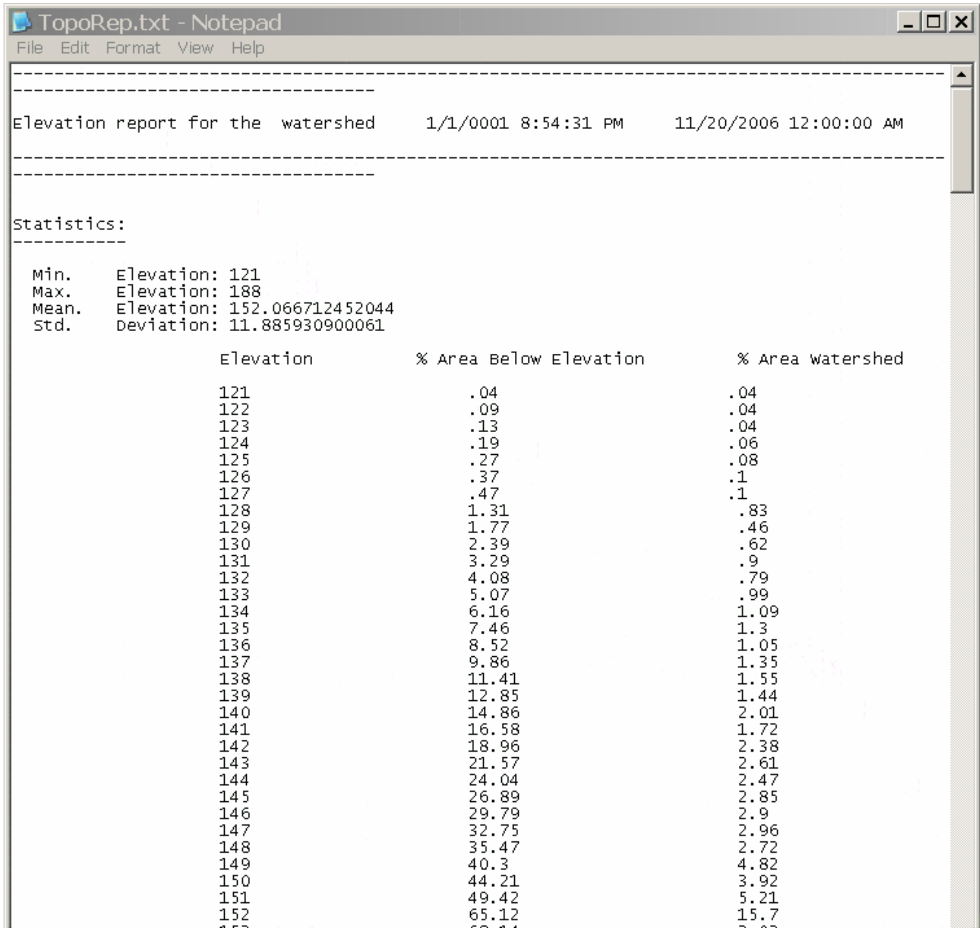


Figure 5.49

Note: Each subbasin is coupled to a single stream reach. If the user removed any of the outlets defined by the interface during the initial analysis of the DEM, the main stem within the subbasin area is assumed to represent the single stream reach associated with the subbasin.

A new report named *Topographic Report* is now available from the *Watershed Reports* item on the *Watershed Delineation* menu (Figure 5.50). This report provides a statistical summary and distribution of discrete land surface elevations in the watershed and all the sub watersheds. In addition, a new layer called *LongestPath* is added to the map. This represents the longest flow path within each of the subbasins.



Elevation report for the watershed 1/1/0001 8:54:31 PM 11/20/2006 12:00:00 AM

Statistics:

Min. Elevation: 121
Max. Elevation: 188
Mean. Elevation: 152.066712452044
Std. Deviation: 11.885930900061

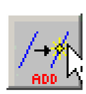
Elevation	% Area Below Elevation	% Area Watershed
121	.04	.04
122	.09	.04
123	.13	.04
124	.19	.06
125	.27	.08
126	.37	.1
127	.47	.1
128	1.31	.83
129	1.77	.46
130	2.39	.62
131	3.29	.9
132	4.08	.79
133	5.07	.99
134	6.16	1.09
135	7.46	1.3
136	8.52	1.05
137	9.86	1.35
138	11.41	1.55
139	12.85	1.44
140	14.86	2.01
141	16.58	1.72
142	18.96	2.38
143	21.57	2.61
144	24.04	2.47
145	26.89	2.85
146	29.79	2.9
147	32.75	2.96
148	35.47	2.72
149	40.3	4.82
150	44.21	3.92
151	49.42	5.21
152	65.12	15.7

Figure 5.50

Adding a Reservoir

Once the delineation is complete, the user has the option of inserting/removing reservoir locations along the main channel network (Figure 5.51).

Figure 5.51

1. To add a reservoir, click the  button.
2. The dialog box will be minimized and the cursor will become a crosshair. Click over the target subbasin area to add a reservoir. The new reservoir location will be placed at the outlet of the respective subbasin.

If you try to add a reservoir to a subbasin that already has one, you will get the following message:

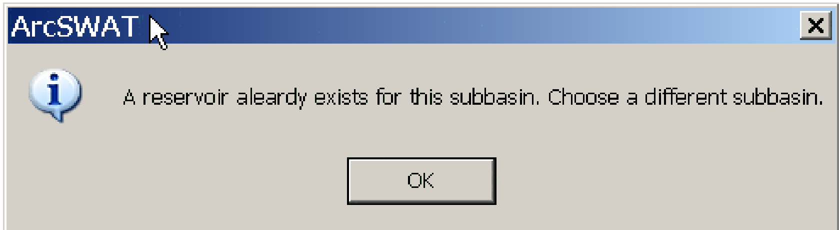


Figure 5.52

3. Once the first reservoir location is added, the reservoir symbols will be added to the *MonitoringPoints* layer in the map (Figure 5.53).

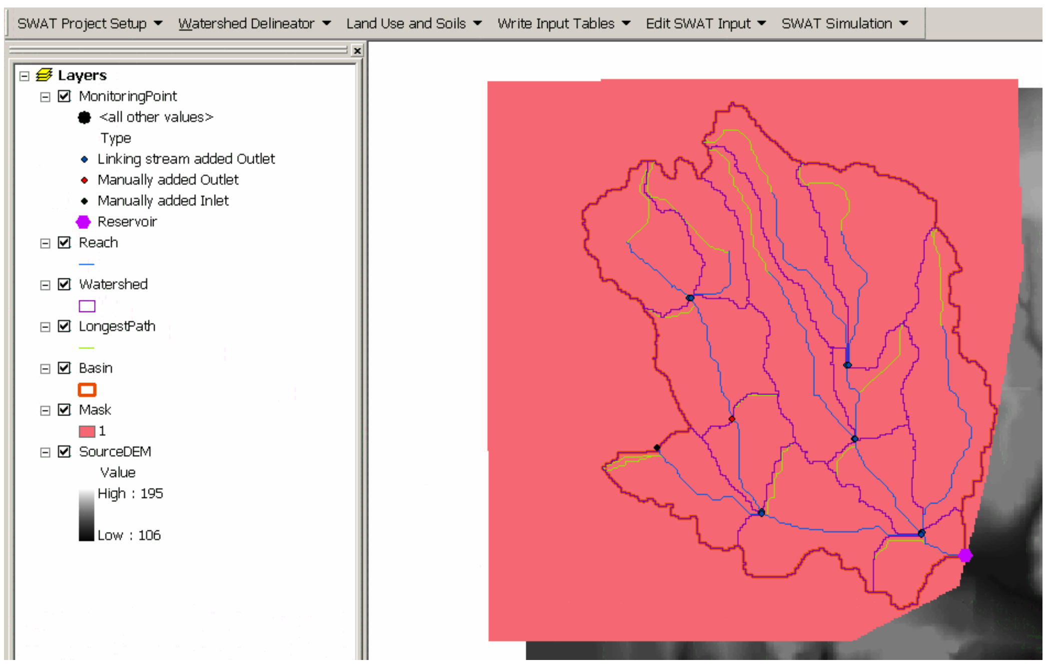
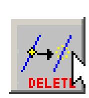


Figure 5.53

Tip: The user is allowed to add a single reservoir location for each subbasin. Refine the outlet set if more than one reservoir location needs to be set in the current subbasin area.

Removing a Reservoir(s).

1. To remove a reservoir, first click the  button.

2. The *Watershed Delineation* dialog box will be minimized and the mouse cursor will become an arrow head. Draw a square around the reservoir(s) you wish to remove by holding down the left mouse button.

3. A prompt box will be displayed asking for verification of the reservoir(s) removal (Figure 5.54).

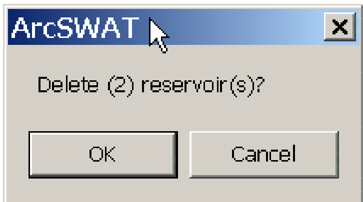


Figure 5.54

4. When you have completed deleting reservoirs, right-click and select “Stop Editing”

SECTION 6: HRU ANALYSIS

Land use, soil, and slope characterization for a watershed is performed using commands from the HRU Analysis menu on the ArcSWAT Toolbar. These tools allow users to load land use and soil layers into the current project, evaluate slope characteristics, and determine the land use/soil/slope class combinations and distributions for the delineated watershed(s) and each respective sub-watershed. The datasets can be ESRI grid, shapefile, or geodatabase feature class format.

Once the land use and soil datasets have been imported and linked to the SWAT databases, the user specifies criteria used in determining the HRU distribution. One or more unique land use/soil/slope combinations (hydrologic response units or HRUs) can be created for each subbasin.

SECTION 6.1: LAND USE / SOIL / SLOPE DEFINITION AND OVERLAY

Purpose

The *Land Use/Soils/Slope Classification and Overlay* tool allows the user to load the land use and soil datasets and determine land use/soil/slope class combinations and distributions for the delineated watershed(s) and each respective sub-watershed. The datasets can be ESRI grid, shapefile, or geodatabase feature class. Vector data sources are automatically converted to grid, the format required by Spatial Analyst to compute cross-tabulated areas between land use and soil data sets. The land use and soil datasets must be in the same projection as the DEM used in the watershed delineation. Slope characterization is based upon the DEM defined in the watersheds delineation.

Application

Hydrologic models like **SWAT** require land use and soil data to determine the area and the hydrologic parameters of each land-soil category simulated within each sub-watershed. The Land Use/Soil/Slope Classification tool guides the user through the process of specifying the data to be used. ArcSWAT also allows the integration of land slope classes when defining hydrologic response units. The user may choose to use simply a single slope class, or choose multiple classes.

Once the overlay is finished, a detailed report is added to the current project. This report describes the land use, soil, and slope class distribution within the watershed and within each sub-watershed unit (subbasin).

Key Procedures

- Define the land use dataset
- Reclassify the land use layer
- Define the soil dataset
- Reclassify the soil layer
- Reclassify the slope layer
- Overlay land use, soil, and slope layers

Tip: The operations of defining the land use, soils, and slope datasets and performing the overlay MUST be completed in one ArcSWAT session. If you close and restart ArcMap in the middle of these operations, the interface will save your settings. Once you have completed the overlay operation, you may save your project, exit ArcMap, and return to perform the HRU delineation during a subsequent session.

SECTION 6.1.1: GET STARTED

Initiate the *Land Use/Soil/Slope Definition* tool by selecting **Land Use/Soil/Slope Definition** in the **HRU Analysis** menu (Figure 6.1).

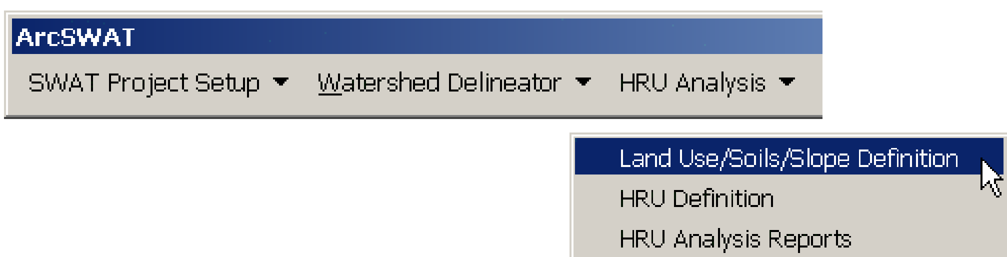


Figure 6.1

The *Land Use/Soils/Slope Definition* dialog will open (Figure 6.2).

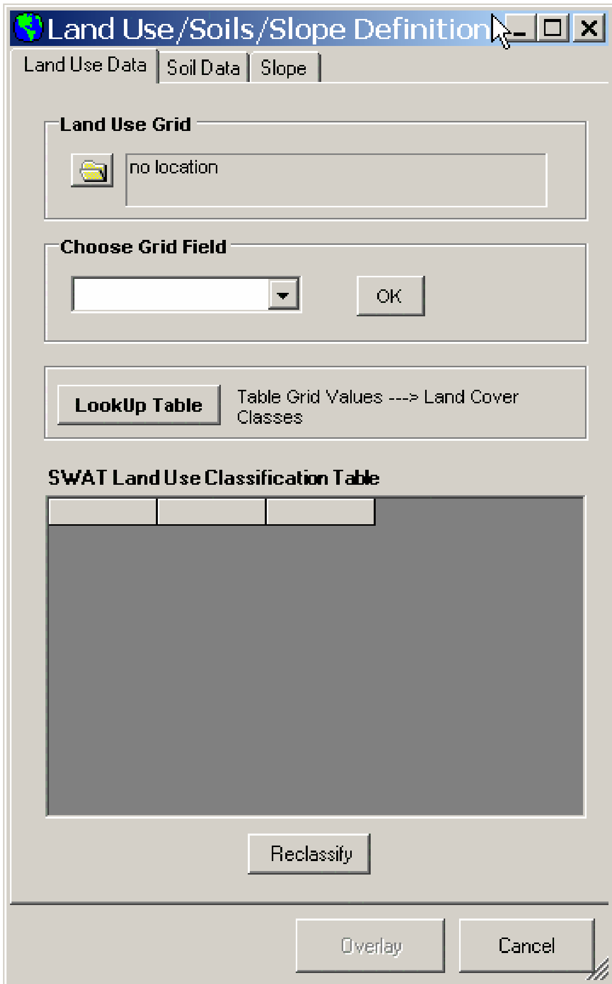


Figure 6.2

The dialog is divided into three tabs: *Land Use Data* and *Soil Data* and *Slope*.

SECTION 6.1.2: LAND USE DATA

Define LandUse/LandCover layer:

1. Select the land use data layer by clicking the file browse button under the next to the text box labeled **Land Use Grid**. A dialog box labeled *Select Land Use Data* will appear (Figure 6.3).

Figure 6.3

2. If the land use layer is already displayed in the map, choose **Select Land Use layer(s) from the map**. If the land use layer is not displayed, select **Load Land Use dataset(s) from disk**. Click **Open**.

   a. If you select Load Land Use dataset(s) from disk:

      i. A message appears asking if your data is projected. If it is not projected, you should click **No**, then go back and project the land use dataset using ArcToolbox.

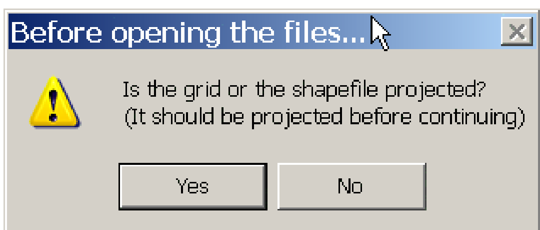


Figure 6.4

      ii. If your data is already projected and you click **Yes**, a new dialog is displayed for the user to browse to the land use dataset(s) (Figure 6.5). Either raster or vector datasets may be selected. If multiple land use datasets are required to cover the area of analysis, then multiple datasets can be selected in the file browse dialog.

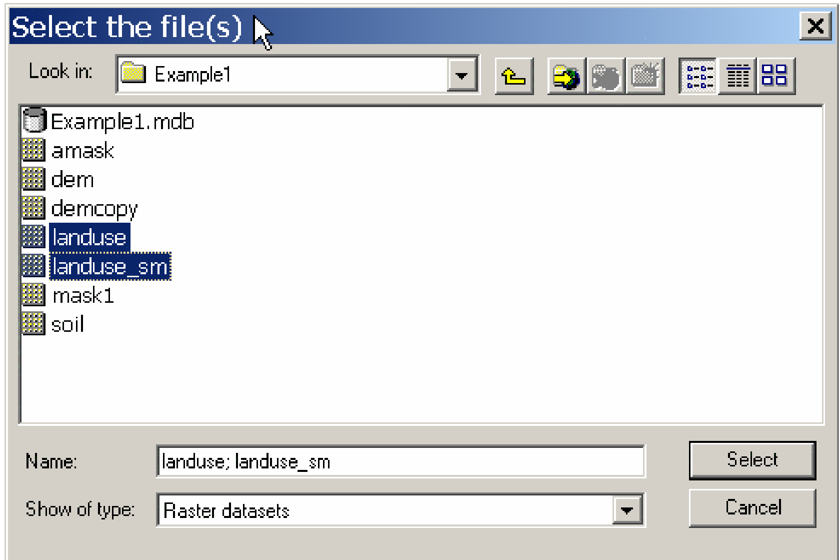


Figure 6.5

iii. After loading, you will receive a message describing the overlap between the land use dataset and the watershed (Figure 6.6).

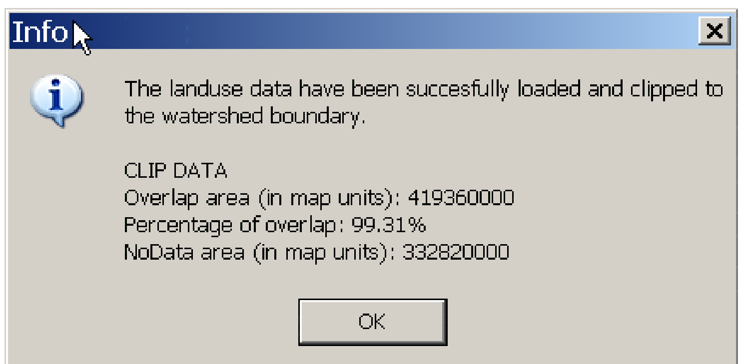


Figure 6.6

iv. If the data on disk that you select is a vector dataset, then you will need to change the “Show of type” list in the file browse dialog and then select the land use datasets (Figure 6.7).

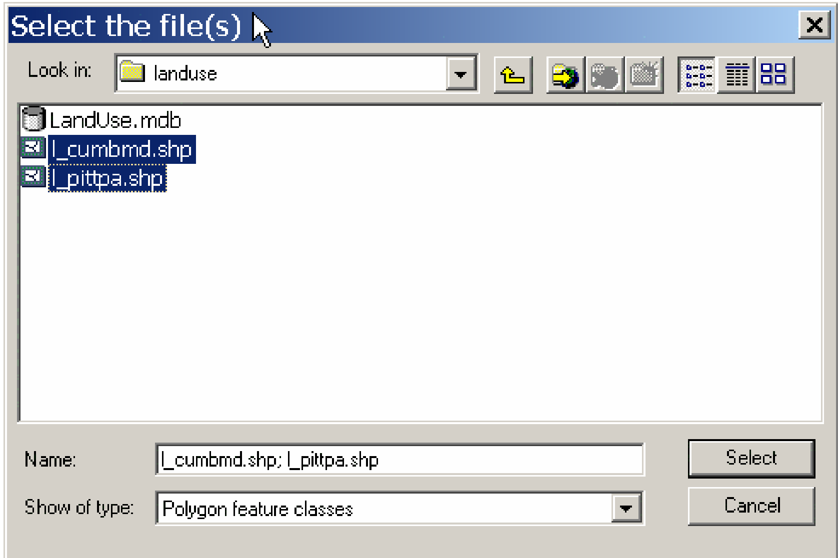


Figure 6.7

v. You will then be prompted to select the land use code field in the land use dataset (Figure 6.8). This is the field that wil be converted to the grid value in the raster that is created.

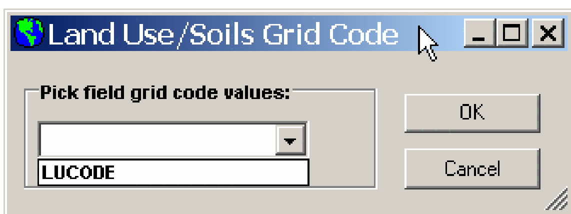


Figure 6.8

vi. The selected datasets are converted to a grid with the cell size set to the base cell size. The base cell size is the cell size of the DEM.

vii. If there is not appropriate overlap between the land use dataset and the watersheds, you will receive an error message (Figure 6.9).

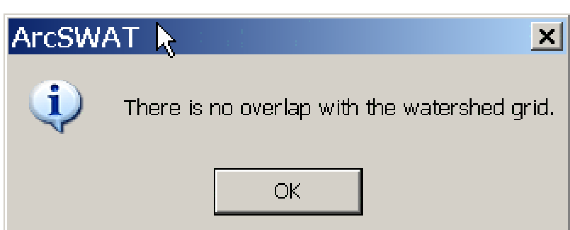


Figure 6.9

b. If you select Load Land Use dataset(s) from the map (Figure 6.3)

i. You will be prompted to identify whether the dataset is grid or vector format (Figure 6.10).

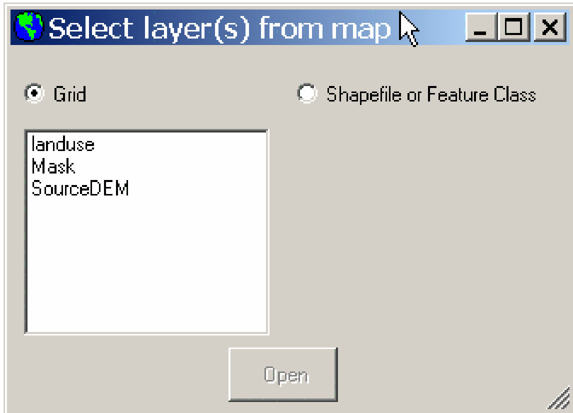


Figure 6.10

ii. Choose the name of the land use dataset from your map, and click Open.

iii. If you choose Shapefile of Feature Class, then you will be prompted to define the land use value field (Figure 6.8)

> **Note**: The base cell size of the land use grid is automatically set to the same size as the DEM grid cell. This is required to properly overlay the different maps for comparison.

3. When the land use dataset has been successfully loaded and clipped to the watershed boundary a new layer will be added to the map.

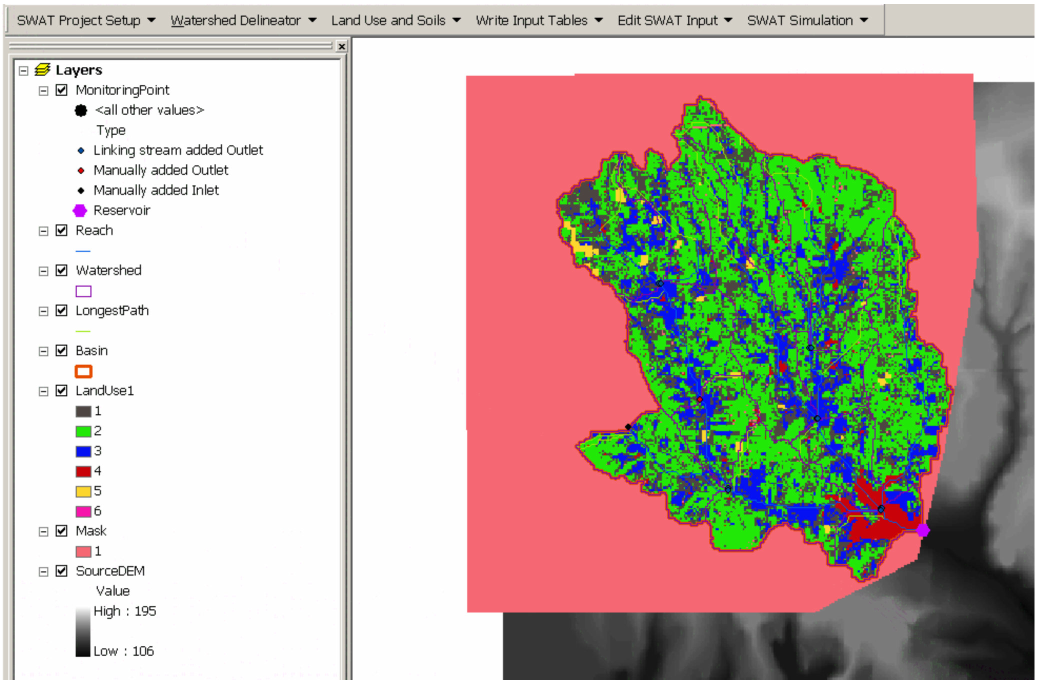


Figure 6.11

4. The path of the resulting grid is shown in the text box labeled Landuse Grid. The table that displays the landuse grid values with percent watershed area and classification name will be blank. The land use value field and the land use dataset lookup table will need to be defined (Figure 6.12).

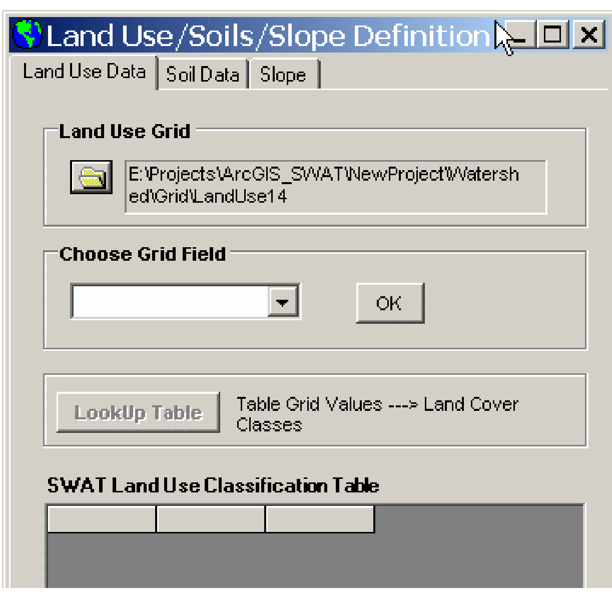


Figure 6.12

Tip: Prior to loading the land use map in a project, edit the SWAT Land use/Plant Growth or Urban data base (see Section 14) to add any new types of land cover required for the landuse map reclassification.

Define SWAT Land Cover associated with land use layer categories using lookup table:

1. Select the Grid attribute field containing the codes/category values to be reclassified.

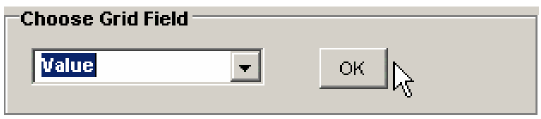


Figure 6.13

2. Click OK. The Value and Area(%) fields in the SWAT Land Use table will become populated (Figure 6.14).

Value	Area(%)	LandUseSwat
1	27.51	
2	51.11	
3	16.99	
4	3.28	
5	1.10	
6	0.02	

Figure 6.14

3. To load land use classes from a lookup table, click on the Lookup Table button  to select the land use lookup table to relate the grid values to SWAT land cover/plant classes.

A dialog will appear that will ask you which land cover lookup table to use with your land use grid. There are three choices (Figure 6.15). The LULC USGS Table option will load the USGS LULC classifications. The NLCD 1992 table will load the NLCD 1992 classifications. The User Table option will open a file browse dialog to select a user defined lookup table. Users may refer to the usgs table and nlcd_lu table in the SWAT2005.mdb database to review SWAT land cover codes for the USGS LULC and NLCD 1992 classifications respectively.

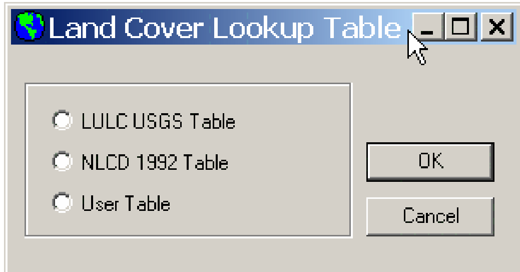


Figure 6.15

Tip: Prior to loading the land use map in a project, edit the SWAT Land use/Plant Growth or Urban data base (see Section 14) to add any new types of land cover required for the landuse map reclassification.

4. If the User Table option is selected, then the user has the option of loading a text file (.txt), dBase (.dbf), or geodatabase table (.mdb) (Figure 6.16). Select the appropriate type of table, choose the proper table, and then click Select.

Note: Information on the land use classification or look-up table format (dBASE and ASCII (.txt)) is provided in Section 3.

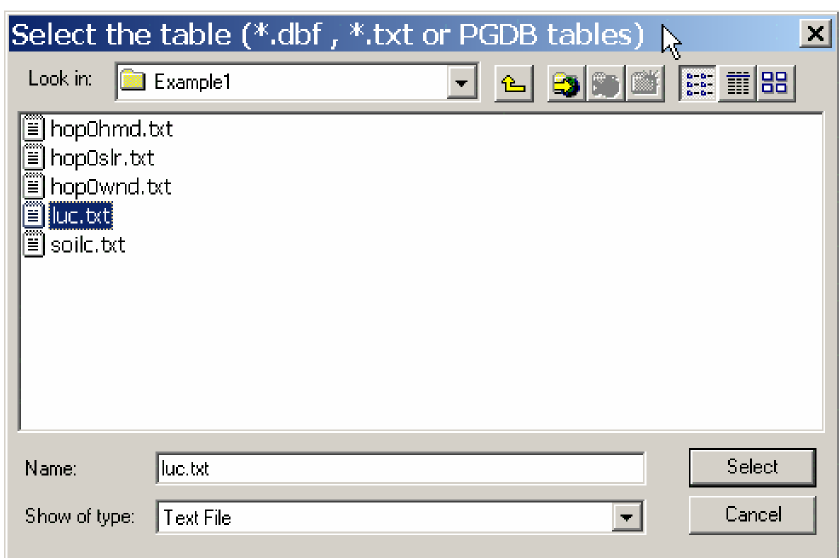


Figure 6.16

5. SWAT land cover/plant descriptions are assigned to land use layer in the map and the LandUseSwat field in the in the SWAT Land Use Classification Table is populated (Figure 6.17).

Value	Area(%)	LandUseSwat
1	27.51	RNGE
2	51.11	PAST
3	16.99	FRSD
4	3.28	WATR
5	1.10	AGRL
6	0.02	URBN

Figure 6.17

You may also define the SWAT land cover classes for your land use grid manually. You might want to do this if you do not have a land use lookup table, or there are some land uses codes that are not found in your land use lookup table, or if you want to redefine the SWAT land cover description for one or more of the land use classifications in your dataset. To define land cover/plant codes manually:

> Tip: If your land use lookup table results in a value of "NOCL" for the LandUseSwat class, this indicates that there is no class in the SWAT land cover/plant database for that grid class. If this occurs, you would want to either fix your lookup table, or manually assign a land cover/plant class.

Define SWAT Land Cover associated with land use layer categories manually:

1. To manually define a land cover class, double click in the LandUseSwat column in the Swat Land Use Classification Table (Figure 6.18)

Value	Area(%)	LandUseSwat
3	7.77	
4	8.30	
5	28.35	
6	55.59	

Figure 6.18

2. A dialog will appear and you will be asked to select either the crop or the urban database to choose a land class from (Figure 6.19).

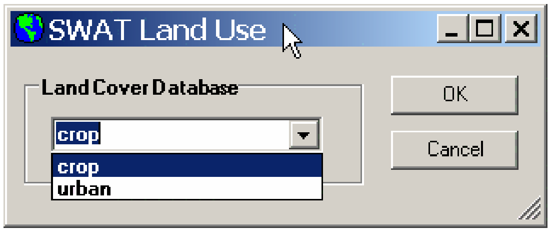


Figure 6.19

3. A dialog with a list box containing the possible classes to choose from will appear (Figure 6.20). Select the land cover class you want to assign to the current grid land use code and click **OK**.

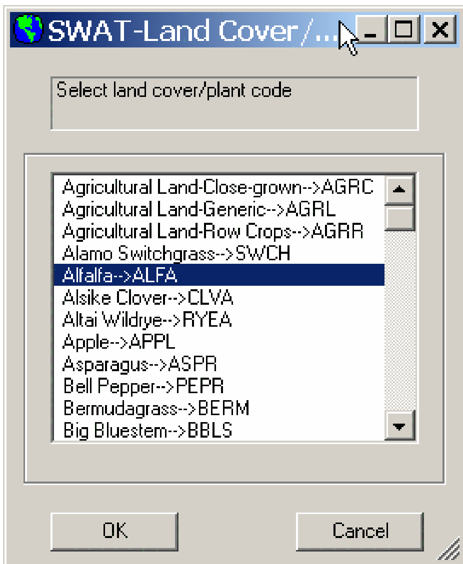


Figure 6.20

4. The selected land cover class will appear in the LandUseSwat column in the SWAT Land Use Classification Table (Figure 6.21). Repeat this process for all the land uses grid code that you want to define (or redefine).

Value	Area(%)	LandUseSwat
3	7.77	ALFA
4	8.30	
5	28.35	
6	55.59	

Figure 6.21

Reclassify land use layer with SWAT land cover classes:

1. Once a LandUseSwat code has been assigned to all map categories, the **Reclassify** button will be enabled. Click **Reclassify**. A message box will appear if reclassification is successful.

Figure 6.22

2. A new theme named "SwatLanduseClass" will be displayed in the map (Figure 6.23).

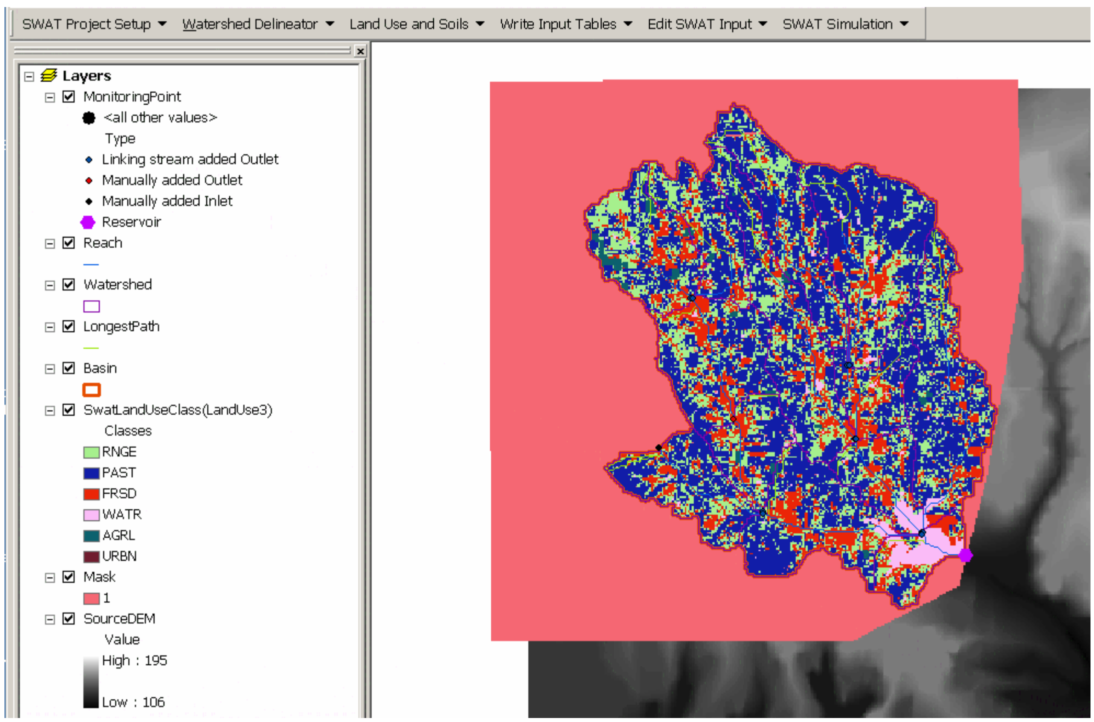


Figure 6.23

3. The land use data layer is now loaded.

SECTION 6.1.3: SOIL DATA LAYER

Define Soil layer:

1. Click on the Soil Data tab of the Land Use/Soils/Slope Definition too (Figure 6.24).

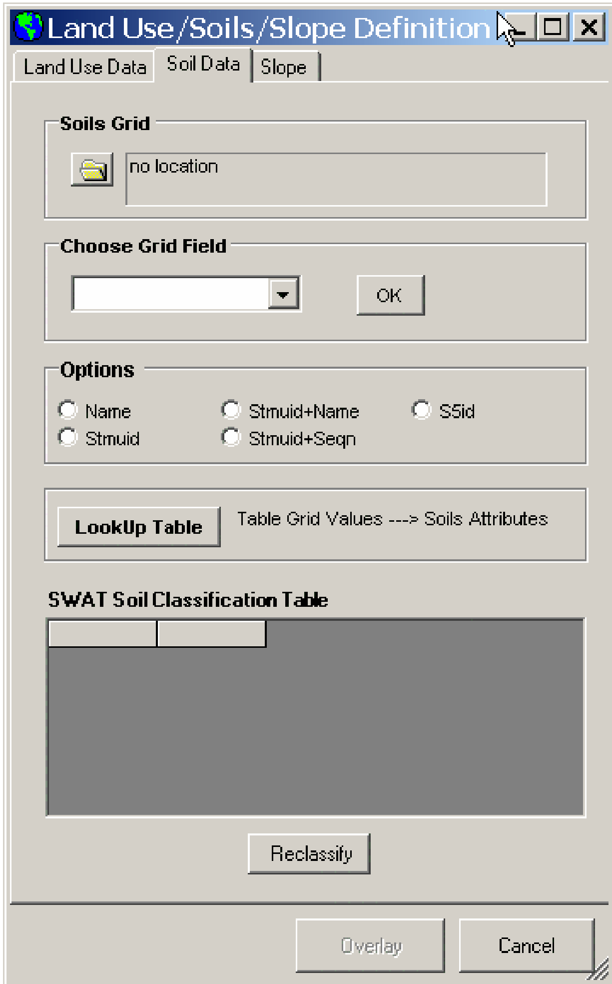


Figure 6.24

2. Select the soils data layer by clicking the file browse button under the next to the text box labeled **Soils Grid**. A dialog box labeled Select Soils Data will appear (Figure 6.25).

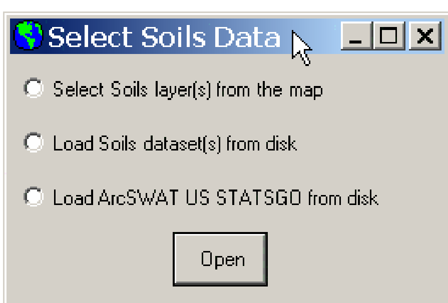


Figure 6.25

3. If the soils layer is already displayed in the map, choose **Select Soils layer(s) from the map**. If the soils layer is not displayed, select **Load Soilsdataset(s) from disk**. In addition, if you have downloaded and

installed the ArcSWAT US STATSGO database, you can select the **Load ArcSWAT US STATSGO from Disk** option. Click **Open**.

a. If you select Load Soils dataset(s) from disk:

i. A message appears asking if your data is projected. If it is not projected, you should click **No**, then go back and project the land use dataset using ArcToolbox.

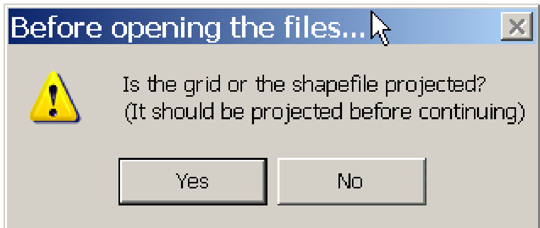


Figure 6.26

ii. If your data is already projected and you click **Yes**, a new dialog is displayed for the user to browse to the land use dataset(s) (Figure 6.27). Either raster or vector datasets may be selected. If multiple land use datasets are required to cover the area of analysis, then multiple datasets can be selected in the file browse dialog.

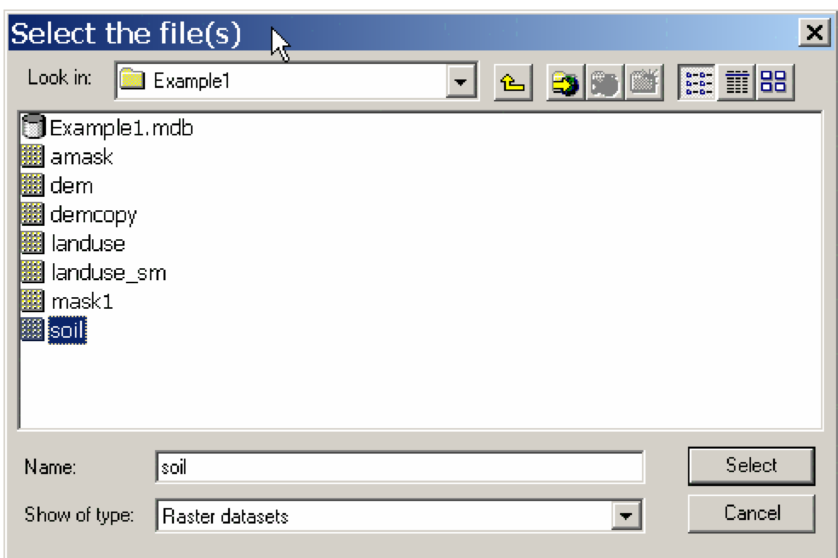


Figure 6.27

iii. After loading, you will receive a message describing the overlap between the soils dataset and the watershed (Figure 6.28).

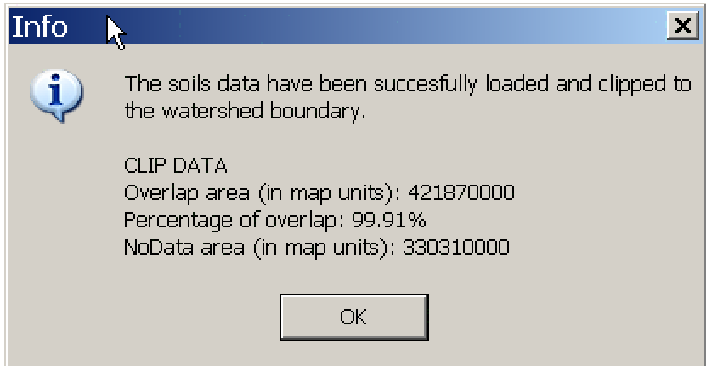


Figure 6.28

iv. If the data on disk that you select is a vector dataset, then you will need to change the “Show of type” list in the file browse dialog and then select the land use datasets (Figure 6.29).

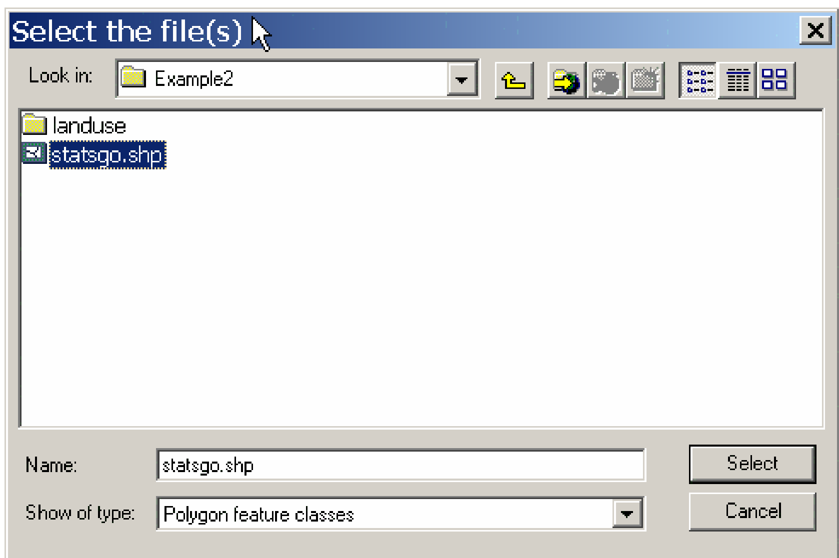


Figure 6.29

v. You will then be prompted to select the soil code field in the soils dataset (Figure 6.30). This is the field that wil be converted to the grid value in the raster that is created.

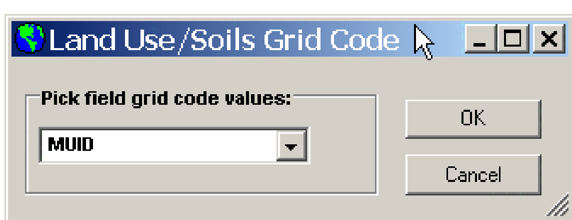


Figure 6.30

vi. The selected datasets are converted to a grid with the cell size set to the base cell size. The base cell size is the cell size of the DEM.

vii. If there is not appropriate overlap between the land use dataset and the watersheds, you will receive an error message.

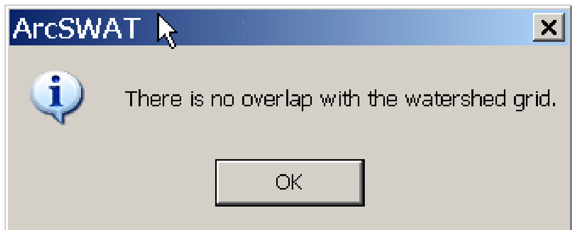


Figure 6.31

b. If you select Load Soils dataset(s) from the map (Figure 6.25)

i. You will be prompted to identify whether the dataset is grid or vector format (Figure 6.32).

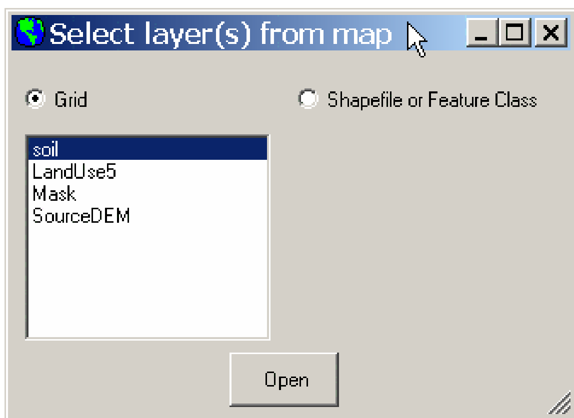


Figure 6.32

ii. Choose the name of the soils dataset from your map, and click **Open**.

iii. If you choose Shapefile of Feature Class, then you will be prompted to define the land use value field (Figure 6.30)

Note: The base cell size of the land use grid is automatically set to the same size as the DEM grid cell. This is required to properly overlay the different maps for comparison.

c. If you select Load ArcSWAT US STATSGO from disk (Figure 6.24), then the ArcSWAT interface will automatically load the US STATSGO grid from the “InstallationDir\Databases\SWAT_US_Soils.mdb” geodatabase. It will perform the clipping to the watershed boundary, load and apply any relevant soils lookup tables contained in the database. When these operations are completed, you can move directly to the **Reclassify** operation described below in step 4 of the section called **Assign soil attribute information using a look-up table**.

4. When the soils dataset has been successfully loaded and clipped to the watershed boundary a new layer will be added to the map.

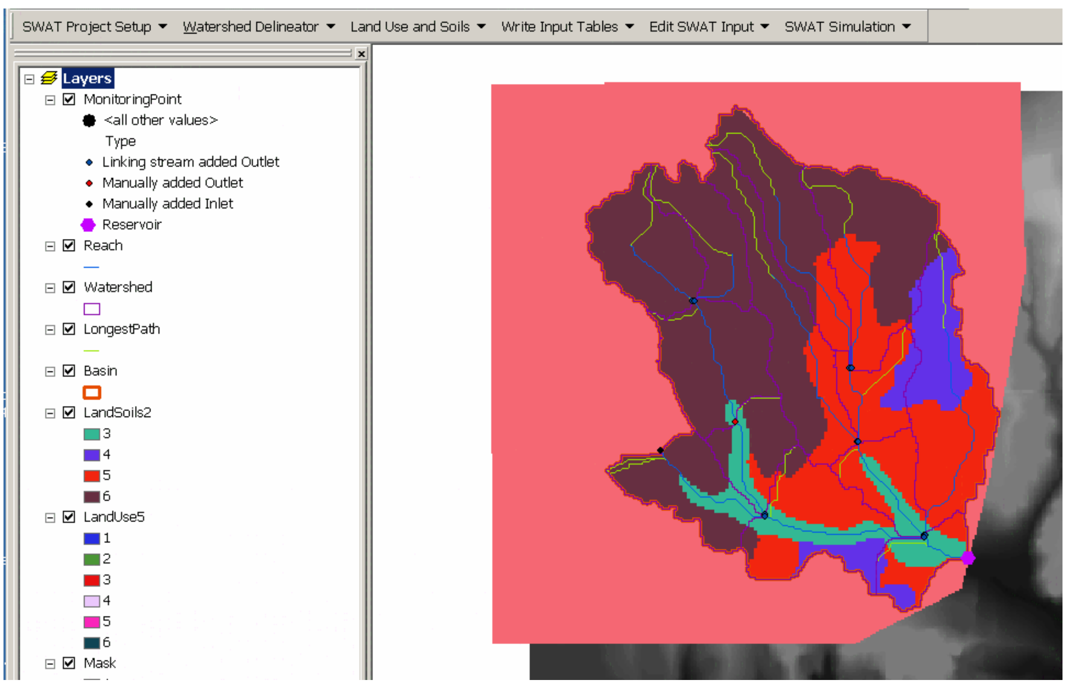


Figure 6.33

5. The path of the resulting grid is shown in the text box labeled **Soil Grid**. The SWAT Soil Classification Table that displays the soil grid values with percent watershed area and classification name will be blank. The soil grid value field and the soil dataset lookup table will need to be defined (Figure 6.34).

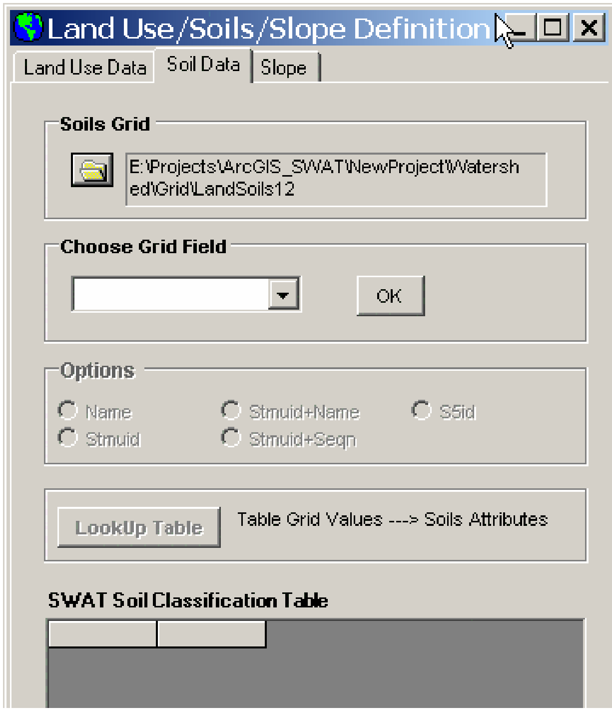


Figure 6.34

Define SWAT Soil associated with soil layer categories:

1. Select the Grid attribute field containing the codes/category values to be reclassified.

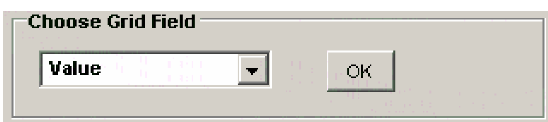


Figure 6.35

2. Click **OK**. The Value and Area(%) fields in the SWATSoils table will become populated (Figure 6.36).

Value	Area(%)
3	7.77
4	8.30
5	28.35
6	55.59

Figure 6.36

3. Soil map categories must be linked to one of two databases: the U.S. STATSGO database or the User Soils database. STATSGO data for the entire United States is included with an optional database download

available from the SWAT web page. Information on the User Soils database is provided in Section 15.

The interface allows map categories to be linked to the soil databases in one of five ways. The database and linkage options are defined by the soil option radio buttons (Figure 6.37).

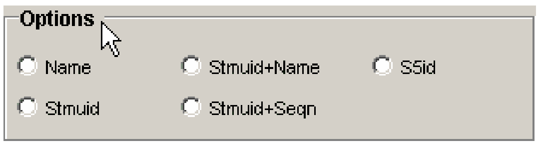


Figure 6.37

To link to the User Soils database, the **Name** radio button is selected. To link a STATSGO map to the STATSGO soil database, the **Stmuid**, **Stmuid + Seqn**, or **Stmuid + Name** radio buttons are used. STATSGO maps are general soil distribution maps. STATSGO map associations or polygons are comprised of many soil series. The **Stmuid** button will assign data for the dominant soil series in the STATSGO polygon to HRUs. The **Stmuid + Seqn** or **Stmuid + Name** radio buttons provide users with methods to assign data from a soil series other than the dominant to HRUS. To link a soil series, or Soils5 map, to the STATSGO database, the S5id radio button is selected.

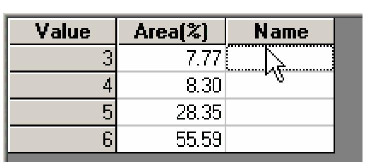
4. As for land use, the attribute data required to link the map categories to soil information in one of the two databases may be entered manually or loaded from a look-up table.

Manually assign soil attribute data:

For user-provided soil data click the radio button labeled **Name** 

.

1. The *Name* column will be added to the SWAT Soil Classification Table. Double click in the Name column of the record you want to assign a soil name to (Figure 6.38).



Value	Area(%)	Name
3	7.77	
4	8.30	
5	28.35	
6	55.59	

Figure 6.38

2. A dialog box is displayed listing all soils in the User Soil database (Figure 6.39).

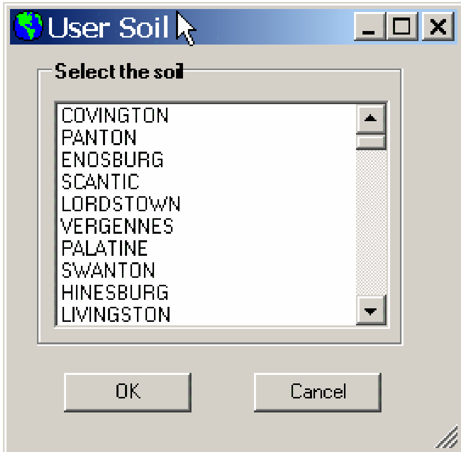


Figure 6.39

3. Select the soil and click **OK**. The selected soil name is added to the SWAT Soil Classification Table (Figure 6.40). Repeat his process for all soils.

Value	Area(%)	Name
3	7.77	PANTON
4	8.30	
5	28.35	
6	55.59	

Figure 6.40

> Tip: Input your soils entry and data sets in the User Soils data base (See Section 15) before you reclassify the Soil grid.

For the use of the STATSGO database the user has four options:

1. **Stmuid**. The State STATSGO polygon number is specified by the user and the interface selects the dominant soil phase in the STATSGO polygon to represent the soil attributed in the area mapped in the polygon.

   a. Click the Stmuid radio button .

   b. Double click the respective record. A dialog box will be displayed that allows the user to enter the State STATSGO polygon number (Figure 6.41).

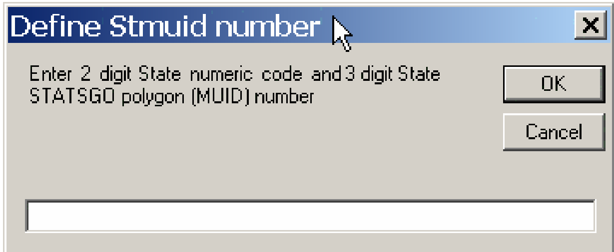


Figure 6.41

Type the Stmuid number in the text box. Click **OK**. The entry is now set in the selected record.

2. **S5id**. The Soils5 ID number for USDA soil series data is specified by the user.

   a. Click the S5id radio button 

.

   b. Double click the respective record. A dialog box will be displayed that allows the user to enter the Soils5 ID number (Figure 6.42).

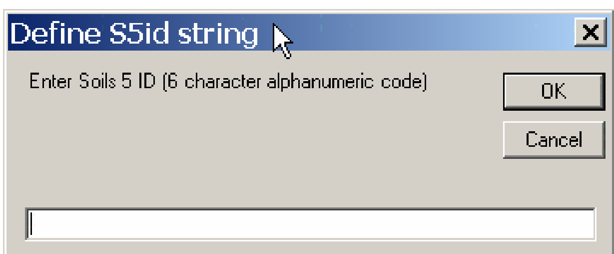


Figure 6.42

Type the Soils5 ID number in the text box. Click **OK**. The entry is now set in the selected record.

3. **Stmuid+Seqn**. The State STATSGO polygon number and sequence number of soil phase is specified by the user.

   a. Click the **Stmuid + Seqn** radio button 

.

   b. Two joining attribute records must be defined for each map category.

   c. When the **Stmuid** record is double-clicked, a dialog box (Figure 6.39) is displayed. Enter the State STATSGO polygon number and click **OK**. The Stmuid number is set in the selected record.

d. Double click the **Seqn** record. A dialog box will be displayed that allows the user to enter a sequence number. This number is the ranking in dominance (1=dominant, 2=second most dominant, etc.) used to select the soil series data assigned to HRUs containing the STATSGO polygon. (Figure 6.43).

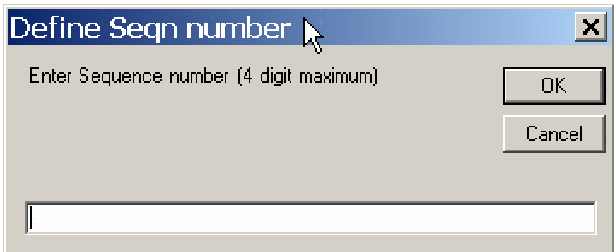


Figure 6.43

Type the sequence number in the text box. Click **OK**. The entry is now set in the selected record.

4. **Stmuid + Name**. The State STATSGO polygon number and soil series name is specified by the user.

a. Click the **Stmuid + Name** radio button .

b. Two joining attribute records must be defined for each map category.

c. When the **Stmuid** record is double-clicked, a dialog box (Figure 6.39) is displayed. Enter the State STATSGO polygon number and click **OK**. The Stmuid number is set in the selected record.

d. Double click the **Name** record. A dialog box will be displayed that allows the user to enter a soil series name (Figure 6.44).

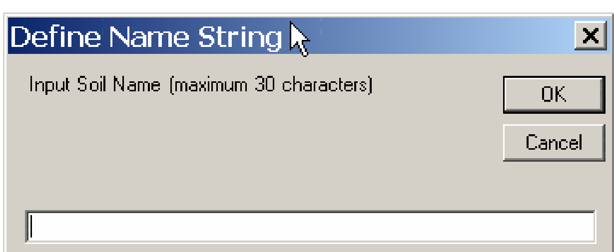


Figure 6.44

e. Type the soil series name in the text box. Click **OK**. The entry is now set in the selected record.

f. Repeat these steps until all soil joining attribute codes are defined.

Assign soil attribute information using a look-up table:

1. To load a look-up table select the soil look-up table by clicking on the button labeled **Look-up table Grid Values→Soil Attributes**

2. A browser will appear, allowing you to select and load the look-up table from disk (Figure 6.45). The user has the option of loading a text file (.txt), dBase (.dbf), or geodatabase table (.mdb). Select the appropriate type of table, choose the proper table, and then click **Select**.

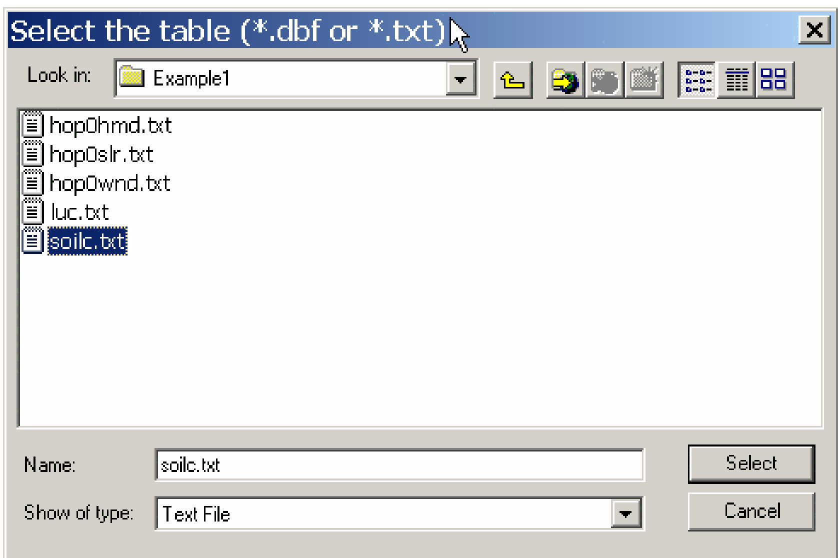
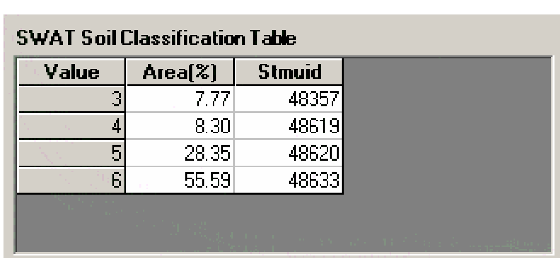


Figure 6.45

Note: Information on the soil classification or look-up table format (dBASE and ASCII (.txt)) is provided in Section 3.

3. The interface will apply the selected lookup table the soil grid codes and populate the SWAT Soil Classification Table (Figure 6.46).



Value	Area[%]	Stmuid
3	7.77	48357
4	8.30	48619
5	28.35	48620
6	55.59	48633

Figure 6.46

4. Once the soil attribute codes have been assigned to all map categories, the **Reclassify** button will be enabled. Click the 

button.

5. A new map layer named "SwatSoilClass" will be displayed in the *map* (Figure 6.47).

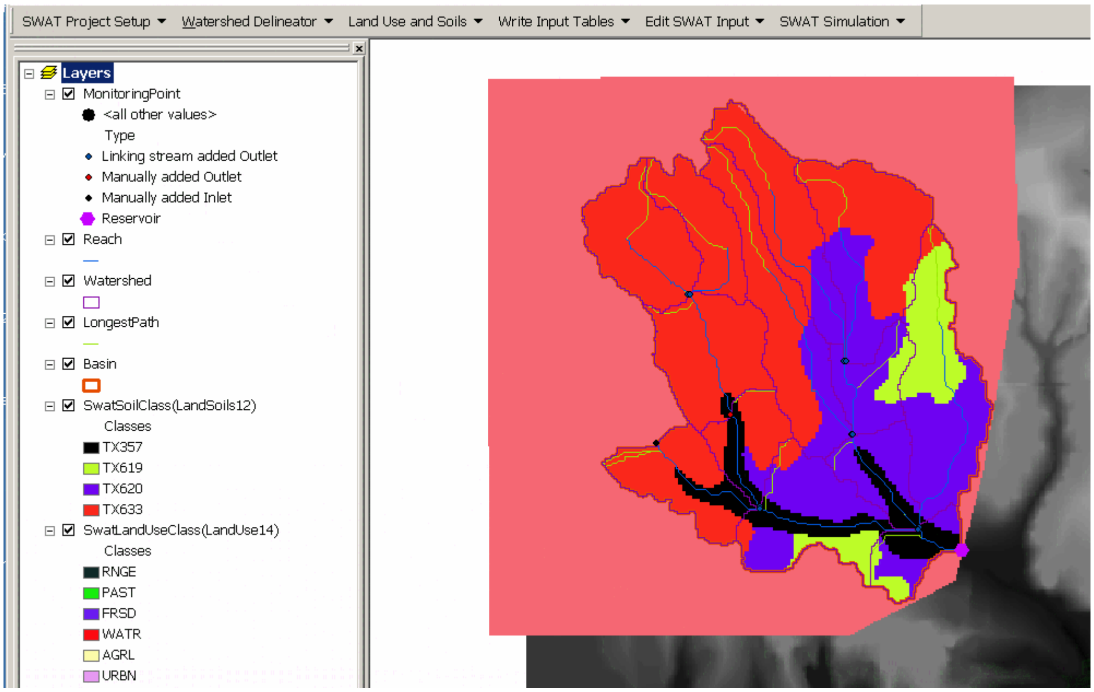


Figure 6.47

6. The soil data layer is now loaded.

SECTION 6.1.4: **SLOPE CLASSIFICATION**

HRU analysis in ArcSWAT includes division of HRUs by slope classes in addition to land use and soils. This is particularly important if subbasins are known to have a wide range of slopes occurring within them. In ArcSWAT, users are required to create a slope classification based on the DEM used during watershed delineation, even if only a single slope class will be used.

To define slope classes:

1. Click on the Slope tab of the Land Use/Soils/Clop Definition tool (Figure 6.48).

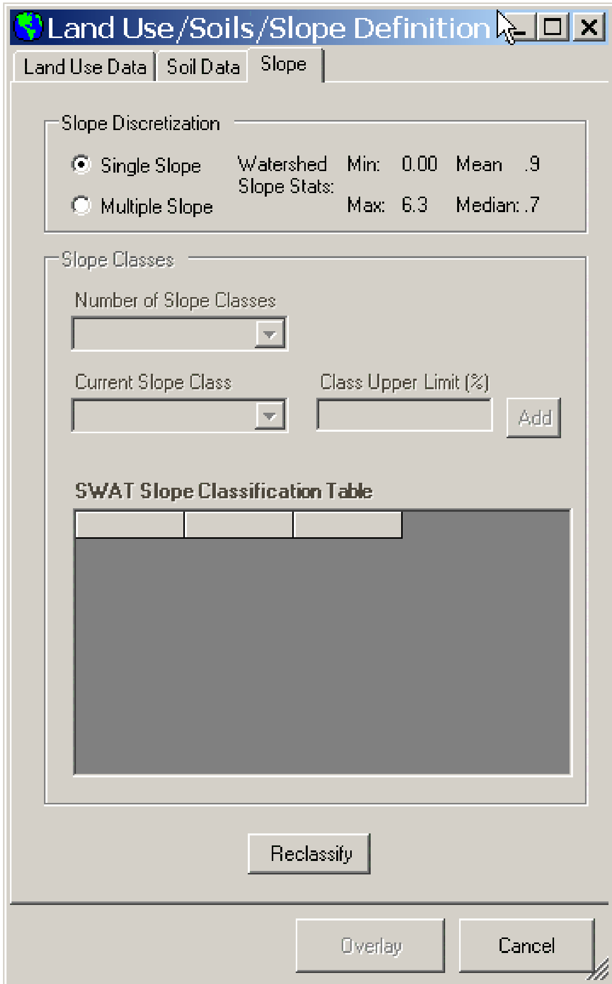


Figure 6.48

2. Information on the slope ranges within your watershed are displayed in the **Slope Discretization** section. The **Min, Max, Mean**, and **Median** statistics are provided. These will help to determine the number of slope classes required and the ranges for those classes.

3. Select the **Single Slope** option if only one slope class is desired for the HRU delineation (Figure 6.49).

Figure 6.49

4. Select the **Multiple Slope** option if more than one slope class is desired for the HRU delineation. If Multiple Slope is selected, then the **Slope Classes** section will become enabled (Figure 6.50).

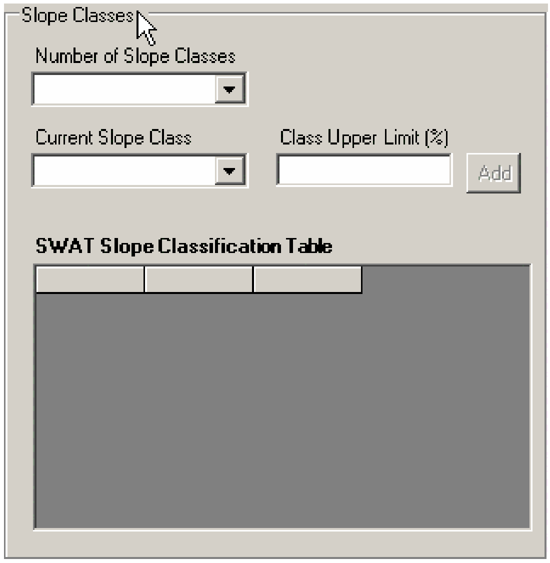
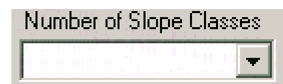


Figure 6.50

5. Choose the **Number of Slope Classes** from the 

combo box. You may select from 1 to 5 slope classes. More classes than 5 are impractical and 3 or fewer slope classes are sufficient for most situations.

6. After selecting the Number of Slope Classes, the SWAT Slope Classification Table is enabled and the number of rows corresponding to the number of slope classes is added to the table (Figure 6.51).

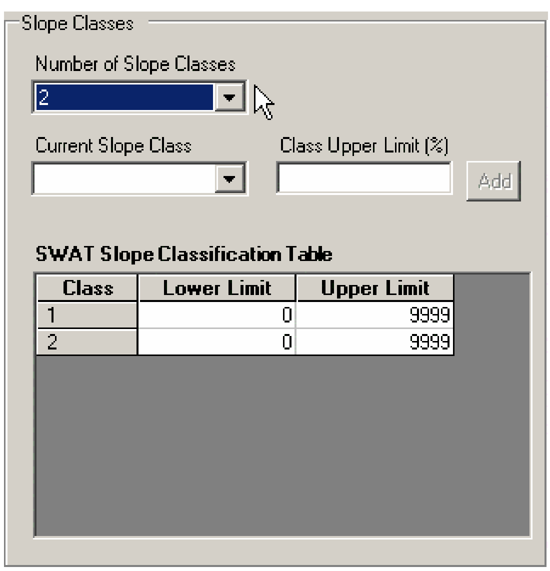
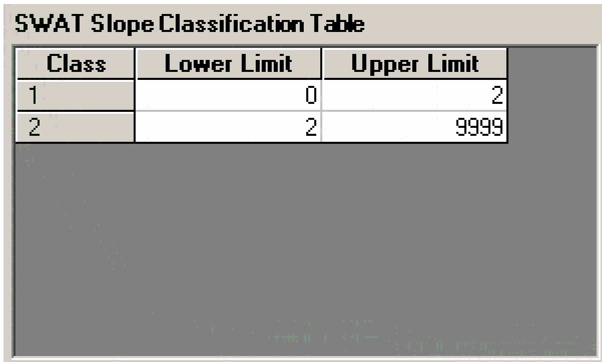


Figure 6.51

7. Select the **Current Slope Class** from the 

combo box. Then enter the upper limit for that slope class in the 

text box. The units for the classes are in percent (%). Then click the **Add** button. The SWAT Slope Classification Table is update to reflect the class definition added (Figure 6.52).



SWAT Slope Classification Table

Class	Lower Limit	Upper Limit
1	0	2
2	2	9999

Figure 6.52

8. Repeat this procedure for all the slope classes defined. You will not be required to enter a slope **Class Upper Limit** for the highest slope class. This will be set at 9999 by default.

9. When slope class definition is complete, click the Reclassify button. A new layer called *LandSlope* will be added to the map.

10. Slope class definition is complete.

SECTION 6.1.5: OVERLAY OF LANDUSE, SOIL, AND SLOPE LAYERS

1. When the land use, soil, and slope grids are reclassified the 

button is enabled. Click the **Overlay** button.

2. A message box signals the end of the overlay process (Figure 6.53)

Figure 6.53

A new layer called *FullHRU* will be added to the map (Figure 6.54). This dataset will contain the unique combinations of all the land use, soils, and slope classes.

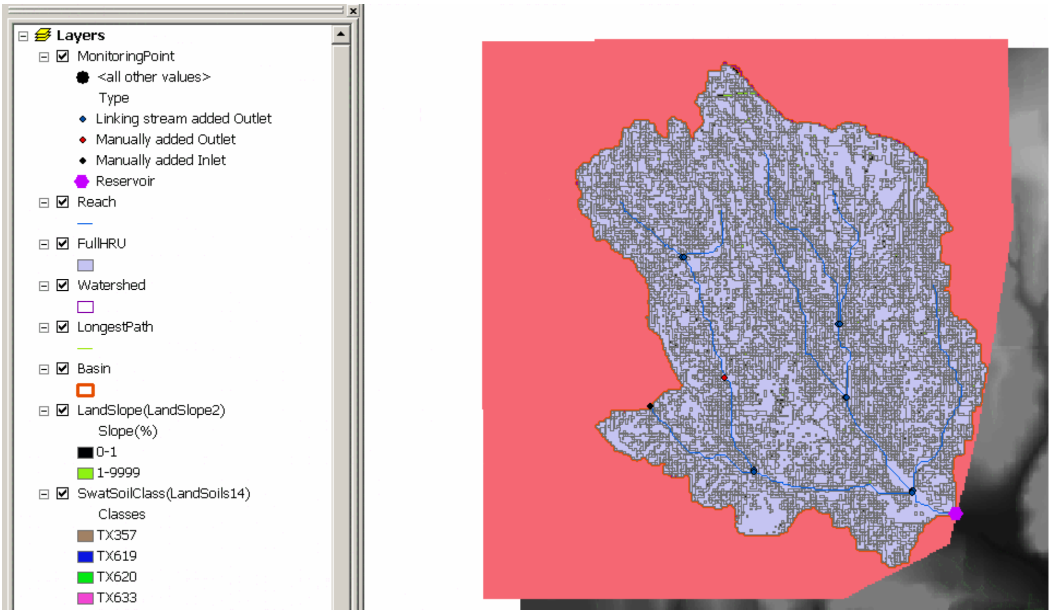


Figure 6.54

3. A report named *Land Use, Soils, Slope Distribution* is generated during the overlay process. This report provides a detailed description of the distribution of the land use, soil, and slope classes in the watershed and all the sub-watersheds. To access this report, click on **HRU Analysis Reports** item under the **HRU Analysis** menu. A dialog will appear listing the available reports (Figure 6.55)

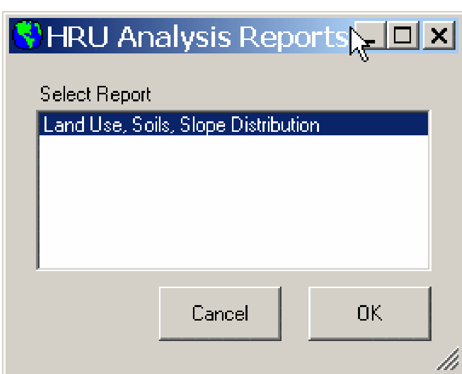
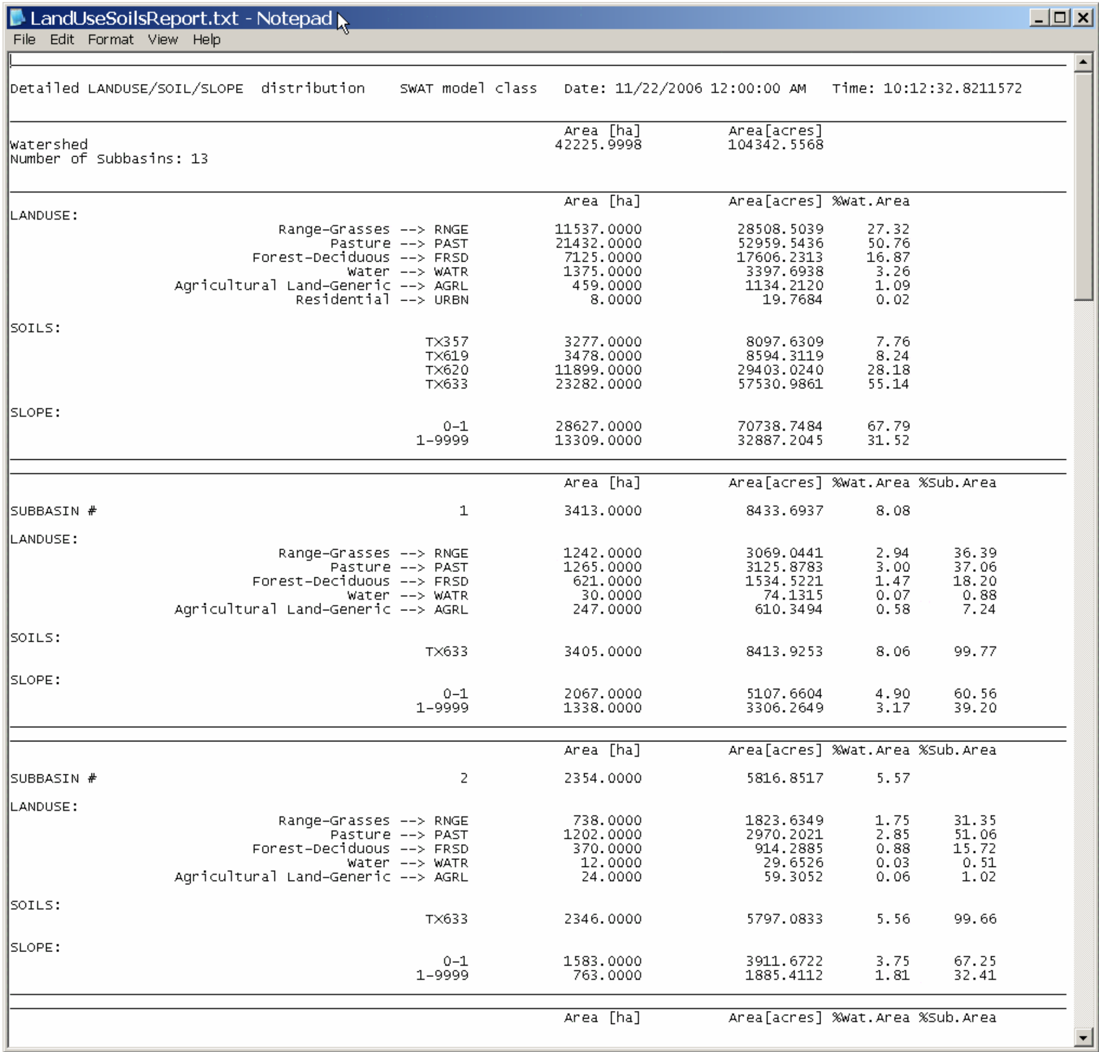


Figure 6.55

4. Select *Land Use, Soils, Slope Distribution* and click **OK**. The report will appear in a text editor (Figure 6.56).



LandUseSoilsReport.txt - Notepad

File Edit Format View Help

```
Detailed LANDUSE/SOIL/SLOPE  distribution    SWAT model class    Date: 11/22/2006 12:00:00 AM    Time: 10:12:32.8211572

                                                               Area [ha]         Area[acres]
Watershed                                                     42225.9998         104342.5568
Number of Subbasins: 13

                                                               Area [ha]         Area[acres] %Wat.Area
LANDUSE:
                              Range-Grasses --> RNGE          11537.0000          28508.5039     27.32
                                    Pasture --> PAST          21432.0000          52959.5436     50.76
                           Forest-Deciduous --> FRSD           7125.0000          17606.2313     16.87
                                      Water --> WATR           1375.0000           3397.6938      3.26
                  Agricultural Land-Generic --> AGRL            459.0000           1134.2120      1.09
                                Residential --> URBN              8.0000             19.7684      0.02

SOILS:
                                              TX357            3277.0000           8097.6309      7.76
                                              TX619            3478.0000           8594.3119      8.24
                                              TX620           11899.0000          29403.0240     28.18
                                              TX633           23282.0000          57530.9861     55.14

SLOPE:
                                                0-1           28627.0000          70738.7484     67.79
                                             1-9999           13309.0000          32887.2045     31.52

                                                               Area [ha]         Area[acres] %Wat.Area %Sub.Area

SUBBASIN #                                        1            3413.0000           8433.6937      8.08

LANDUSE:
                              Range-Grasses --> RNGE           1242.0000           3069.0441      2.94     36.39
                                    Pasture --> PAST           1265.0000           3125.8783      3.00     37.06
                           Forest-Deciduous --> FRSD            621.0000           1534.5221      1.47     18.20
                                      Water --> WATR             30.0000             74.1315      0.07      0.88
                  Agricultural Land-Generic --> AGRL            247.0000            610.3494      0.58      7.24

SOILS:
                                              TX633            3405.0000           8413.9253      8.06     99.77

SLOPE:
                                                0-1            2067.0000           5107.6604      4.90     60.56
                                             1-9999            1338.0000           3306.2649      3.17     39.20

                                                               Area [ha]         Area[acres] %Wat.Area %Sub.Area

SUBBASIN #                                        2            2354.0000           5816.8517      5.57

LANDUSE:
                              Range-Grasses --> RNGE            738.0000           1823.6349      1.75     31.35
                                    Pasture --> PAST           1202.0000           2970.2021      2.85     51.06
                           Forest-Deciduous --> FRSD            370.0000            914.2885      0.88     15.72
                                      Water --> WATR             12.0000             29.6526      0.03      0.51
                  Agricultural Land-Generic --> AGRL             24.0000             59.3052      0.06      1.02

SOILS:
                                              TX633            2346.0000           5797.0833      5.56     99.66

SLOPE:
                                                0-1            1583.0000           3911.6722      3.75     67.25
                                             1-9999             763.0000           1885.4112      1.81     32.41

                                                               Area [ha]         Area[acres] %Wat.Area %Sub.Area
```

Figure 6.56

5. Once the overlay process is complete, the user may proceed with determination of hydrologic response units (HRUs).

SECTION 6.2: HRU DEFINITION

Purpose

Once the land use, soil, and slope data layers have been imported overlaid, the distribution of hydrologic response units (HRUs) within the watershed must be determined. The **HRUs Definition** command in the **HRU Analysis** menu allows the user to specify criteria used in determining the HRU distribution. One or more unique land use/soil/slope combinations (hydrologic response units or HRUs) can be created for each subbasin.

Application

Subdividing the watershed into areas having unique land use and soil combinations enables the model to reflect differences in evapotranspiration and other hydrologic conditions for different land covers/crops and soils. Runoff is predicted separately for each HRU and routed to obtain the total runoff for the watershed. This increases the accuracy of load predictions and provides a much better physical description of the water balance.

The user has two options in determining the HRU distribution: assign a single HRU to each subwatershed or assign multiple HRUs to each subwatershed. If a single HRU per subbasin is selected, the HRU is determined by the dominant land use category, soil type, and slope class within each watershed. If multiple HRUs are selected, the user may specify sensitivities for the land use, soil, and slope data that will be used to determine the number and kind of HRUs in each watershed.

Key Procedures

- Select single or multiple HRUs per subwatershed
- For multiple HRUs, define land use and soil threshold levels
- Optional: Set land use refinement parameters to split HRU land use classes and define special land uses exempt from threshold levels
- Click the OK button to determine the HRU distribution

Detailed Operations

1. Select **HRU Definition** from the **HRU Analysis** menu. The *HRU Definition* dialog box will be displayed with the HRU Thresholds tab activated (Figure 6.57).

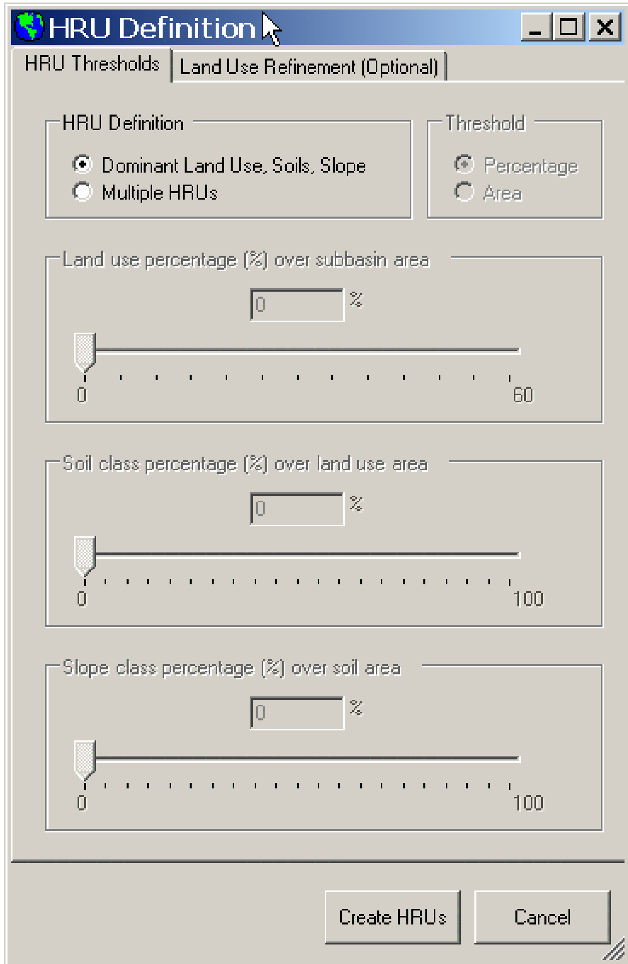


Figure 6.57

2. The dialog box has two radio buttons: **Dominant Land Use and Soil** and **Multiple HRUs**. The user must select the button for the method used to create HRUs.

   a. The **Dominant Land Use and Soil** option will create one HRU for each subbasin. The dominant land use, soil, and slope class in the subbasin are simulated in the HRU. To activate this option, select the radio button.

   b. The **Multiple HRUs** option will create multiple HRUs within each subbasin. This option is selected by default. To activate this option, select the radio button.

   Three slide bars and the **Threshold** options are now enabled (Figure 6.58). The thresholds can be based on either a percentage of area or an absolute area. These options are controlled by the **Percentage** and **Area** radio button options in the **Threshold** section.

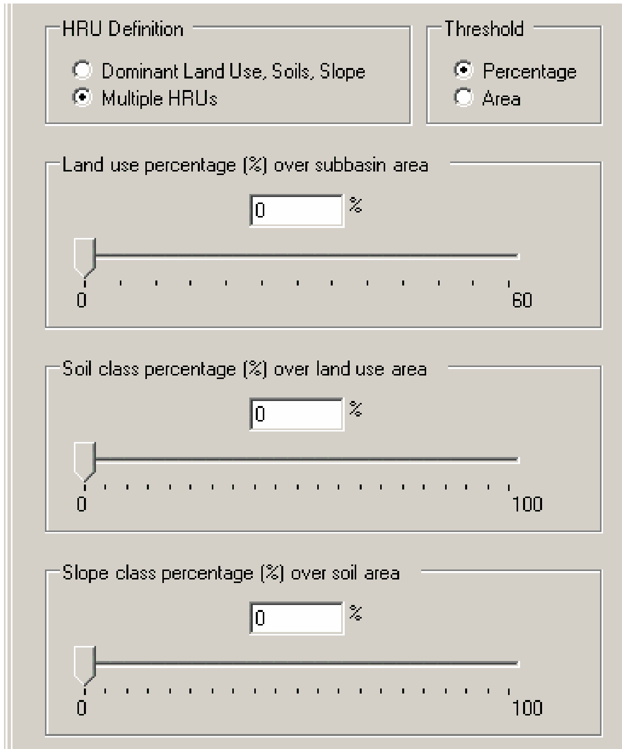


Figure 6.58

The land use slider bar controls the threshold level used to eliminate minor land uses in each subbasin. Land uses that cover a percentage (or area) of the subbasin area less than the threshold level are eliminated. After the elimination process, the area of the remaining land uses is reapportioned so that 100% of the land area in the subbasin is modeled.

For example, assume there is a subbasin that contains

- 35% agricultural land in corn
- 30% pasture
- 21% forest
- 10% agricultural land in orchard
- 4% urban

If the threshold level for land use is set to 20%, HRUs would be created for pasture, forest, and corn. The areas of modeled land uses would be modified as follows:

- corn: (35% ÷ 86%) x 100% = 41%
- pasture: (30% ÷ 86%) x 100% = 35%
- forest: (21% ÷ 86%) x 100% = 24%

where 86% was the percentage of the subbasin originally covered by pasture, forest, and corn.

The soil slider bar controls the creation of additional HRUs based on the distribution of the selected land uses over different soil types. This scale is used to eliminate minor soils within a land use area. As with the land use areas, once minor soil types are eliminated, the area of remaining soils is reapportioned so that 100% of the land use area is modeled.

For example, assume that the overlay performed by the interface during the land use, soil, slope overlay identified the following soil distribution for pastureland in the subbasin:

- 20% Houston Black
- 25% Branyon
- 15% Heiden
- 10% Austin
- 7% Stephen
- 6% Denton
- 5% Frio
- 4% Purves
- 3% Bastrop
- 2% Altoga
- 1% Eddy
- 1% San Saba
- 1% Ferris

If the threshold level for soils within a land use area is set to 10%, the following HRUs will be created for this example:

- pasture/Houston Black
- pasture/Branyon
- pasture/Heiden
- pasture/Austin

This process is performed for every land use modeled in the subbasin.

The slope slider bar controls the creation of additional HRUs based on the distribution of the selected soil types over different slope classes. This scale is used to eliminate minor slope classes within a soil on a specific land use area. As with the land use areas and soil areas, once minor slope classes are eliminated, the area of remaining slope classes is reapportioned so that 100% of the soil area is modeled.

For example, assume that the overlay performed by the interface during the land use, soil, slope overlay identified the following slope distribution for Branyon soil on pastureland in the subbasin:

- 50% 0 -1% slopes
- 35% 1%-2% slopes
- 15% > 2% slopes

If the threshold level for slope within a soil on a land use area is set to 20%, the following HRUs will be created for this example:

- pasture/Branyon/0-1% slopes
- pasture/Branyon/1%-2% slopes

This process is performed for every soil on every land use modeled in the subbasin.

The threshold levels set for multiple HRUs is a function of the project goal and the amount of detail desired by the modeler. For most applications, the default settings for land use threshold (20%) and soil threshold (10%) and slope threshold (20%) are adequate.

i. Specify the *Landuse* threshold level by moving the pointer on the first slide bar (Figure 6.59).

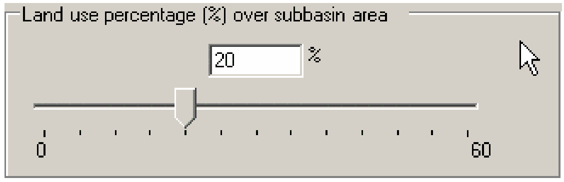


Figure 6.59

ii. Specify the *Soil* threshold level by moving the pointer on the second slide bar (Figure 6.60).

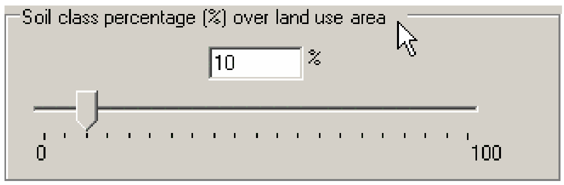


Figure 6.60

iii. Specify the *Slope* threshold level by moving the pointer on the third slide bar (Figure 6.61).

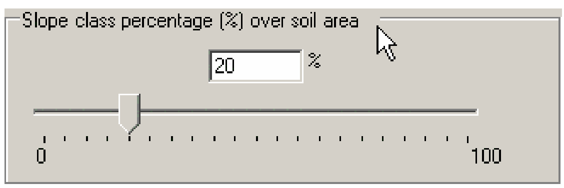


Figure 6.61

iv. The slider bar minimum and maximum values will be set based on valid values within the datasets. However, if you type a value in to one of the text boxes that is beyond the valid range for the slider, you will receive the following error message:

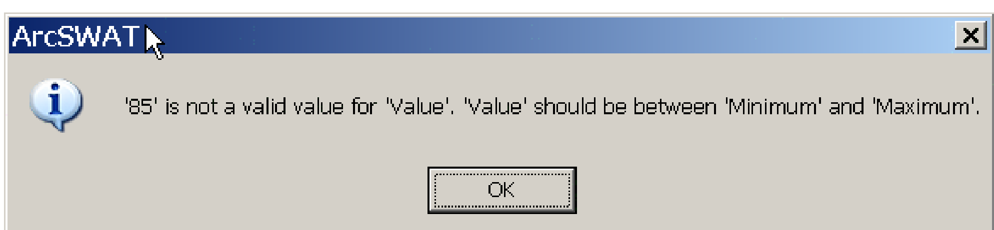


Figure 6.62

3. At this point, the user has the option of performing some additional land use refinements before applying the thresholds and creating the HRUs. On the **Land Use Refinement (Optional)** tab, the user has the option to

define certain land use classes to split into multiple “sub-land uses” and the option to set special land uses “exempt” from the land use threshold setting defined.

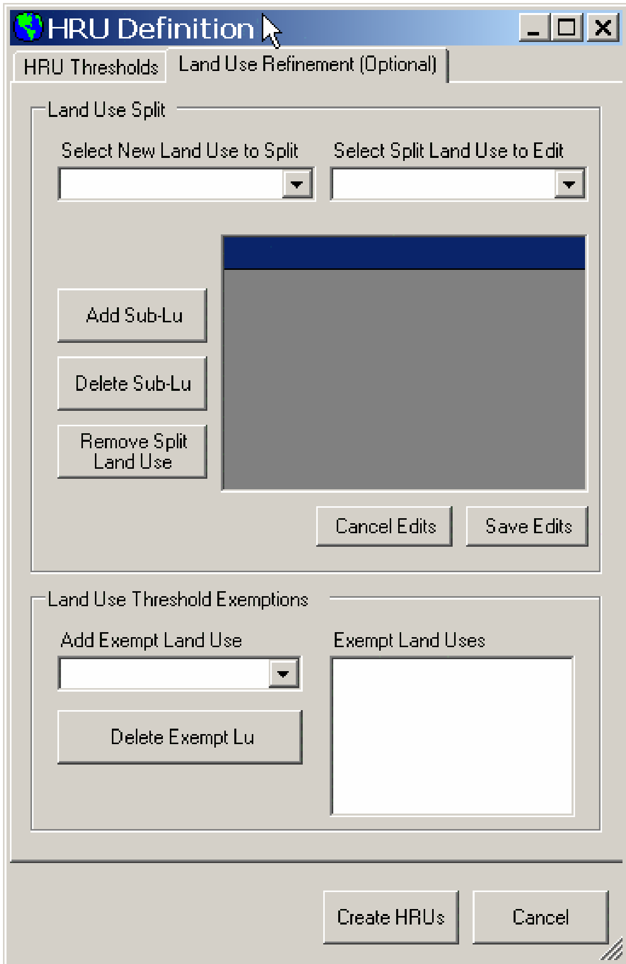


Figure 6.63

Set land use split settings:

Users may wish to split a land use grid classification into multiple, more specific land cover or crop classes. A common occurrence of this will be when the source spatial dataset contains a broad land use classification such as “Row Crops”. Users may want to model “corn” and “soybean” independently. This can be accomplished by splitting the “Row Crops” land use into sub-land uses.

1. To select a land use to split, select a land use from the Select New Land Use to Split combo box (Figure 6.64). This combo box will contain all the land uses in your watershed that have not already been split.

Figure 6.64

2. A new record will appear in the Sub land Use Table (Figure 6.65). This table has three columns: 1) **Landuse** represents the “parent” land use class defined based the spatial dataset and lookup t able. 2) **Sub-Lu** represents the sub-land use component of the parent land use class. 3) **Percent** represents the percent of the parent Landuse that the Sub-Lu covers. By default, when a new land use to split is selected, the parent land use will be added as a sub-land use in the table, and the **Percent** set to 100.

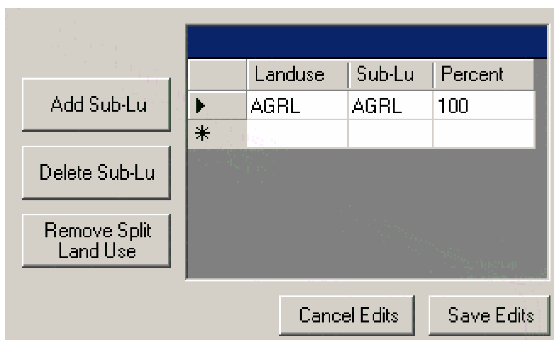


Figure 6.65

3. To an addition sub-land use, click the **Add Sub-Lu** button.

4. A dialog will appear that contains a list of the land cover types from the SWAT crop database (Figure 6.66). Select the sub-land use you want to create, and click **OK**.

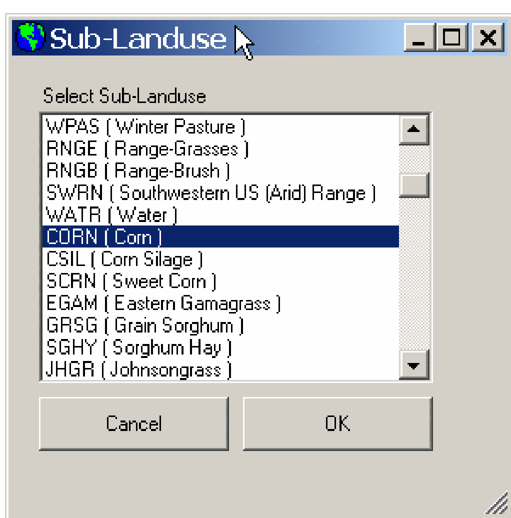


Figure 6.66

5. The new sub-land use will appear in the Sub Land Use Table (Figure 6.67). Add additional sub-land uses if needed.

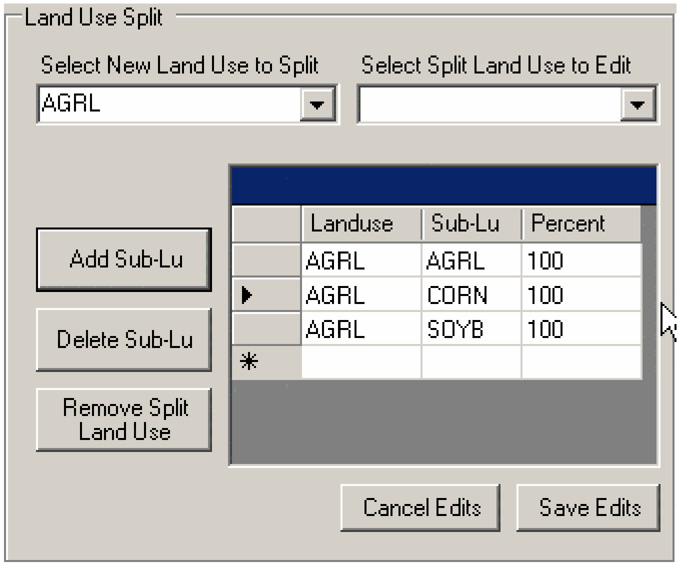


Figure 6.67

6. To delete a sub-land use, select the record to delete and click **Delete Sub-Lu**. The sub-land use is removed from the table (Figure 6.68)

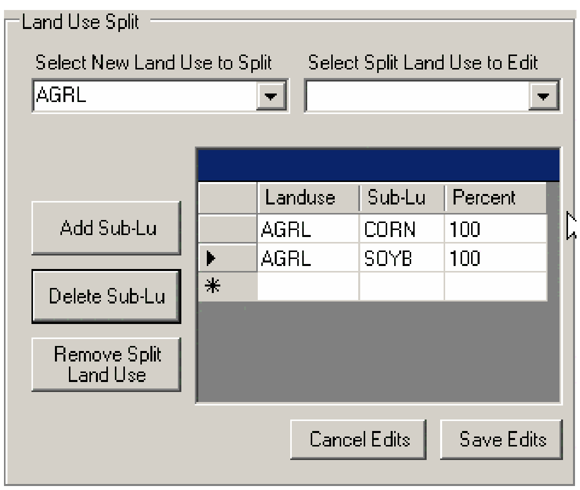


Figure 6.68

7. Set the **Percent** values by typing directly in the table. The sum of the percents MUST add up to 100. If the percents do not add up to 100, an error message will appear (Figure 6.69) after you click on the **Save Edits** button.

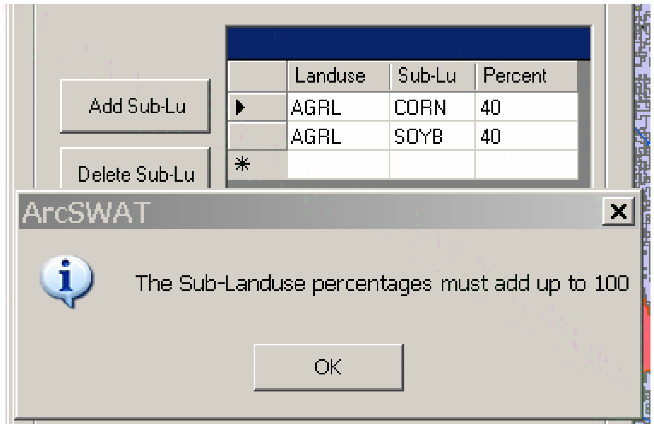


Figure 6.69

8. Once the percents are set correctly, click the **Save Edits** button. A message indicating the edits were successfully saved will appear (Figure 6.70). In addition, a table called SplitHrus is written to the SWAT Project geodatabase. This table keeps track of the parent land uses that have been split, their sub-land uses, and their percents.

Figure 6.70

9. The Sub Land Use Table will now be clear. You can now select a new land use to split or go back and edit the one you just defined.

10. You may want to edit the percents of the sub-land uses you have defined for a parent land use. To do this, select the split land use from the Select Split Land Use to Edit combo box (Figure 6.71)

Figure 6.71

11. The current percent settings appear in the Sub Land Use Table (Figure 6.72)

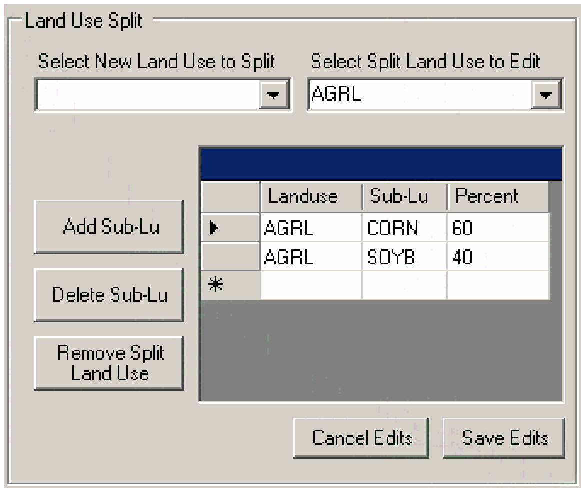


Figure 6.72

12. You can now edit the percent values in the table, or add additional sub-land uses. If you decide against your edits, you can click the **Cancel Edits** button, and the editing session will stop with the previous settings restored

13. To remove a split land use and return that land use to its original, single class state, click on the **Remove Split Land Use** button while the land use is being edited in the Sub Land Use Table. That land use will now appear back in the Select New Land Use to Split combo box (Figure 6.73).

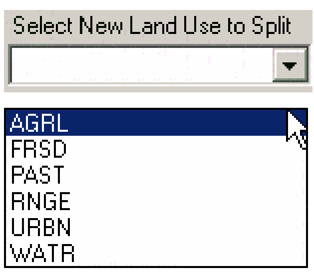


Figure 6.73

14. The land use splitting settings are now complete!

Set land use threshold exemptions:

The land use threshold set on the **HRU Thresholds** tab sets a percentage (or area) that a land use must cover within a subbasin in order to be included as part of an HRU. There may often be occasions where the user wants to include specific land uses as part of an HRU, even if their extent is below the threshold. To accommodate this, the user may specify which land uses are exempt from the threshold criteria. The Land Use Thresholds Exemptions section is shown in Figure 6.74.

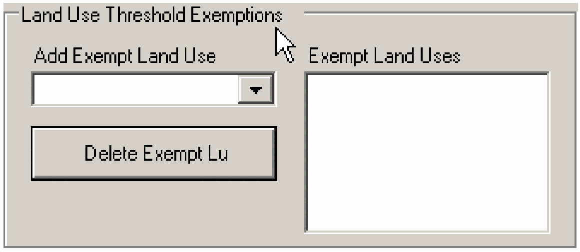


Figure 6.74

1. To select a land use to make exempt, select it from the Add Exempt Land Use combo box (Figure 6.75). This combo box will contain all the land uses in your watershed that have not already been set as exempt. **NOTE**: If you have defined split land uses, then this combo box will contain the name of the parent land use, not the sub-land uses.

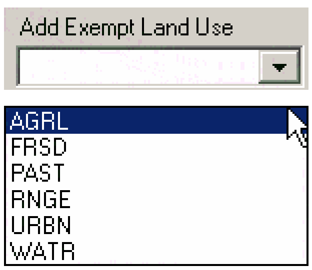


Figure 6.75

2. The selected land use will then appear in the Exempt Land Uses list box (Figure 6.76). A table called *LuExempt* is written to the SWAT Project geodatabase. This table contains a list of the exempt land uses for the current project.

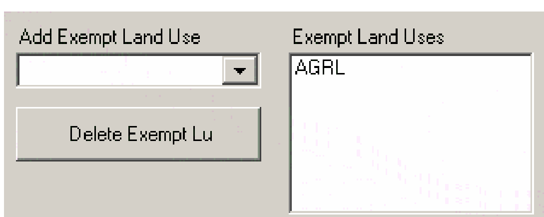


Figure 6.76

3. To remove a land use from the exempt group, select it in the **Exempt Land Uses** list box (Figure 6.77), and click the **Delete Exempt Lu** button.

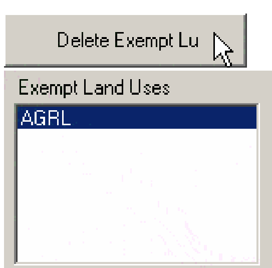


Figure 6.77

4. Once all HRU threshold and land use refinement settings are complete, click the **Create HRUs** button 

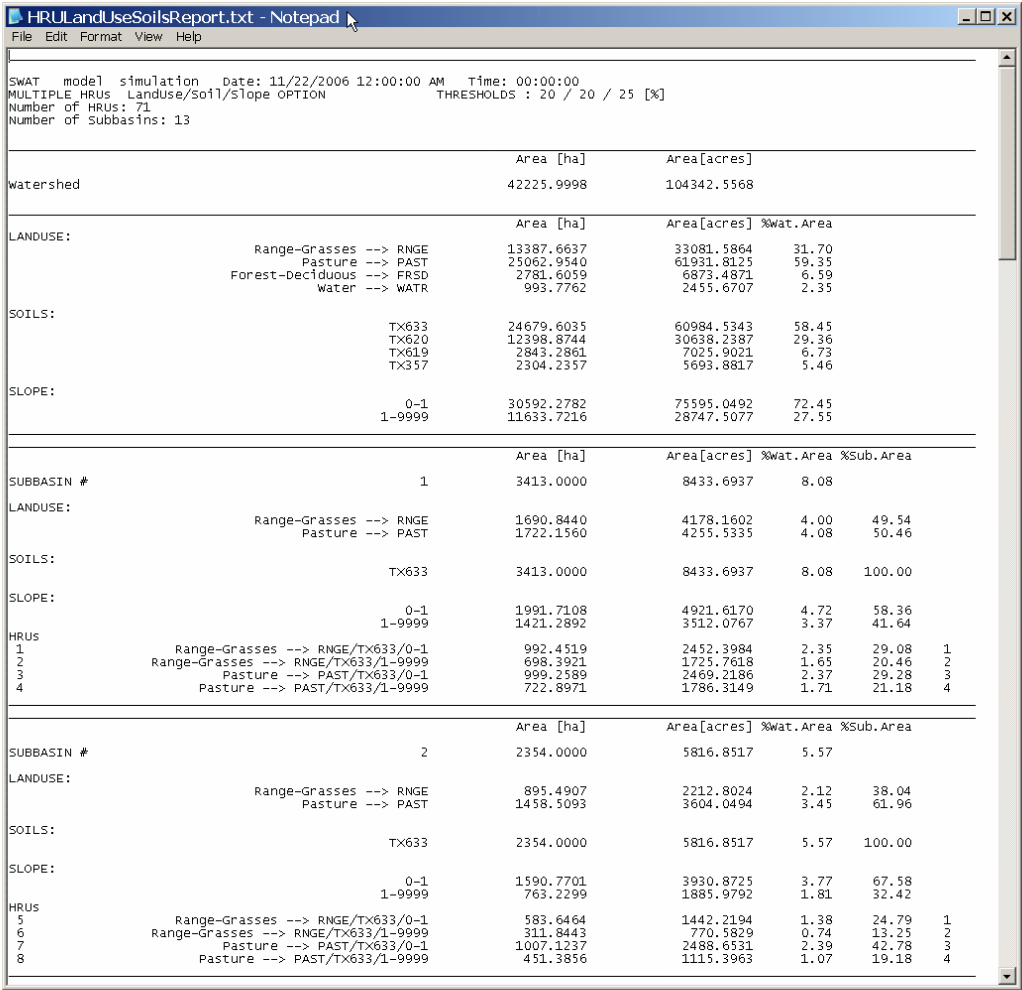
.

5. Once the HRUs are created a message dialog pops up (Figure 6.78).

Figure 6.78

6. Click **OK**.

7. A report named *Final HRU Distribution* is generated during the HRU definition process (Figure 6.79). This report provides a detailed description of the distribution of the land use, soil, and slope classes after application of thresholds for the watershed and all the sub-watersheds. The number of HRUs with the land use/soil/slope classes and aerial extent are listed for each subbasin. To access this report, click on **HRU Analysis Reports** under the **HRU Analysis** menu. Select **Final HRU Distribution** and click **OK**.



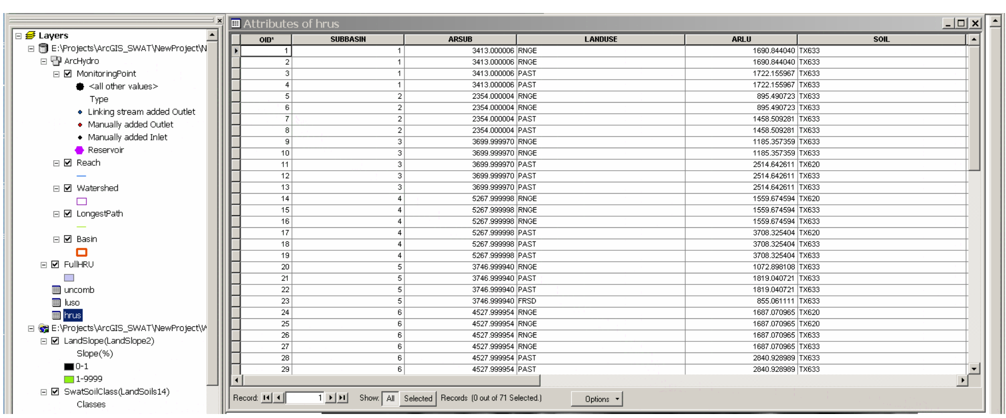
HRULandUseSoilsReport.txt - Notepad

File Edit Format View Help

```
SWAT   model  simulation   Date: 11/22/2006 12:00:00 AM   Time: 00:00:00
MULTIPLE HRUs  LandUse/Soil/Slope OPTION              THRESHOLDS : 20 / 20 / 25 [%]
Number of HRUs: 71
Number of Subbasins: 13

                                                          Area [ha]         Area[acres]

Watershed                                                 42225.9998        104342.5568

                                                          Area [ha]         Area[acres] %Wat.Area
LANDUSE:
                              Range-Grasses --> RNGE      13387.6637         33081.5864    31.70
                                    Pasture --> PAST      25062.9540         61931.8125    59.35
                           Forest-Deciduous --> FRSD       2781.6059          6873.4871     6.59
                                      Water --> WATR        993.7762          2455.6707     2.35

SOILS:
                                              TX633       24679.6035         60984.5343    58.45
                                              TX620       12398.8744         30638.2387    29.36
                                              TX619        2843.2861          7025.9021     6.73
                                              TX357        2304.2357          5693.8817     5.46

SLOPE:
                                                0-1       30592.2782         75595.0492    72.45
                                             1-9999       11633.7216         28747.5077    27.55

                                                          Area [ha]         Area[acres] %Wat.Area %Sub.Area

SUBBASIN #                                        1        3413.0000          8433.6937     8.08

LANDUSE:
                              Range-Grasses --> RNGE       1690.8440          4178.1602     4.00     49.54
                                    Pasture --> PAST       1722.1560          4255.5335     4.08     50.46

SOILS:
                                              TX633        3413.0000          8433.6937     8.08    100.00

SLOPE:
                                                0-1        1991.7108          4921.6170     4.72     58.36
                                             1-9999        1421.2892          3512.0767     3.37     41.64
HRUS
 1                 Range-Grasses --> RNGE/TX633/0-1         992.4519          2452.3984     2.35     29.08   1
 2              Range-Grasses --> RNGE/TX633/1-9999         698.3921          1725.7618     1.65     20.46   2
 3                       Pasture --> PAST/TX633/0-1         999.2589          2469.2186     2.37     29.28   3
 4                    Pasture --> PAST/TX633/1-9999         722.8971          1786.3149     1.71     21.18   4

                                                          Area [ha]         Area[acres] %Wat.Area %Sub.Area

SUBBASIN #                                        2        2354.0000          5816.8517     5.57

LANDUSE:
                              Range-Grasses --> RNGE        895.4907          2212.8024     2.12     38.04
                                    Pasture --> PAST       1458.5093          3604.0494     3.45     61.96

SOILS:
                                              TX633        2354.0000          5816.8517     5.57    100.00

SLOPE:
                                                0-1        1590.7701          3930.8725     3.77     67.58
                                             1-9999         763.2299          1885.9792     1.81     32.42
HRUS
 5                 Range-Grasses --> RNGE/TX633/0-1         583.6464          1442.2194     1.38     24.79   1
 6              Range-Grasses --> RNGE/TX633/1-9999         311.8443           770.5829     0.74     13.25   2
 7                       Pasture --> PAST/TX633/0-1        1007.1237          2488.6531     2.39     42.78   3
 8                    Pasture --> PAST/TX633/1-9999         451.3856          1115.3963     1.07     19.18   4
```

Figure 6.79

8. An ArcSWAT geodatabase table called *hrus* is also created and added to the current map document. This table provides a detailed distribution of the HRUs, land use, soil, and slope classes in the watershed and all subwatersheds (Figure 6.80).



OID*	SUBBASIN	ARSUB	LANDUSE	ARLU	SOIL
1	1	3413.000006	RNGE	1690.844040	TX633
2	1	3413.000006	RNGE	1690.844040	TX633
3	1	3413.000006	PAST	1722.155967	TX633
4	1	3413.000006	PAST	1722.155967	TX633
5	2	2354.000004	RNGE	895.490723	TX633
6	2	2354.000004	RNGE	895.490723	TX633
7	2	2354.000004	PAST	1458.509281	TX633
8	2	2354.000004	PAST	1458.509281	TX633
9	3	3699.999970	RNGE	1185.357359	TX633
10	3	3699.999970	RNGE	1185.357359	TX633
11	3	3699.999970	PAST	2514.642611	TX620
12	3	3699.999970	PAST	2514.642611	TX633
13	3	3699.999970	PAST	2514.642611	TX633
14	4	5267.999998	RNGE	1559.674594	TX620
15	4	5267.999998	RNGE	1559.674594	TX633
16	4	5267.999998	RNGE	1559.674594	TX633
17	4	5267.999998	PAST	3708.325404	TX620
18	4	5267.999998	PAST	3708.325404	TX633
19	4	5267.999998	PAST	3708.325404	TX633
20	5	3746.999940	RNGE	1072.898108	TX633
21	5	3746.999940	PAST	1819.040721	TX633
22	5	3746.999940	PAST	1819.040721	TX633
23	5	3746.999940	FRSD	855.061111	TX633
24	6	4527.999954	RNGE	1687.070965	TX620
25	6	4527.999954	RNGE	1687.070965	TX620
26	6	4527.999954	RNGE	1687.070965	TX633
27	6	4527.999954	RNGE	1687.070965	TX633
28	6	4527.999954	PAST	2840.928989	TX633
29	6	4527.999954	PAST	2840.928989	TX633

Figure 6.80

SECTION 7: IMPORT WEATHER DATA

Weather data to be used in a watershed simulation is imported once the HRU distribution has been defined. Weather data is loaded using the first command in the Write Input Tables menu item on the ArcSWAT toolbar. This tool allows users to load weather station locations into the current project and assign weather data to the sub-watersheds. For each type of weather data loaded, each sub-watershed is linked to one gage.

1. Select **Weather Stations** from the **Write Input Tables** menu The *Weather Data Definition* dialog is displayed (Figure 7.1)

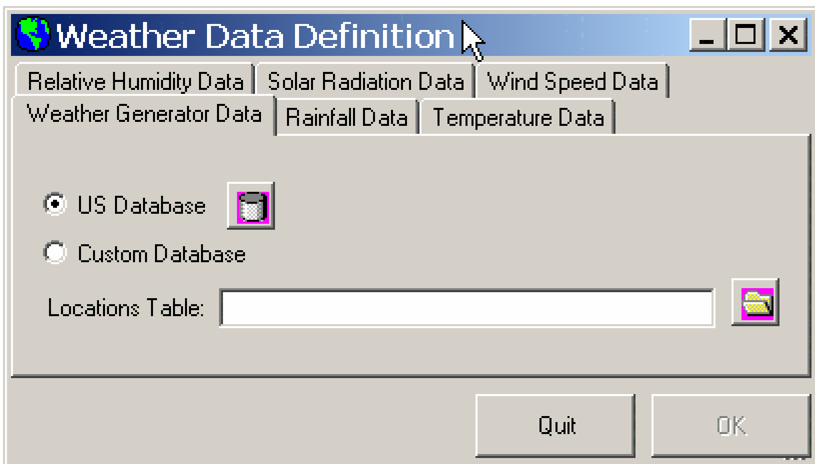


Figure 7.1

2. The *Weather Data Definition* dialog is divided in six tabs: *Weather Generator Data, Rainfall Data, Temperature Data, Solar Radiation Data, Wind Speed Data* and *Relative Humidity Data*. The first section listed, *Weather Generator Data*, **must** be set. The interface will not allow the user to perform other input data processing until the *Weather Generator Data*, is defined. The other five sections allow the user to choose between simulated or measured climate data for specific types of data.

   a. **Weather Generator Data**: In this section (Figure 7.2) the user must define the data used to generate various weather parameters. Data loaded in this section is used to build .wgn files for the dataset. For more information on the type of data used to generate weather data, please see the SWAT2005 Theoretical Documentation and the SWAT2005 User's Manual.

Weather station locations and weather generator data are obtained from one of two sources: the built-in US database or the User Weather Stations database.

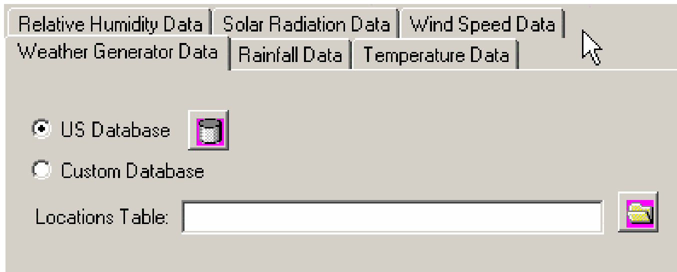
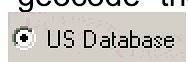


Figure 7.2

i. **US database**: The US database contains weather information for 1,041 stations around the United States and is provided with the interface.

   In order to load and geocode the US database, select the US **Database** radio button 

.

   Click the  button.

ii. **Custom database**: This option is used to load custom weather generator data stored in the *User Weather Stations* database.

   Select the **Custom databas**e radio button 

.

   Click the open file folder button next to the **Locations Table** text box.

   A file browser (Figure 7.3) allows you to select the location table for the weather generator stations. This table may be a dBASE or text table format. The location table is prepared by the user following the format described in Section 3.

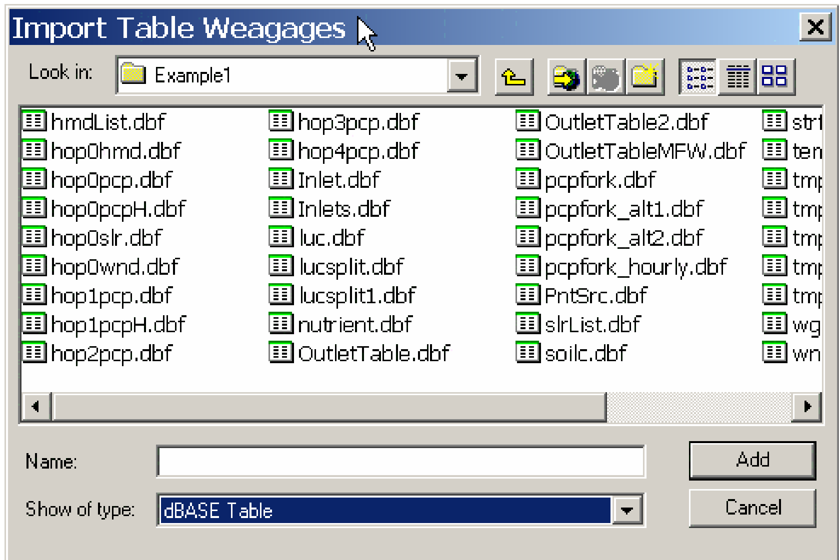


Figure 7.3

Highlight the name of the weather generator location table and click **Add**. The browser will close and the path to the gage location table will be displayed in the **Locations Table** text box.

b. **Rainfall data** (optional). In this section the user can import measured precipitation data for use in the project (Figure 7.4).

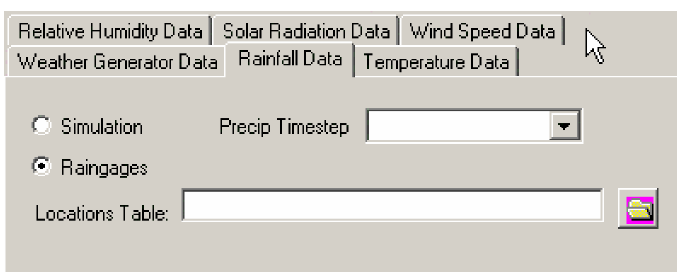
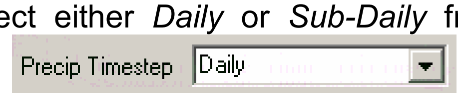


Figure 7.4

To use measured precipitation data, select the **Raingages** radio button 

. Next, select either *Daily* or *Sub-Daily* from the **Precip. Timestep** combo box 

. Click the open file folder button next to the **Locations Table** text box.

A file browser will appear that allows you to select the Precipitation gage location table. This table may be a dBASE or text table format. The rain gage location table must be prepared by the user following the format described in Section 3.

Highlight the name of the precipitation gage location table and click **Add**. The browser will close and the path to the gage location table will be displayed in the **Locations Table** text box.

> **Note**: The individual precipitation gage data files must be located within the same folder as the precipitation gage location table.

c. **Temperature data** (optional) In this section the user can import measured temperature data for use in the project (Figure 7.5).

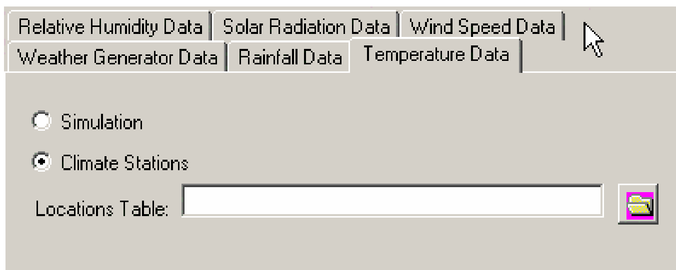
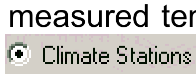


Figure 7.5

To use measured temperature data, select the **Climate Stations** radio button 

. Click the open file folder button next to the **Locations Table** text box.

A file browser will appear that allows you to select the Temperature gage location table. This table may be a dBASE or text table format. The temperature gage location table must be prepared by the user following the format described in Section 3.

Highlight the name of the temperature gage location table and click **Add**. The browser will close and the path to the gage location table will be displayed in the **Locations Table** text box.

> **Note:** The individual temperature gage data files must be located within the same folder as the temperature gage location table.

d. **Solar Radiation data** (optional) In this section the user can import measured solar radiation data for use in the project (Figure 7.6).

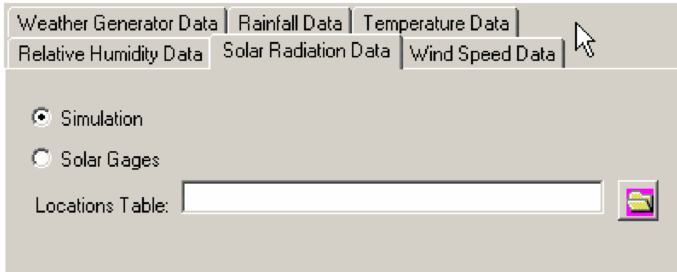


Figure 7.6

To use measured solar radiation data, select the **Solar Gages** radio button 

. Click the open file folder button next to the **Locations Table** text box.

A file browser will appear that allows you to select the Solar gage location table. This table may be a dBASE or text table format. The solar gage location table must be prepared by the user following the format described in Section 3.

Highlight the name of the solar gage location table and click **Add**. The browser will close and the path to the gage location table will be displayed in the **Locations Table** text box.

Note: The individual solar gage data files must be located within the same folder as the solar gage location table.

e. **Wind Speed data** (optional) In this section the user can import measured wind speed data for use in the project (Figure 7.7).

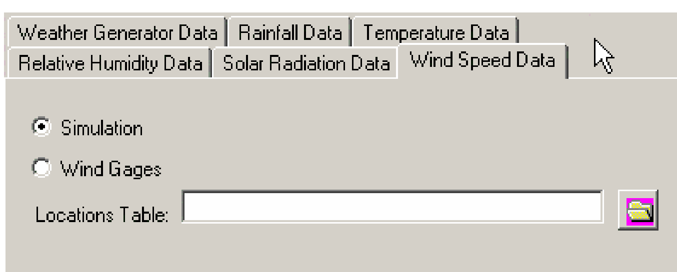
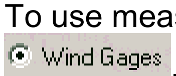


Figure 7.7

To use measured wind speed data, select the **Wind Gages** radio button 

. Click the open file folder button next to the **Locations Table** text box.

A file browser will appear that allows you to select the Wind gage location table. This table may be a dBASE or text table format. The wind gage location table must be prepared by the user following the format described in Section 3.

Highlight the name of the wind gage location table and click **Add**. The browser will close and the path to the gage location table will be displayed in the **Locations Table** text box.

Note: The individual wind gage data files must be located within the same folder as the wind gage location table.

f. **Relative humidity data** (optional) In this section the user can import measured relative humidity data for use in the project (Figure 7.8).

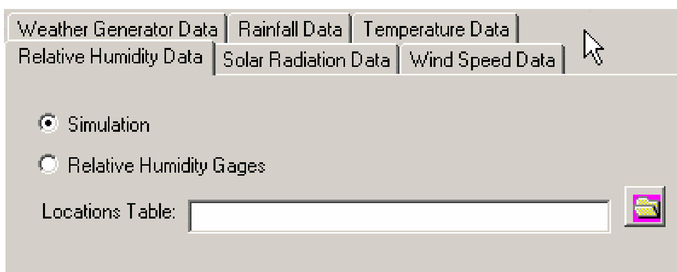


Figure 7.8

To use measured relative humidity data, select the **Relative Humidity Gages** radio button 

. Click the open file folder button next to the **Locations Table** text box.

A file browser will appear that allows you to select the Humidity gage location table. This table may be a dBASE or text table format. The humidity gage location table must be prepared by the user following the format described in Section 3.

Highlight the name of the humidity gage location table and click **Add**. The browser will close and the path to the gage location table will be displayed in the **Locations Table** text box.

Note: The individual humidity gage data files must be located within the same folder as the humidity gage location table.

3. Once all weather data is specified and station locations are loaded, an **OK** button will appear in the lower right corner of the *Weather Data Definition* dialog box (Figure 7.9).

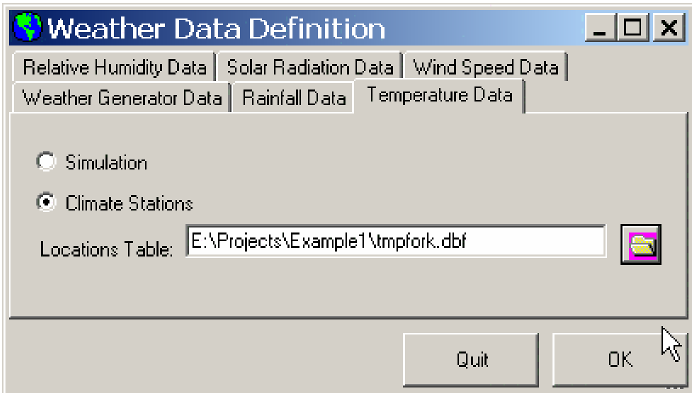


Figure 7.9

Click the **OK** button. This starts the set up of the weather database:

a. Data assigned to a subbasin is obtained from the closest station.

b. A -99.0 value is used to fill in skipped daily data and to fill in measured climate records so that all records have the same starting and ending date. The starting date used for measured climate data is the earliest starting date listed in any record while the ending date is the latest ending date listed in any record. The –99.0 value is used to call the weather generator to generate a value to replace the missing data during run time.

4. When setup of the weather database is complete, a message dialog is displayed (Figure 7.10).

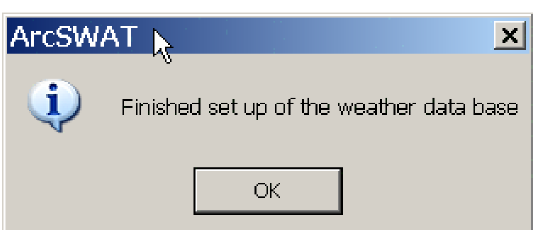


Figure 7.10

5. When the database setup is completed, the weather gages selected will be added to the MonitoringPoint layer in the current map (Figure7.11).

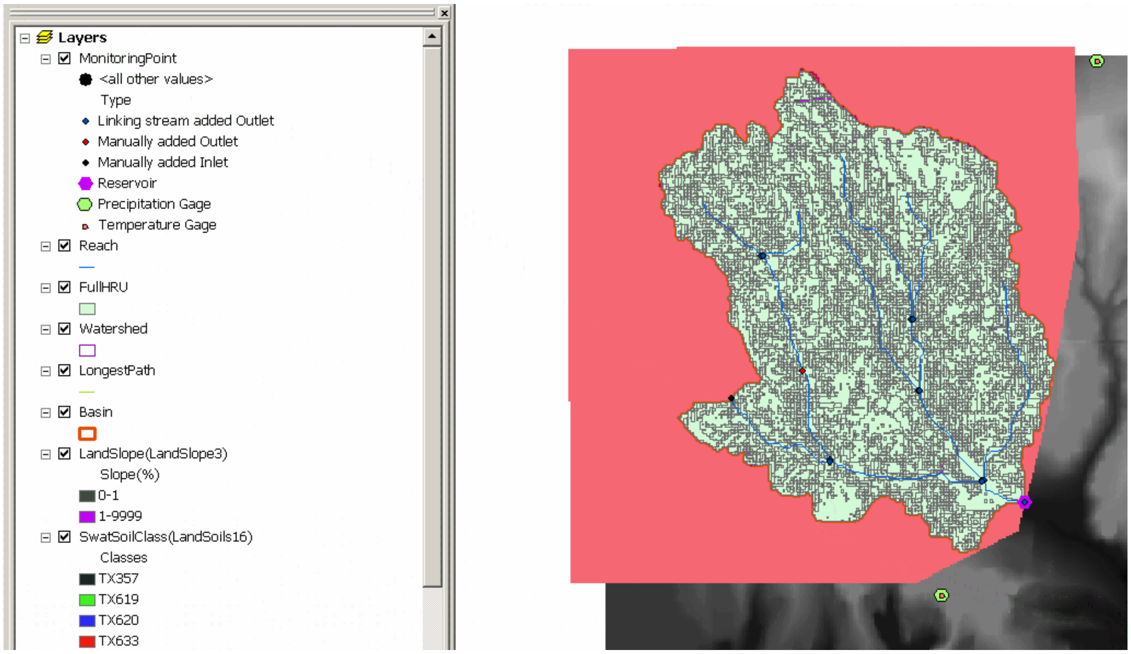

Layers
MonitoringPoint
<all other values>
Type
Linking stream added Outlet
Manually added Outlet
Manually added Inlet
Reservoir
Precipitation Gage
Temperature Gage
Reach
FullHRU
Watershed
LongestPath
Basin
LandSlope(LandSlope3)
Slope(%)
0-1
1-9999
SwatSoilClass(LandSoils16)
Classes
TX357
TX619
TX620
TX633

Figure 7.11

SECTION 8: CREATION OF INPUT

The Write Input Tables menu contains items that allow the user to build database files containing the information needed to generate default input for SWAT. The Write commands become enabled after weather data is successfully loaded. These commands are enabled in sequence (the next command is enabled only after the steps associated with the previous command are completed) and need to be processed only once for a project. However, if the user modifies the HRU distribution (see Section 6.1 and 6.2) after building the input database files, the Input menu commands will need to be processed again.

Before SWAT can be run, the initial watershed input values must be defined. These values are set automatically based on the watershed delineation and landuse\soil\slope characterization (see Section 5 and Section 6) or from defaults.

There are two ways to build the initial values: activate the Write All command or the individual Write commands on the Write Input Tables menu. The majority of users will perform the first option.

SECTION 8.1: WRITE ALL

Select the Write All item from the Write Input Tables menu (Figure 8.1).

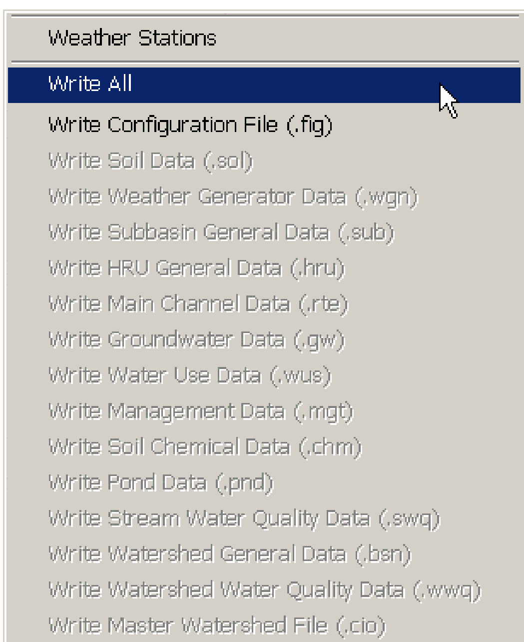


Figure 8.1

1. The SWAT input tables will begin to be written in the order listed in the **Write Input Tables** menu.
2. A new progress dialog will appear as each table is written. An example is shown in Figure 8.2.

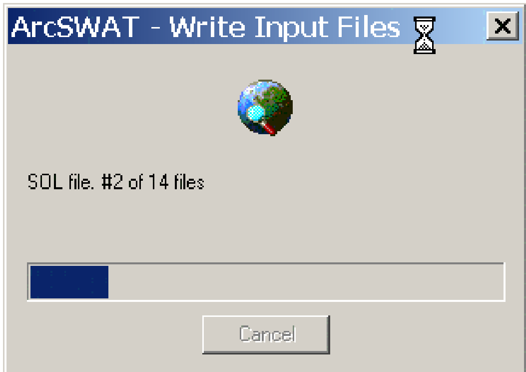


Figure 8.2

3. When writing of the *.sub* (subbasin general input) database begins, a prompt box appears (Figure 8.3) offering two options for defining Manning's roughness factor for the tributary channels in all subbasins.

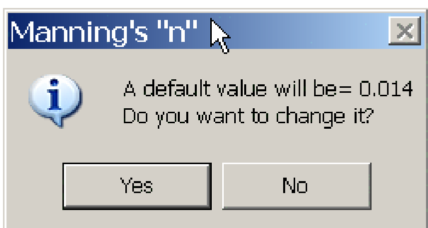


Figure 8.3

Click **No** to accept the default value (0.014). Click **Yes** to open the Manning's Roughness Factor "n" dialog (Figure 8.4).

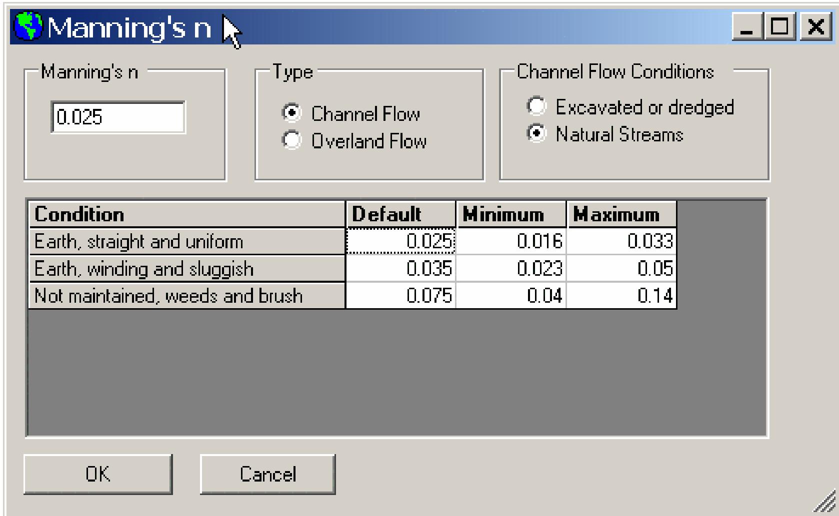


Figure 8.4

Enter the input value in the box labeled "Manning's n" or set its value by clicking on one of the tabulated values within the dialog. Click **Cancel** to use the default value (0.014). Click **OK** to use the current value in the input box.

4. When writing of the *.rte* (main channel input) database begins, a prompt box appears (Figure 8.5) offering two options for defining Manning's roughness factor for the main channels in all subbasins.

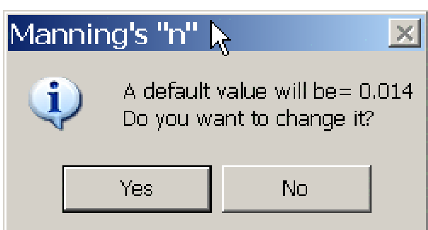


Figure 8.5

Click **No** to accept the default value (0.014). Click **Yes** to open the Manning's Roughness Factor "n" dialog (Figure 8.4).

Enter the input value in the box labeled "Manning's n" or set its value by clicking on one of the tabulated values within the dialog. Click **Cancel** to use the default value (0.014). Click **OK** to use the current value in the input box.

5. When writing of the *.mgt* (management input) database begins, a prompt box appears with two options for defining plant growth heat units (Figure 8.6):

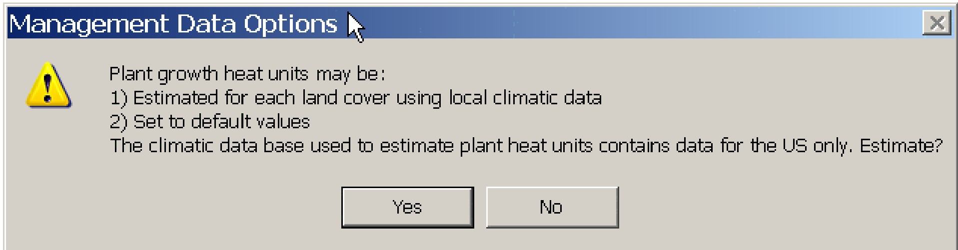


Figure 8.6

a. **Yes** may be chosen only for watersheds in the northern hemisphere. If you click **Yes**, the plant heat units will be calculated from local climatic parameters stored in an internal weather generator database.

b. If you click **No**, a dialog box will appear asking for a default heat unit value (Figure 8.7). The default heat unit value will be used for all land cover/plants within the watershed. Click **Cancel** to abort. Click **OK** to use the current value in the input box.

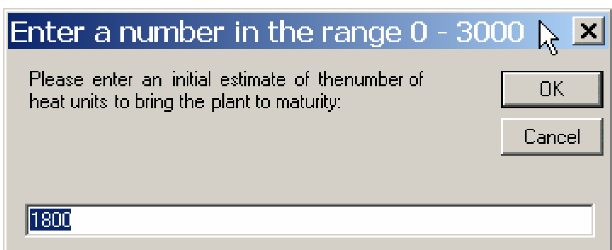


Figure 8.7

6. When all databases have been built, a message box will be displayed (Figure 8.8).

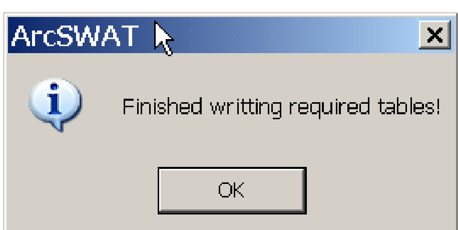


Figure 8.8

Click **OK** to proceed.

At this point, all the **Write** commands will be active (Figure 8.9). You can recreate the default input for all the tables by clicking **Write All** at a later time, or you can recreate default inputs for individual tables by clicking on the individual Write commands (described in the next section).

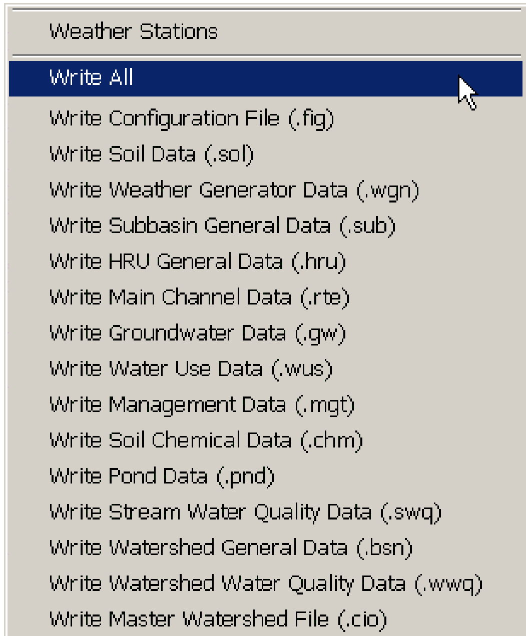


Figure 8.9

7. When all of the default inputs have been generated, you can move to the **SWAT Simulation** menu and make a SWAT run (See Section 14) or edit the default inputs using the editors activated under the **Edit SWAT Inputs** menu (See Sections 9-13).

SECTION 8.2: INDIVIDUAL WRITE COMMANDS

As an alternative to writing all the input files at once, they can be written individually. If this method is used to write the input database files, the database files must be written (selected) in the sequence in which they are presented in the *Input* menu: watershed configuration file (Figure 8.10), soil data, weather generator data, general subbasin data, hru general data, main channel data, groundwater data, water use data, management data, soil chemical data, pond data, stream water quality data, watershed general data, watershed water quality data, and master watershed file.

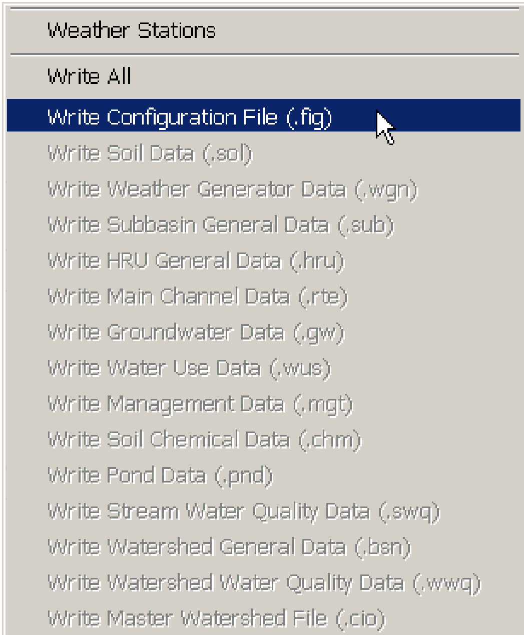


Figure 8.10

1. To write SWAT input databases individually, begin by selecting the **Write Configuration File (.fig)** command from the **Write Input Tables** menu. This selection generates the watershed configuration file (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 2 and Appendix B). When the file has been written, a message box will pop up (Figure 8.11).

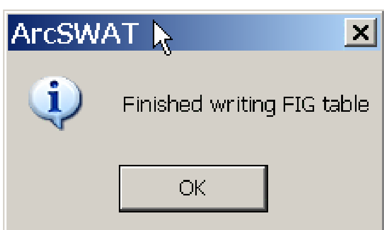
   

   Figure 8.11

   Click **OK** to proceed.

2. From the **Write Input Tables** menu, select **Write Soil Data (.sol)**. This selection generates the HRU soil data (see the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 22). When the data files have been written, a message box will pop up (Figure 8.12).

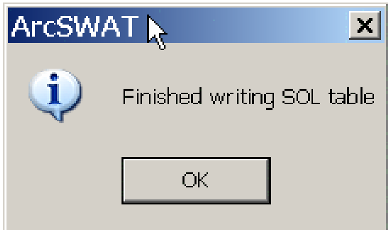


Figure 8.12

Click **OK** to proceed.

3. From the **Write Input Tables** menu, select **Write Weather Generator Data (.wgn)**. This selection generates the subbasin weather generator data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 12). When the data files have been written, a message box will pop up (Figure 8.13).

Figure 8.13

Click **OK** to proceed.

4. From the **Write Input Tables** menu, select **Write General Subbasin Data (.sub)**. This selection generates the general subbasin data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 6). A prompt box pops up (as described in 1.c under Section 8.1). When the data files have been written, a message box will pop up (Figure 8.14).

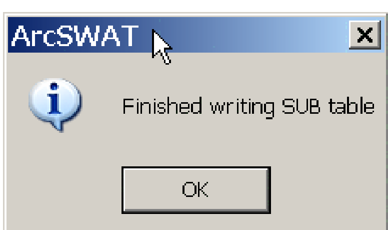


Figure 8.14

Click **OK** to proceed.

5. From the **Write Input Tables** menu, select **Write General HRU Data (.hru)**. This selection generates the general HRU data (see *Soil and Water*

Assessment Tool User's Manual, Version 2005, Chapter 19). When the data files have been written, a message box will pop up (Figure 8.15).

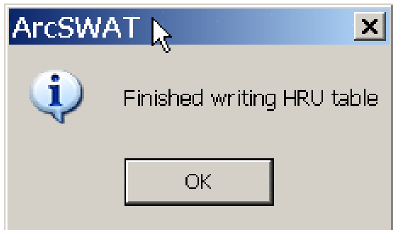


Figure 8.15

Click **OK** to proceed.

6. From the **Write Input Tables** menu, select **Write Main Channel Data (.rte)**. This selection generates the subbasin main channel data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 25). A prompt box pops up (as described in 1.d under Section 8.1). When the data files have been written, a message box will pop up (Figure 8.16).

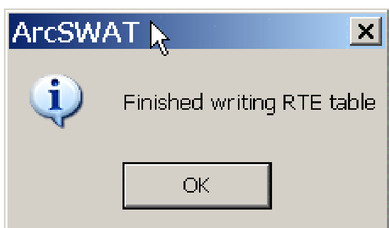


Figure 8.16

Click **OK** to proceed.

7. From the **Write Input Tables** menu, select **Write Groundwater Data (.gw)**. This selection generates the HRU groundwater data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 24). When the data files have been written, a message box will pop up (Figure 8.17).

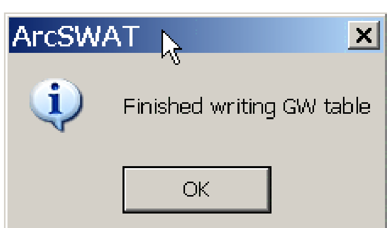


Figure 8.17

Click **OK** to proceed.

8. From the **Write Input Tables** menu, select **Write Water Use Data (.wus)**. This selection generates the subbasin water use data (see *Soil and Water*

Assessment Tool User's Manual, Version 2005, Chapter 21). When the data files have been written, a message box will pop up (Figure 8.18).

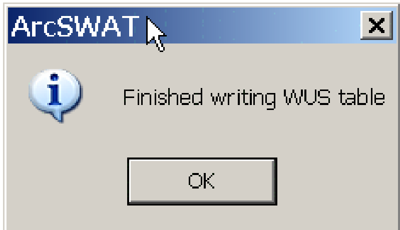


Figure 8.18

Click **OK** to proceed.

9. From the **Write Input Tables** menu, select **Write Management Data (.mgt)**. This selection generates the HRU management data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 20). A prompt box pops up (see description under 1.e under Section 8.1). When the data files have been written, a message box will pop up (Figure 8.19).

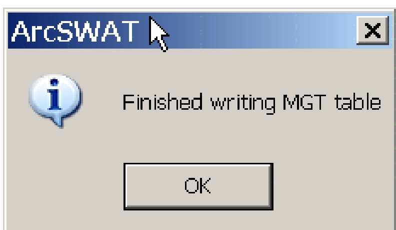


Figure 8.19

Click **OK** to proceed.

10. From the **Write Input Tables** menu, select **Write Soil Chemical Data (.chm)**. This selection generates the HRU soil chemical data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 23). When the data files have been written, a message box will pop up (Figure 8.20).

Figure 8.20

Click **OK** to proceed.

11. From the **Write Input Tables** menu, select **Write Pond Data (.pnd)**. This selection generates the subbasin pond data (see *Soil and Water*

Assessment Tool User's Manual, Version 2005, Chapter 28). When the data files have been written, a message box will pop up (Figure 8.21).

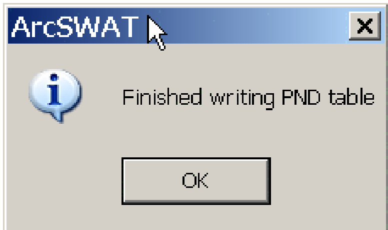


Figure 8.21

Click **OK** to proceed.

12. From the **Write Input Tables** menu, select **Write Stream Water Quality Data (.swq)**. This selection generates the subbasin stream water quality data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 27). When the data files have been written, a message box will pop up (Figure 8.22).

Figure 8.22

Click **OK** to proceed.

13. From the **Write Input Tables** menu, select **Write Watershed General Data (.bsn)**. This selection generates the subbasin stream water quality data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 4). When the data files have been written, a message box will pop up (Figure 8.23).

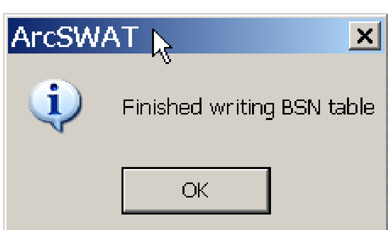


Figure 8.23

Click **OK** to proceed.

14. From the **Write Input Tables** menu, select **Write Watershed Water Quality Data (.wwq)**. This selection generates the subbasin stream water quality data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 26). When the data files have been written, a message box will pop up (Figure 8.24).

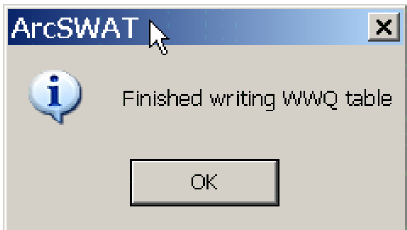


Figure 8.24

Click **OK** to proceed.

15. From the **Write Input Tables** menu, select **Write Master Watershed File (.cio)**. This selection generates the subbasin stream water quality data (see *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 26). When the data files have been written, a message box will pop up (Figure 8.25).

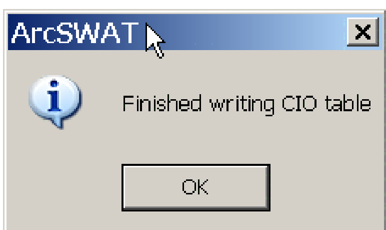


Figure 8.25

Click **OK** to proceed.

16. When all of the default inputs have been generated, you can move to the **SWAT Simulation** menu and make a SWAT run (See Section 14) or edit the default inputs using the editors activated under the **Edit Inputs** menu (See Sections 9-13).

SECTION 9: INPUT MODIFICATION—POINT SOURCES

The **Edit SWAT Input** menu allows you to edit the SWAT model databases and the watershed database files containing the current inputs for the SWAT model. Select the **Edit SWAT Input** menu using the mouse. Seven items are listed on the **Edit Input** menu (Figure 9.1).

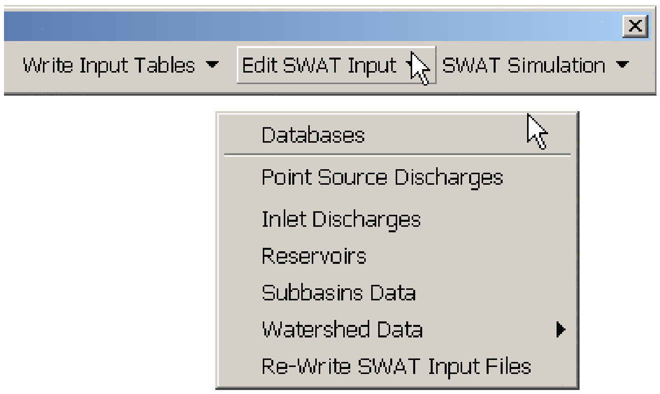


Figure 9.1

The second item of the **Edit SWAT Input** menu allows the user to edit point source discharge loadings. Point source discharges are added to the watershed configuration during the watershed discretization (see Section 5). Edits made to point source discharges using the ArcSWAT interface are reflected only in the current SWAT project.

1. Select **Point Source Discharges** from the **Edit SWAT Input** menu (Figure 9.2).

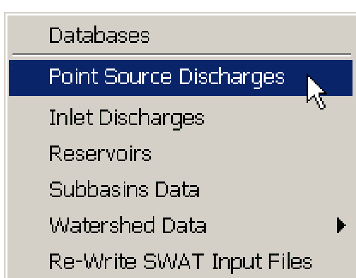


Figure 9.2

If there are no point sources in the watershed (See Section 5) a dialog box warns the user (Figure 9.3).

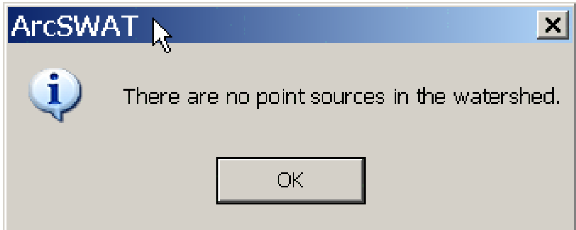


Figure 9.3

The Select Point Source dialog pops up (Figure 9.4) if at least one point source of discharge was set in the watershed (see Section 5).

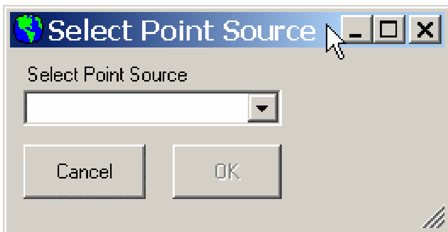


Figure 9.4

All subbasins containing point sources are listed.

2. To edit point source data for a subbasin, select the number of the subbasin from the **Select Point Source** combo box (Figure 9.5) and click the **OK** button.

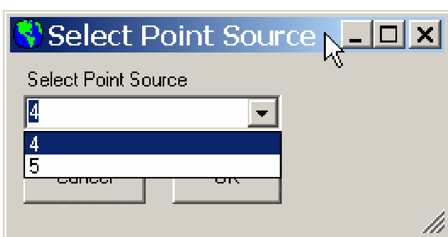


Figure 9.5

3. The Point Discharges Data dialog box will open, displaying the data for the point source in the selected subbasin (Figure 9.6). When the dialog initially appears, the dialog in View mode. This allows the user to view the current parameters for the selected point source. All the controls for editing the data are not enabled (i.e., “grayed out”).

   To edit the current parameters for the point source, click the **Edit Values** button. The dialog is now in Edit mode. The controls for editing the point source become enabled (Figure 9.6). You can now make changes to any of the point source parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your point source will revert back to their original values.

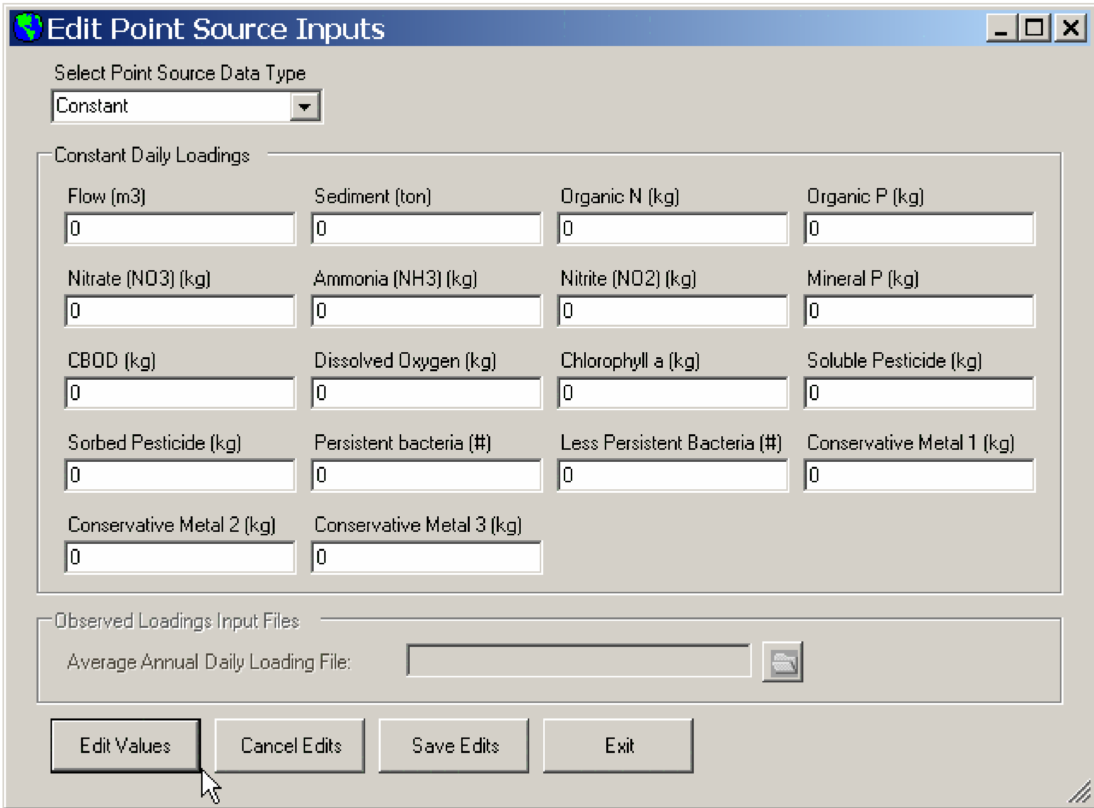


Figure 9.6

Point source data may be summarized in one of four formats: constant daily loadings, average annual loadings, average monthly loadings, and daily loadings. The **Select Point Source Data Type** combo box located at the top of the dialog box allows the user to select the data format they prefer.

a. **Constant Daily Loadings**. By default, this item will be selected. If the point source loadings are to be input as constant daily loadings, verify that the “Constant” item is selected.

   This option allows the user to enter the following data: average daily water loading (flow) [m3], sediment loading [tons], organic nitrogen [kg], organic phosphorus [kg], nitrate (NO3) [kg], ammonia (NH3) [kg], nitrite (NO2) [kg], mineral (soluble) phosphorus loading [kg], CBOD loading [kg], dissolved oxygen loading [kg], chlorophyll a loading [kg], soluble pesticide loading [kg], sorbed pesticide [kg], persistent bacteria, less persistent bacteria (both in [# bacteria/100 ml]), conservative metal #1 [kg], conservative metal #2, conservative metal #3 [kg], as required by the SWAT model (see the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 31). This data represents average daily loadings input to the stream network every day of the simulation.

To define the constant daily loadings, enter the data in the section of the dialog box labeled **Constant Daily Loadings** (Figure 9.7).

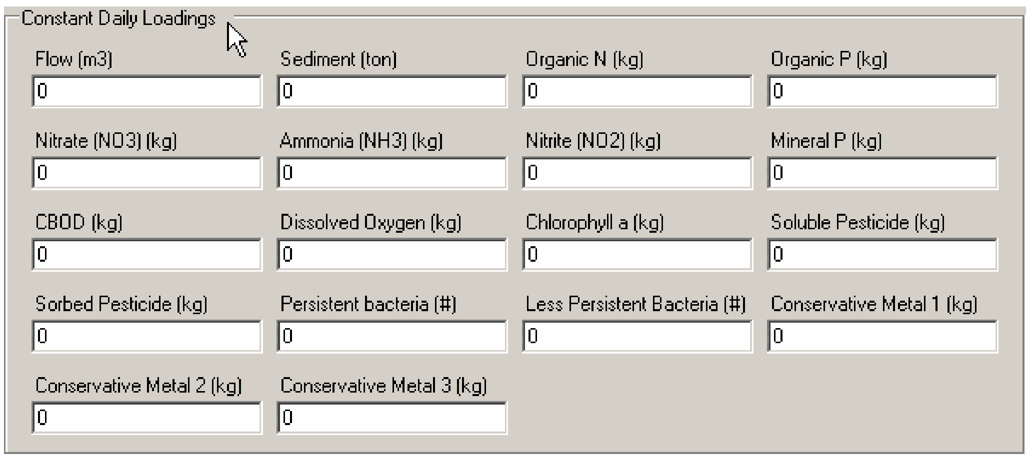


Figure 9.7

b. **Average annual daily loadings**. If the point source loadings are to be input as average daily loadings for each year, verify that the "Annual Records" item is selected from the **Select Point Source Data Type** combo box.

The **Observed Loadings Input Files** section in the dialog box is now enabled (Figure 9.8).

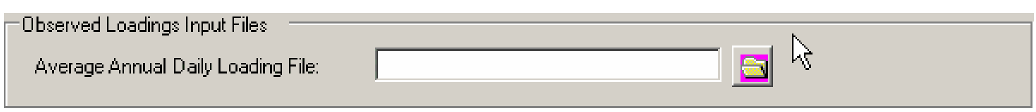


Figure 9.8

This option requires the user to summarize daily loadings by year (see the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 31). Prior to creating the project, a data table should be set up following the format specified for Annual Loadings in Section 3.3.

i. Click the open file folder button to the right of the text box.

ii. A browser will be displayed, allowing the user to select the dBASE file (.dbf) or text file (.txt) containing the point source data from disk (Figure 9.9).

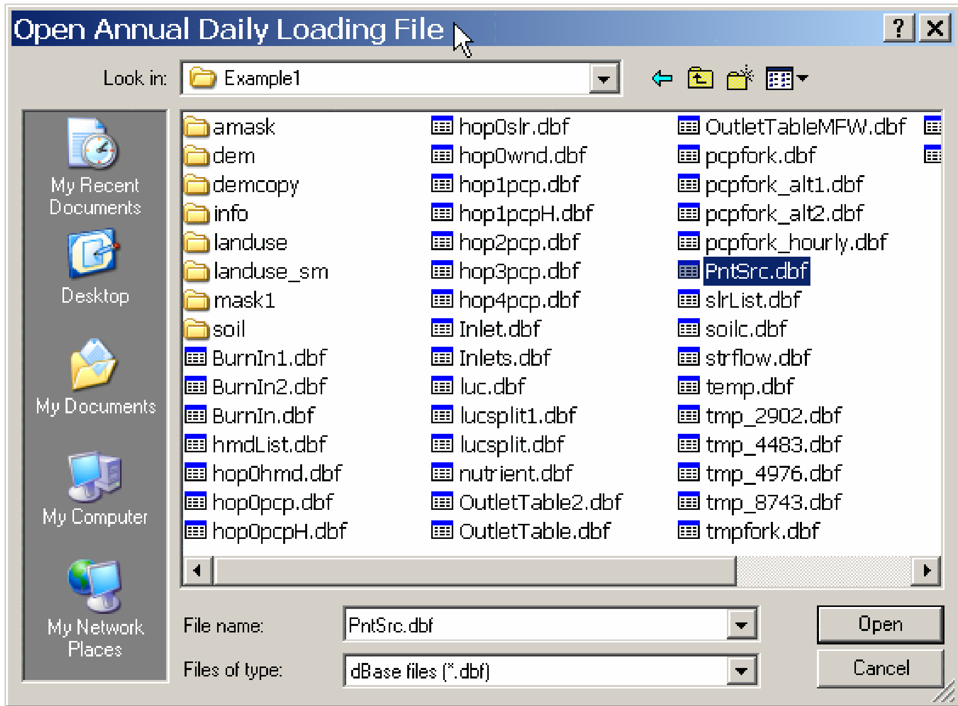


Figure 9.9

iii. Select the file and click **Open**.

c. **Average monthly daily loadings**. If the point source loadings are to be input as average daily loadings summarized on a monthly basis, verify that the “Monthly Records” item is selected from the **Select Point Source Data Type** combo box.

The **Observed Loadings Input Files** section in the dialog box is now enabled (Figure 9.10).

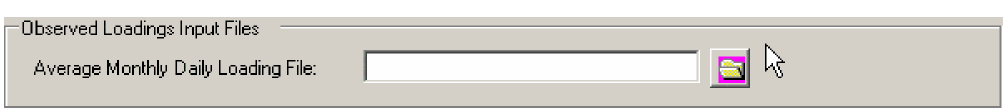


Figure 9.10

This option requires the user to summarize average daily loadings by month (see the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 31). Prior to creating the project, a data table should be set up following the format specified for Monthly Loadings in Section 3.3.

i. Click on the open file folder button to the right of the text box.

ii. A browser will be displayed, allowing the user to select the dBASE file (.dbf) or text file (.txt) containing the point source data from disk (Figure 9.11).

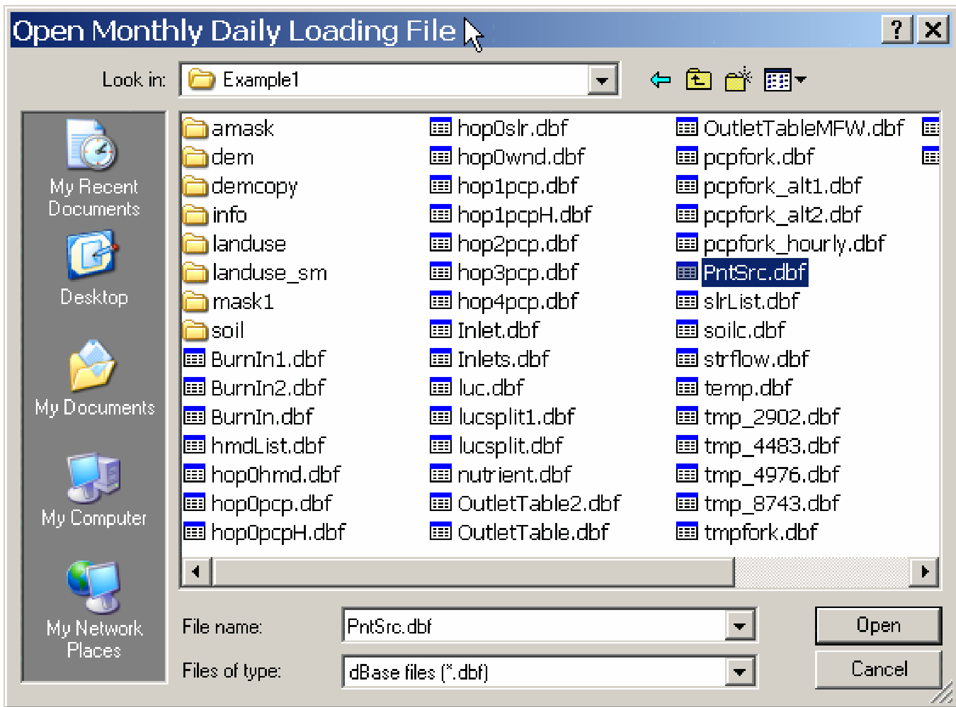


Figure 9.11

iii. Select the file and click Open.

d. **Daily Loadings**. If the point source loadings are to be input as average daily loadings summarized on a monthly basis, verify that the “Daily Records” item is selected from the **Select Point Source Data Type** combo box.

The Daily Loadings section of the dialog box is now enabled (Figure 9.12).

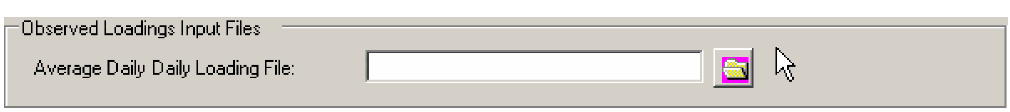


Figure 9.12

This option requires the user to summarize loadings by day (see the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 31). Prior to creating the project, a data table should be set up following the format specified for Daily Loadings in Section 3.3.

i. Click on the open file folder button to the right of the text box.

ii. A browser will be displayed, allowing the user to select the dBASE file (.dbf) or text file (.txt) file containing the point source data from disk (Figure 9.13).

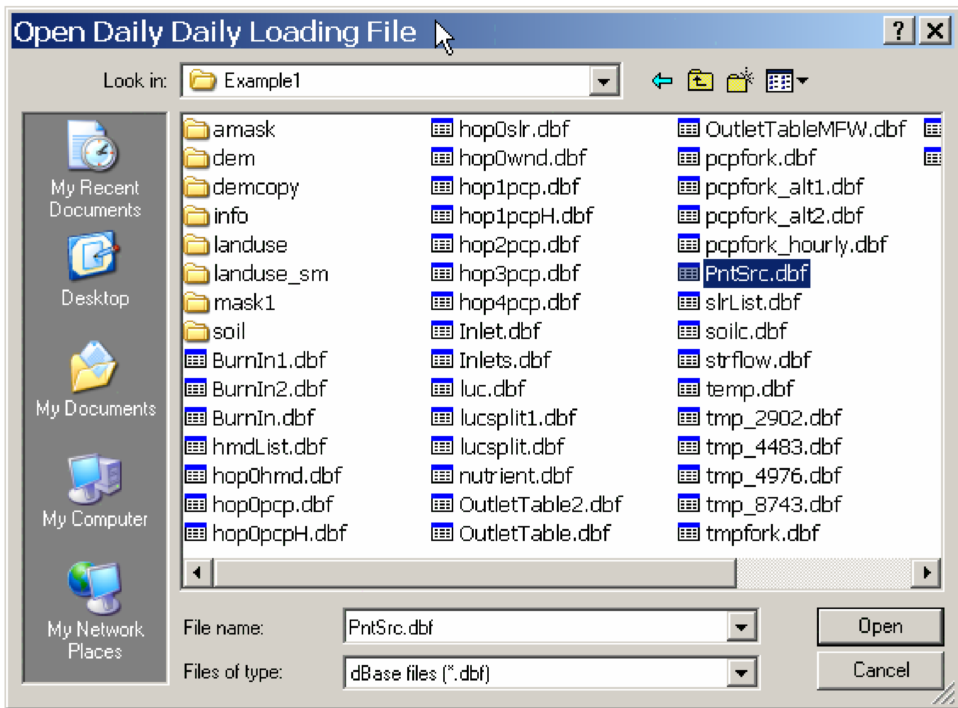


Figure 9.13

iii. Select the file and click **Open**.

4. When you have finished inputting your point source parameters, click the **Save Edits** button. This will write the edits to the "pp" table in the SWAT Project Geodatabase. A message box will appear (Figure 9.14).

Figure 9.14

5. Click the **Exit** button in the Edit Point Discharges Input dialog box to return to the **Select Point Source** dialog (Figure 9.15).

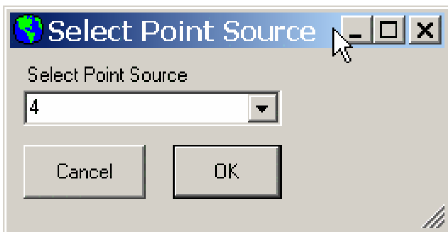


Figure 9.15

6. Click the **Cancel** button on the **Select Point Source** dialog to return the ArcSWAT project, or choose a new point source to edit.

SECTION 10: INPUT MODIFICATION—INLET DISCHARGES

The **Edit SWAT Input** menu allows you to edit the SWAT model databases and the watershed database files containing the current inputs for the SWAT model. Select the **Edit SWAT Input** menu using the mouse. Seven items are listed on the **Edit Input** menu (Figure 10.1).

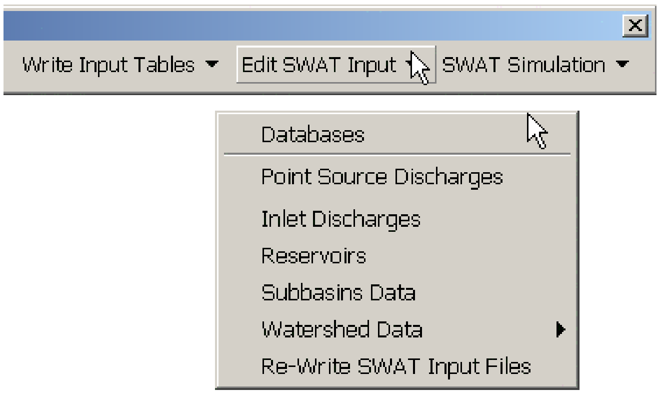


Figure 10.1

The third item of the Edit SWAT Input menu allows the user to edit inlet discharge loadings. Inlet discharges are added to the watershed configuration during the watershed discretization (see Section 5). Edits made to inlet discharges using the ArcSWAT interface are reflected only in the current SWAT project.

1. Select **Inlet Discharges** from the **Edit SWAT Input** menu (Figure 10.2).

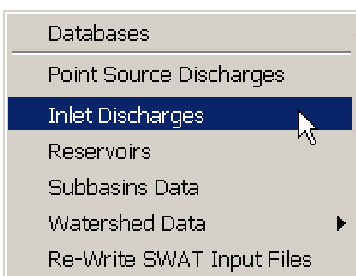


Figure 10.2

If there are no inlets in the watershed (See Section 5) a dialog box warns the user (Figure 10.3).

Figure 10.3

The Select Inlet dialog pops up (Figure 10.4) if at least one inlet discharge was set in the watershed (see Section 5).

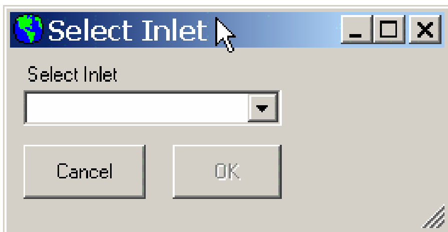


Figure 10.4

All subbasins containing inlets are listed.

2. To edit inlet data for a subbasin, select the number of the subbasin from the **Select Inlet** combo box (Figure 10.5) and click the **OK** button.

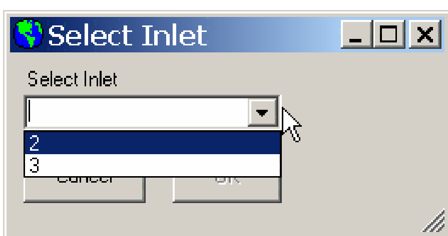


Figure 10.5

3. The Edit Inlet Inputs dialog box will open, displaying the data for the inlet in the selected subbasin (Figure 10.6). When the dialog initially appears, the dialog in View mode. This allows the user to view the current parameters for the selected inlet. All the controls for editing the data are not enabled (i.e., “grayed out”).

   To edit the current parameters for the inlet, click the **Edit Values** button. The dialog is now in Edit mode. The controls for editing the inlet become enabled (Figure 10.6). You can now make changes to any of the inlet parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your inlet will revert back to their original values.

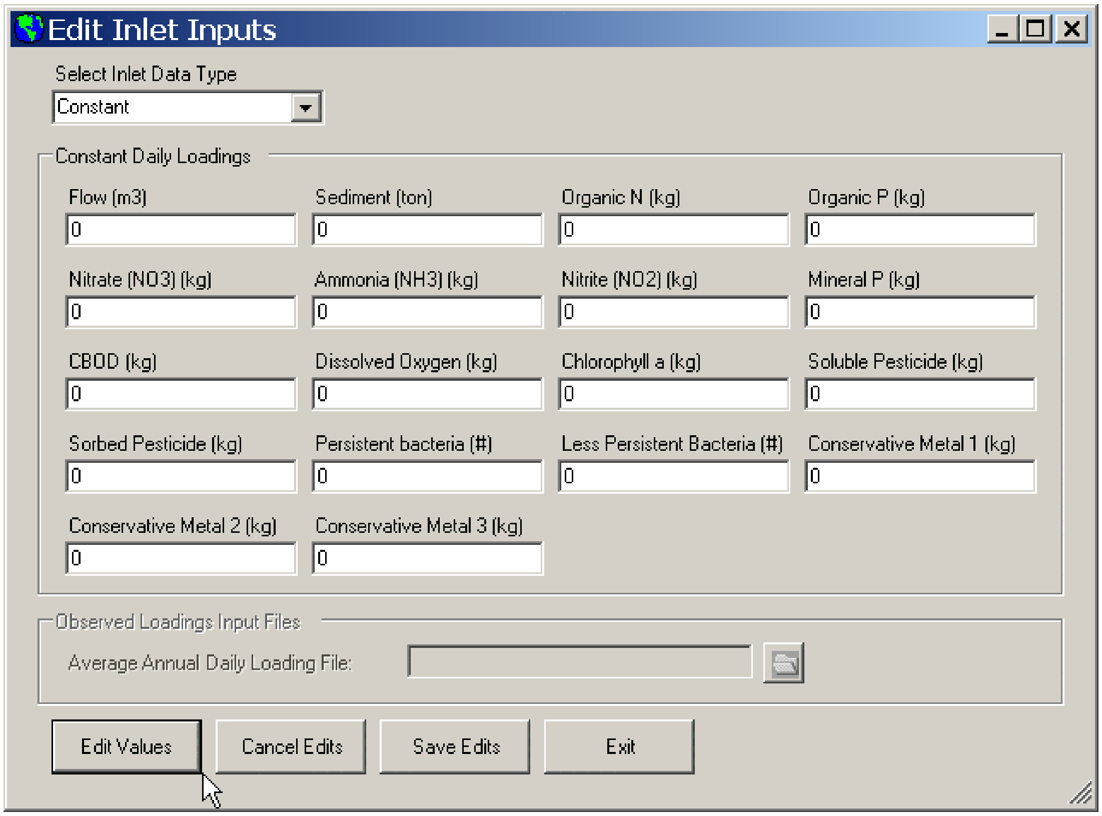


Figure 10.6

Inlet data may be summarized in one of four formats: constant daily loadings, average annual loadings, average monthly loadings, and daily loadings. The **Select Inlet Data Type** combo box located at the top of the dialog box allows the user to select the data format they prefer.

a. **Constant Daily Loadings**. By default, this item will be selected. If the inlet loadings are to be input as constant daily loadings, verify that the "Constant" item is selected.

   This option allows the user to enter the following data: average daily water loading (flow) [m3], sediment loading [tons], organic nitrogen [kg], organic phosphorus [kg], nitrate (NO3) [kg], ammonia (NH3) [kg], nitrite (NO2) [kg], mineral (soluble) phosphorus loading [kg], CBOD loading [kg], dissolved oxygen loading [kg], chlorophyll a loading [kg], soluble pesticide loading [kg], sorbed pesticide [kg], persistent bacteria, less persistent bacteria (both in [# bacteria/100 ml]), conservative metal #1 [kg], conservative metal #2, conservative metal #3 [kg], as required by the SWAT model (see the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 31). This data represents average daily loadings input to the stream network every day of the simulation.

To define the constant daily loadings, enter the data in the section of the dialog box labeled **Constant Daily Loadings** (Figure 10.7).

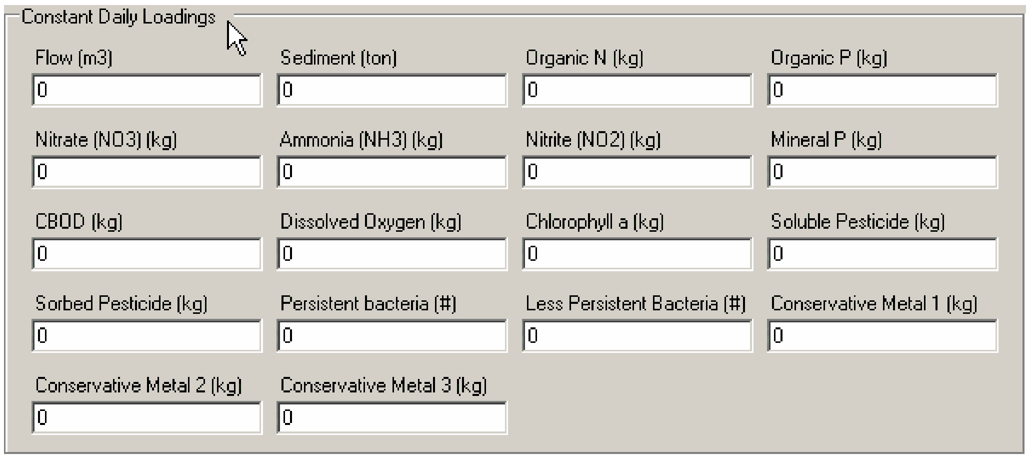


Figure 10.7

b. **Average annual daily loadings**. If the inlet loadings are to be input as average daily loadings for each year, verify that the "Annual Records" item is selected from the **Select Inlet Data Type** combo box.

The **Observed Loadings Input Files** section in the dialog box is now enabled (Figure 10.8).

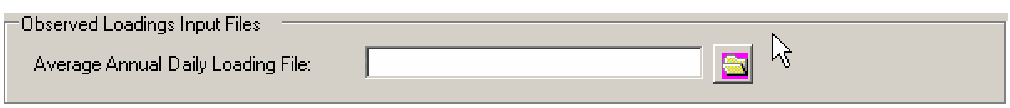


Figure 10.8

This option requires the user to summarize daily loadings by year (see the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 31). Prior to creating the project, a data table should be set up following the format specified for Annual Loadings in Section 3.3.

i. Click the open file folder button to the right of the text box.

ii. A browser will be displayed, allowing the user to select the dBASE file (.dbf)or text file (.txt) containing the inlet data from disk (Figure 10.9).

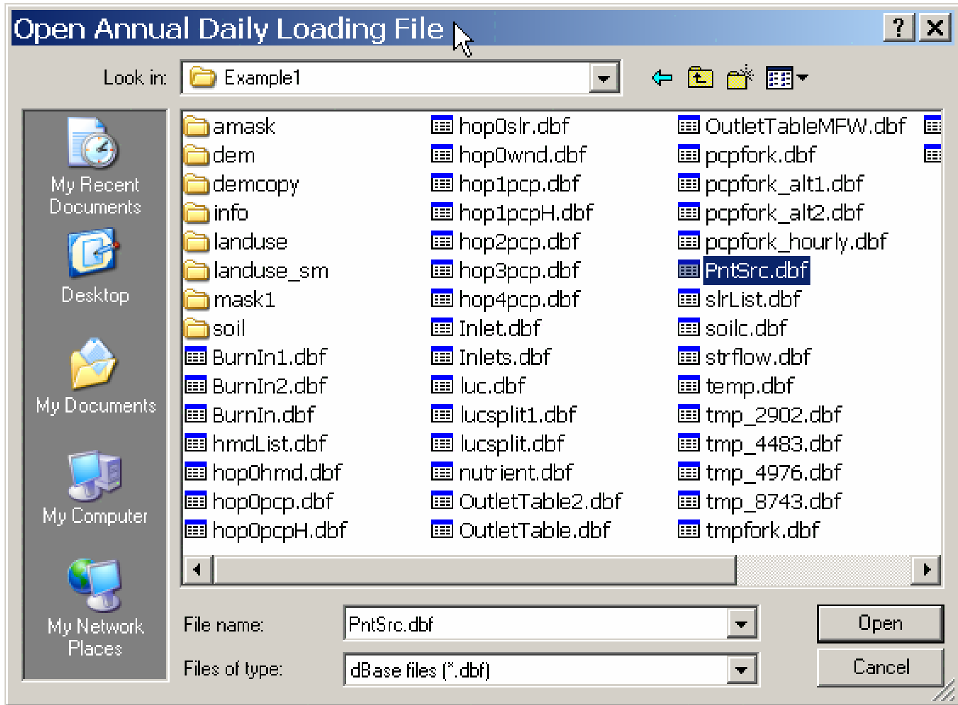


Figure 10.9

iii. Select the file and click **Open**.

c. **Average monthly daily loadings**. If the inlet loadings are to be input as average daily loadings summarized on a monthly basis, verify that the “Monthly Records” item is selected from the **Select Inlet Data Type** combo box.

The **Observed Loadings Input Files** section in the dialog box is now enabled (Figure 10.10).

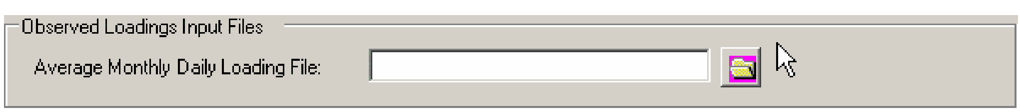


Figure 10.10

This option requires the user to summarize average daily loadings by month (see the *Soil and Water Assessment Tool User's Manual, Version 2005* , Chapter 31). Prior to creating the project, a data table should be set up following the format specified for Monthly Loadings in Section 3.3.

i. Click on the open file folder button to the right of the text box.

ii. A browser will be displayed, allowing the user to select the dBASE file (.dbf) or text file (.txt) containing the inlet data from disk (Figure 10.11).

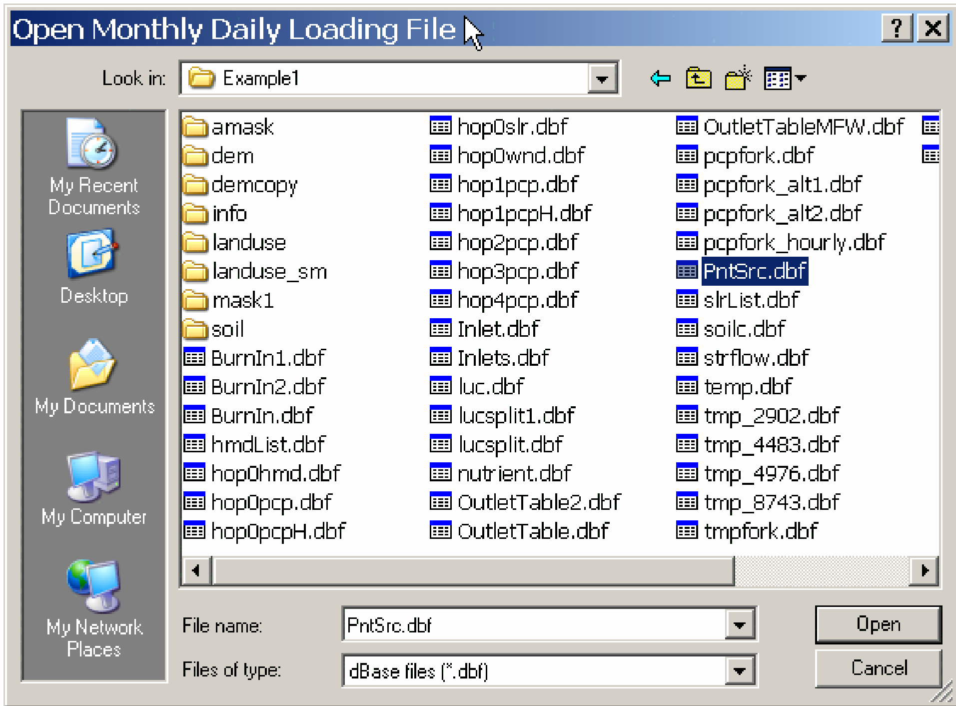


Figure 10.11

iii. Select the file and click **Open**.

d. **Daily Loadings**. If the inlet loadings are to be input as average daily loadings summarized on a monthly basis, verify that the "Daily Records" item is selected from the **Select Inlet Data Type** combo box.

The Daily Loadings section of the dialog box is now enabled (Figure 10.12).

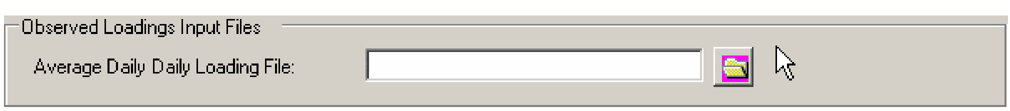


Figure 10.12

This option requires the user to summarize loadings by day (see the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 31). Prior to creating the project, a data table should be set up following the format specified for Daily Loadings in Section 3.3.

i. Click on the open file folder button to the right of the text box.

ii. A browser will be displayed, allowing the user to select the dBASE file (.dbf) or text file (.txt) containing the inlet data from disk (Figure 10.13).

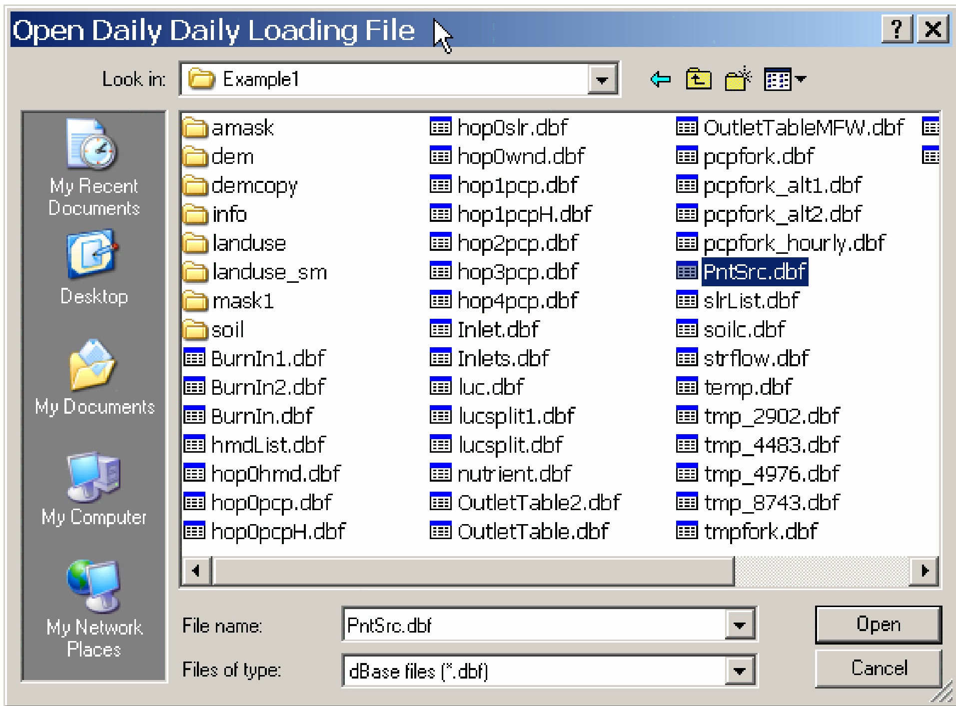


Figure 10.13

iii. Select the file and click **Open**.

4. When you have finished inputting your inlet parameters, click the **Save Edits** button. This will write the edits to the “ppi” table in the SWAT Project Geodatabase. A message box will appear (Figure 10.14).

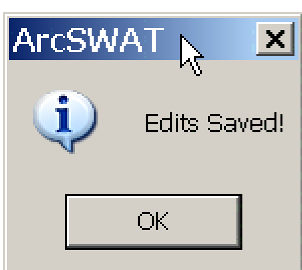


Figure 10.14

5. Click the **Exit** button in the Edit Point Discharges Input dialog box to return to the **Select Inlet** dialog (Figure 10.15).

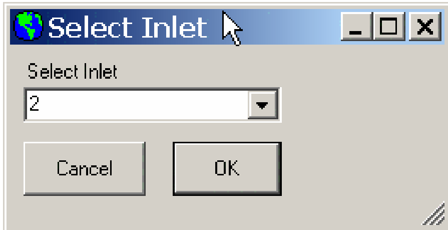


Figure 10.15

6. Click the **Cancel** button on the **Select Inlet** dialog to return the ArcSWAT project, or choose a new inlet to edit.

SECTION 11: INPUT MODIFICATION—RESERVOIRS

The **Edit SWAT Input** menu allows you to edit the SWAT model databases and the watershed database files containing the current inputs for the SWAT model. Select the **Edit SWAT Input** menu using the mouse. Seven items are listed on the **Edit Input** menu (Figure 11.1).

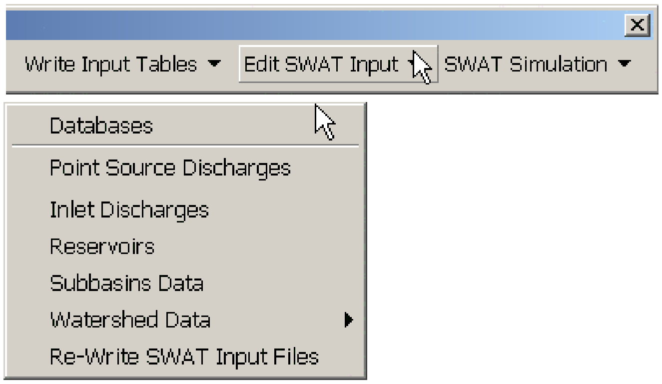


Figure 11.1

The third item of the Edit SWAT Input menu allows the user to edit reservoir parameters/inputs. Reservoirs are added to the watershed configuration during the watershed discretization (see Section 5). Edits made to reservoirs using the ArcSWAT interface are reflected only in the current SWAT project.

1. Select **Reservoirs** from the **Edit Input** menu. If no reservoirs are defined in the watershed (See Section 5), a dialog box notifies the user (Figure 11.2).

Figure 11.2

The Select Reservoir dialog pops up (Figure 11.3) if at least one reservoir was set in the watershed (see Section 5).

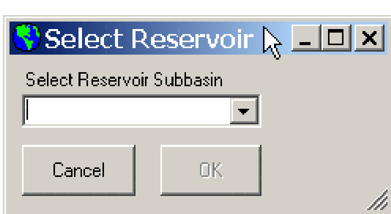


Figure 11.3

All subbasins containing reservoirs will be listed.

2. To edit inlet data for a reservoir, select the number of the subbasin from the **Select Reservoir** combo box (Figure 11.4) and click the **OK** button

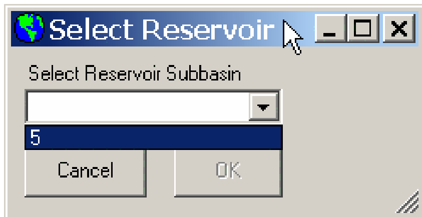


Figure 11.4

3. The Edit Reservoir Parameters dialog box will open, displaying the data for the reservoir in the selected subbasin (Figure 11.5). The Reservoir data dialog box allows the user to enter/edit reservoir parameters related to the water, sediment, nutrient and pesticide processes occurring in the reservoir. The dialog has three tabs: **Reservoir Data, Monthly Data,** and **Lake Water Quality Data**. When the dialog initially appears, the dialog in View mode. This allows the user to view the current parameters for the selected reservoir. All the controls for editing the data are not enabled (i.e., “grayed out”). To edit the current parameters for the reservoir, click the **Edit Values** button. The dialog is now in Edit mode. The controls for editing the reservoir become enabled (Figure 11.6). You can now make changes to any of the reservoir parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your reservoir will revert back to their original values.

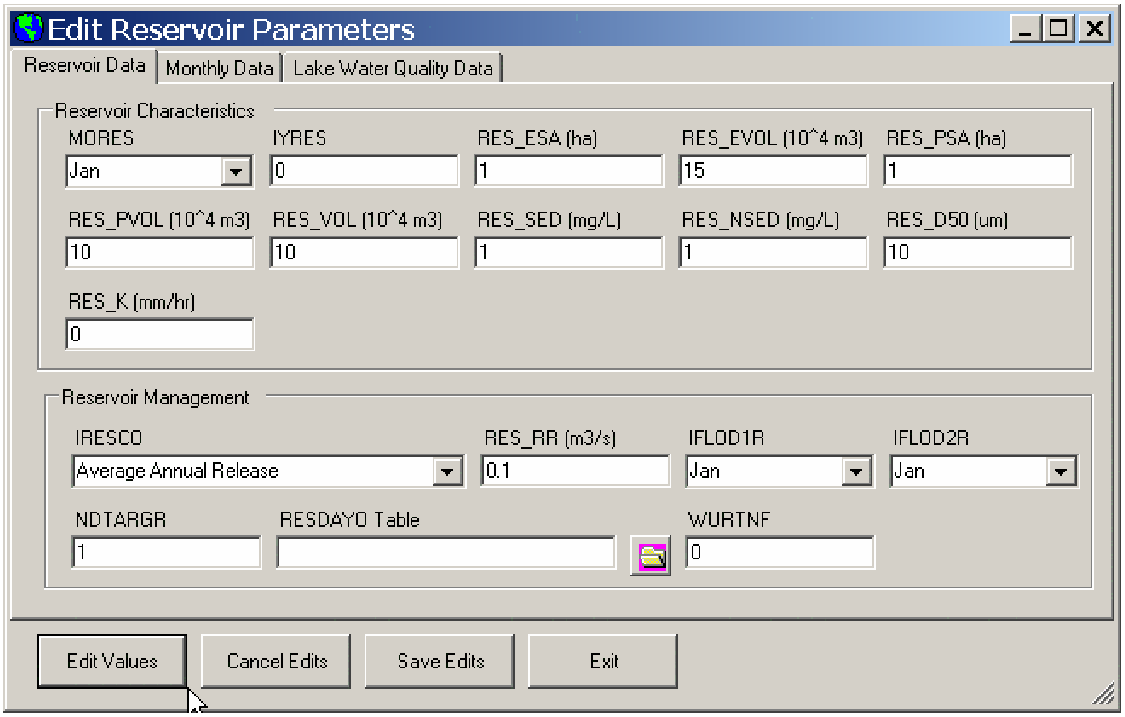


Figure 11.5

a. **Reservoir Data**. The variable names listed in the **Reservoir Data** tab control the physical characteristics and management of the reservoir. There variables are defined in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 29.

Note: If the cursor is placed on top of any text box or button, a short help description "tooltip") appears and the range of variation for parameter is shown.

To edit a parameter, activate the text box adjacent to the variable name by clicking on it. Enter and/or edit the text value.

If the value for the parameter entered is out of range a message box like the one in Figure 11.6 appears.

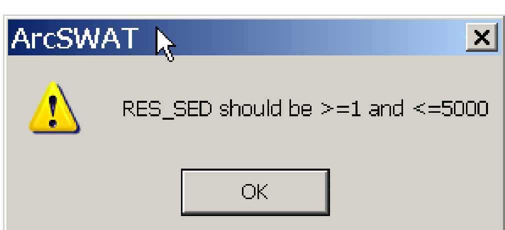


Figure 11.6

Click **OK**. The parameter is reset to the previous value.

If the user selects **Measured monthly outflow** or **Measured daily outflow** as the outflow option (IRESCO), predefined formatted tables must be used to input the outflow data.

i. **Daily Reservoir Outflow data**. If **Measured daily outflow** is selected from the **IRESCO** drop-down list (Figure 11.7), the user is required to create a data table containing the daily outflow information for the reservoir following the format specified for Reservoir Daily Outflow in Section 3.3.

Figure 11.7

The text box labeled “RESDYAO Table” is enabled (Figure 11.8).

Figure 11.8

Click the open file folder button. A browser will be displayed, allowing the user to select the dBASE file (.dbf) or text file (.txt) containing the inlet data from disk (Figure 11.9).

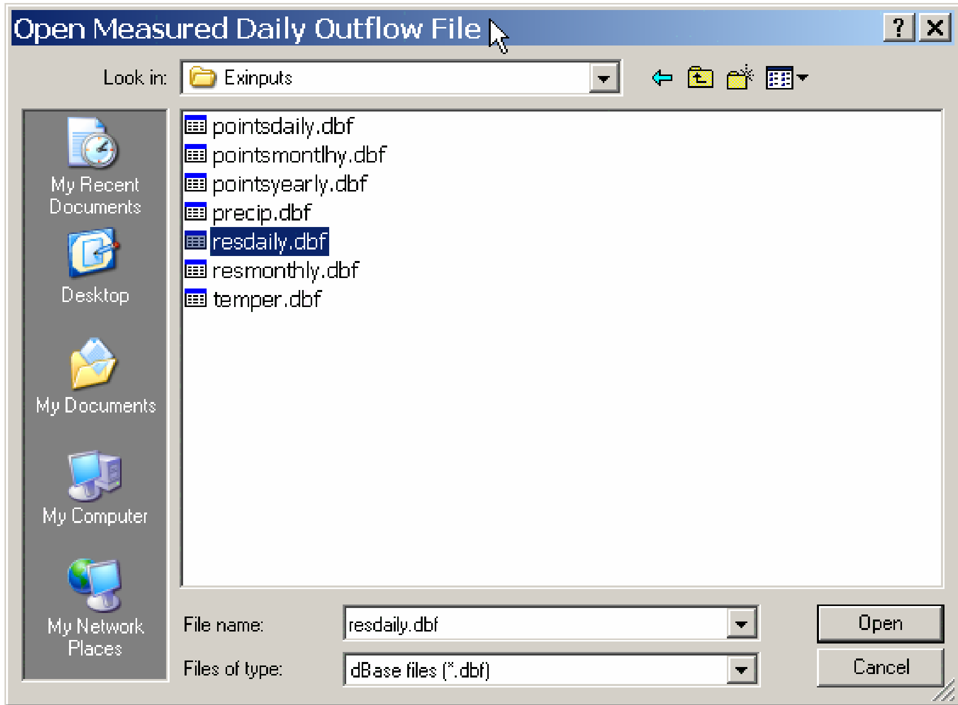


Figure 11.9

Select the file and click Open.

ii. **Monthly Reservoir Outflow data**. If **Measured monthly outflow** is selected from the **IRESCO** drop-down list (Figure 11.10), the user is required to create a data table containing the monthly outflow information for the reservoir following the format specified for Reservoir Monthly Outflow in Section 3.3.

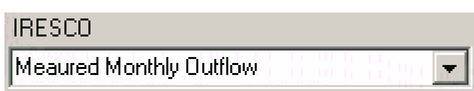


Figure 11.10

The text box labeled “RESMONO Table” is enabled (Figure 11.11).

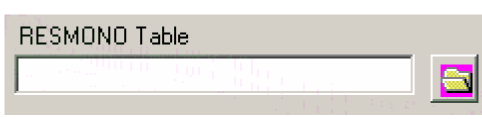


Figure 11.11

Click the open file folder button. A browser will be displayed, allowing the user to select the dBASE file (.dbf) or text file (.txt) containing the inlet data from disk (Figure 11.12).

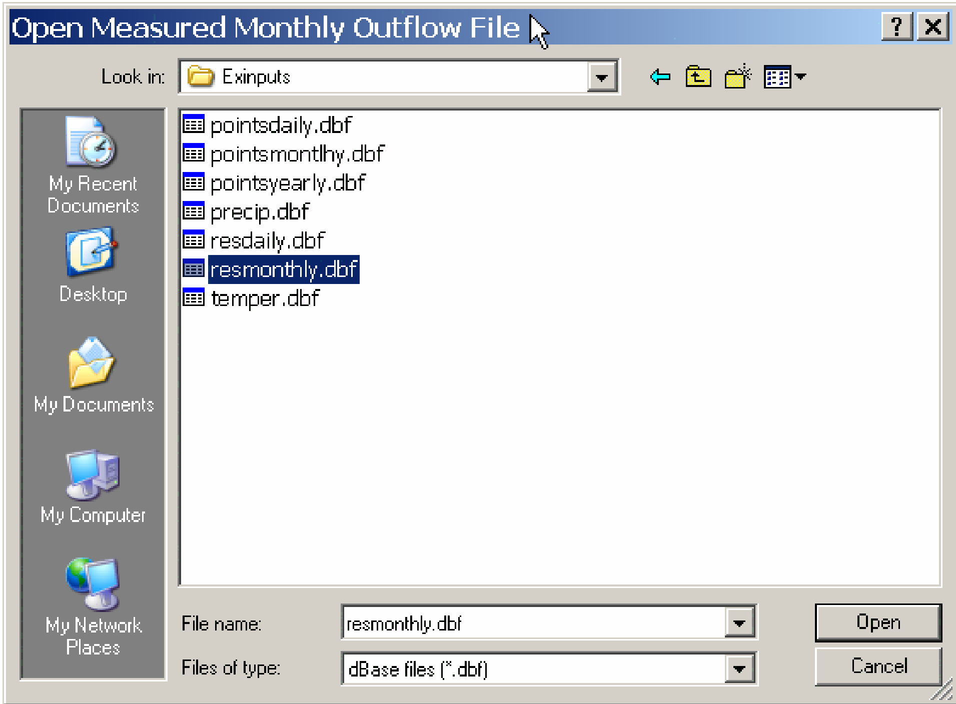


Figure 11.12

Select the file and click Open.

b. **Monthly Data**: The variable names listed in the **Monthly Data** tab (Figure 11.13) control the constant monthly parameters of the reservoir. There variables are defined in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 29.

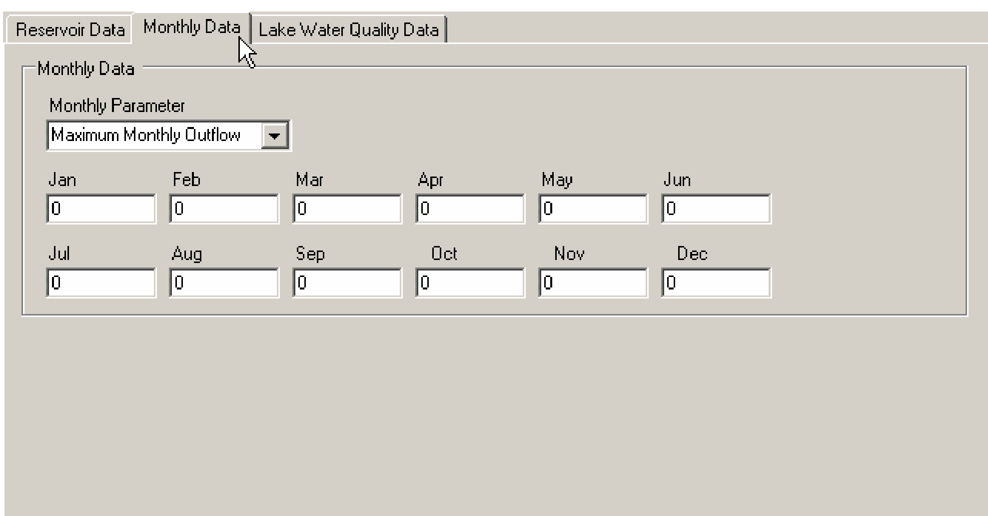


Figure 11.13

The monthly parameter of interest may be changed by selecting different values from the **Monthly Parameter** combo box (Figure 11.14).

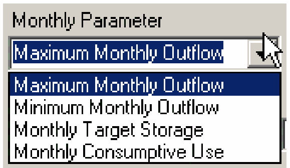


Figure 11.14

New monthly values for the selected parameter are entered into the individual monthly text boxes (**Jan, Feb, Mar**, etc.)

c. **Lake Water Quality Data**. The variable names listed in the **Lake Water Quality Data** tab (Figure 11.15) control the water quality parameters of the reservoir. There variables are defined in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 30.

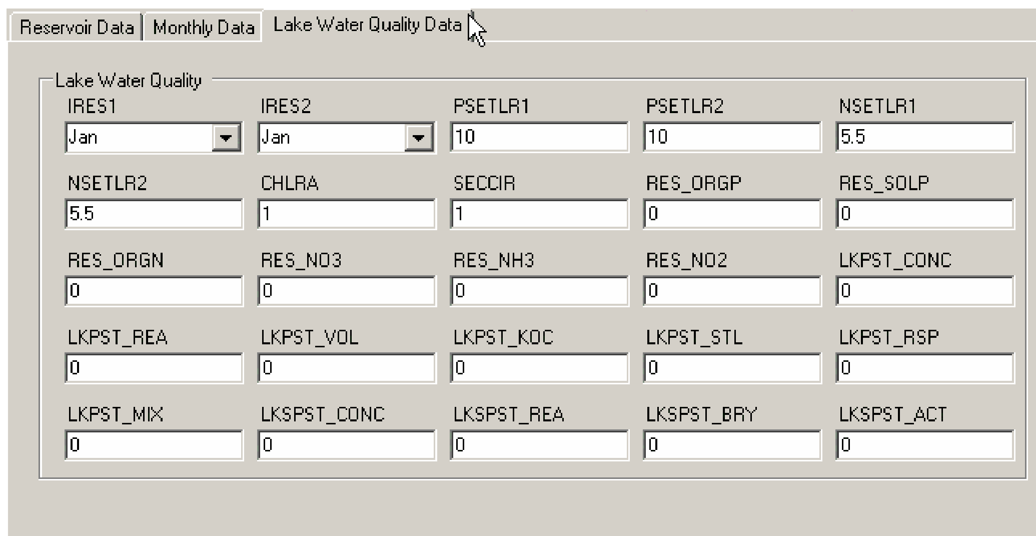


Figure 11.15

Note: If the cursor is placed on top of any text box or button, a short help description (yellow label) appears and the range of variation for parameters is shown.

To edit a parameter, activate the text box adjacent to the variable name by clicking on it. Enter and/or edit the text value.

If the current value of the parameter is out of range a message box like the one in Figure 11.16 appears.

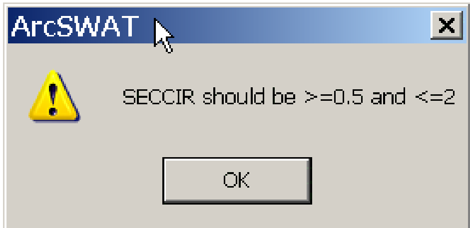


Figure 11.16

Click **OK**. The parameter is reset to the previous value.

4. When you have finished inputting your reservoir parameters, click the **Save Edits** button. This will write the edits to the "res" table in the SWAT Project Geodatabase. A message box will appear (Figure 11.17).

Figure 11.17

5. Click the **Exit** button in the Edit Reservoir Parameters dialog box to return to the **Select Reservoir** dialog (Figure 11.18).

Figure 11.18

6. Click the **Cancel** button on the **Select Reservoir** dialog to return the ArcSWAT project, or choose a new reservoir to edit.

SECTION 12: INPUT MODIFICATION--SUBBASINS

The **Edit SWAT Input** menu allows you to edit the SWAT model databases and the watershed database files containing the current inputs for the SWAT model. Select the **Edit SWAT Input** menu using the mouse. Seven items are listed on the **Edit Input** menu (Figure 12.1).

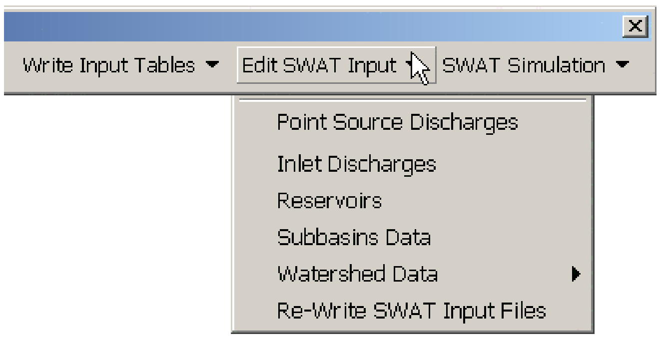


Figure 12.1

The fifth item of the **Edit SWAT Input** menu allows the user to edit land area, channel, pond/wetland, and groundwater parameters/inputs. Edits made to subbasin data using the ArcSWAT interface are reflected only in the current SWAT project.

Select the **Subbasins data** command on the **Edit SWAT Input** menu (Figure 12.2). This item is enabled only once the default input tables are created (see Section 8).

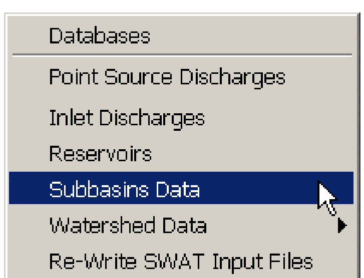


Figure 12.2

The Edit Subbasins Inputs dialog box is displayed (Figure 12.3).

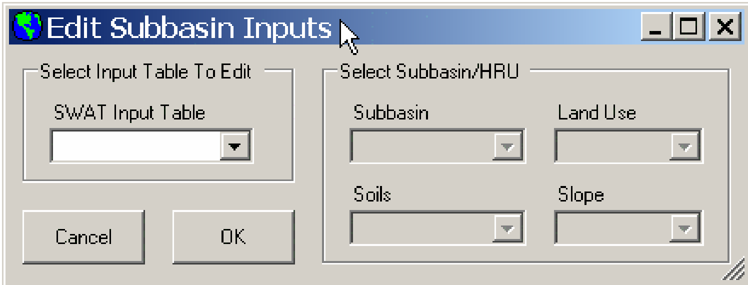


Figure 12.3

This dialog box is designed to facilitate the navigation and editing of the SWAT input data related to subbasins and HRUs. The dialog box contains four two sections.

1. **Select Input Table to Edit**: This section contains a combo box that allows the user to select the table in the SWAT Project Geodatabase that will be edited. The tables listed correspond to the file extensions of the SWAT ASCII files required to run the SWAT model (Figure 12.4). Descriptions of the parameters contained in each of these files can be found in the *Soil and Water Assessment Tool User's Manual, Version 2005*. After a **SWAT Input Table** has been selected, the **Select Subbasin/HRU** section will become enabled.

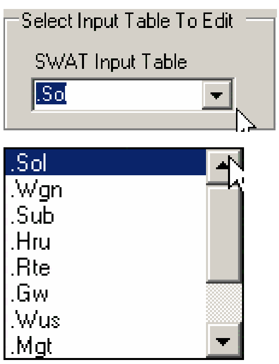


Figure 12.4

2. **Select Subbasin/HRU**: This section contains four combo boxes that allow users to specify the specific subbasin or HRU to edit.

   a. **Subbasin**: This combo box is the first one enabled. The user must select a subbasin from this list before proceeding (Figure 12.5).

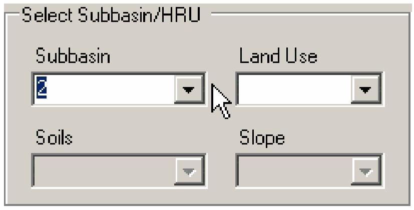


Figure 12.5

b. **Land Use**: The Land Use combo box will display all the land uses available within the selected subbasin. This combo box will only become enabled if the SWAT Input Table selected is one that contains HRU-level data. These include, Sol, Hru, Chm, Gw, and Mgt. The user must select a land use from this list before proceeding (Figure 12.6).

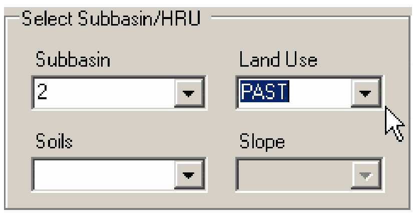


Figure 12.6

c. **Soils**: The Soils combo box will display all the soils available within the selected land use in the selected subbasin. The user must select a soil from this list before proceeding (Figure 12.7).

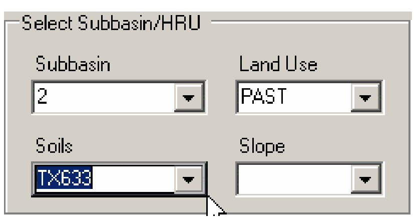


Figure 12.7

d. **Slope**: The Slope combo box will display all the slope classes for the selected soil available within the selected land use in the selected subbasin. The user must select a slope from this list before proceeding (Figure 12.8).

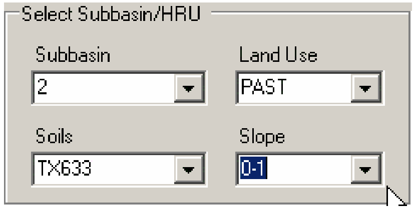


Figure 12.8

Once all HRU components are selected, click the OK button on the Edit Subbasin Inputs dialog (Figure 12.9). This will open an editing dialog for the SWAT input table specified.

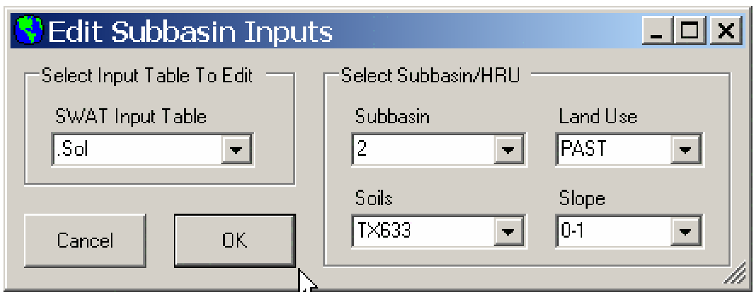


Figure 12.9

The following sections review each of the SWAT input editors. SWAT input in the interface is organized by SWAT input file type (as described in the Soil and Water Assessment Tool User's Manual, Version 2005).

SECTION 12.1: EDIT SOIL PARAMETERS (.SOL)

The **Edit Soil Parameters** dialog is launched if the user selects .Sol from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying the soil physical data for the HRU selected (Figure 12.10). A complete description of the variables is provided in the Soil and Water Assessment Tool User's Manual, Version 2005, Chapter 22. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected HRU. All the controls for editing the data are not enabled (i.e., "grayed out").

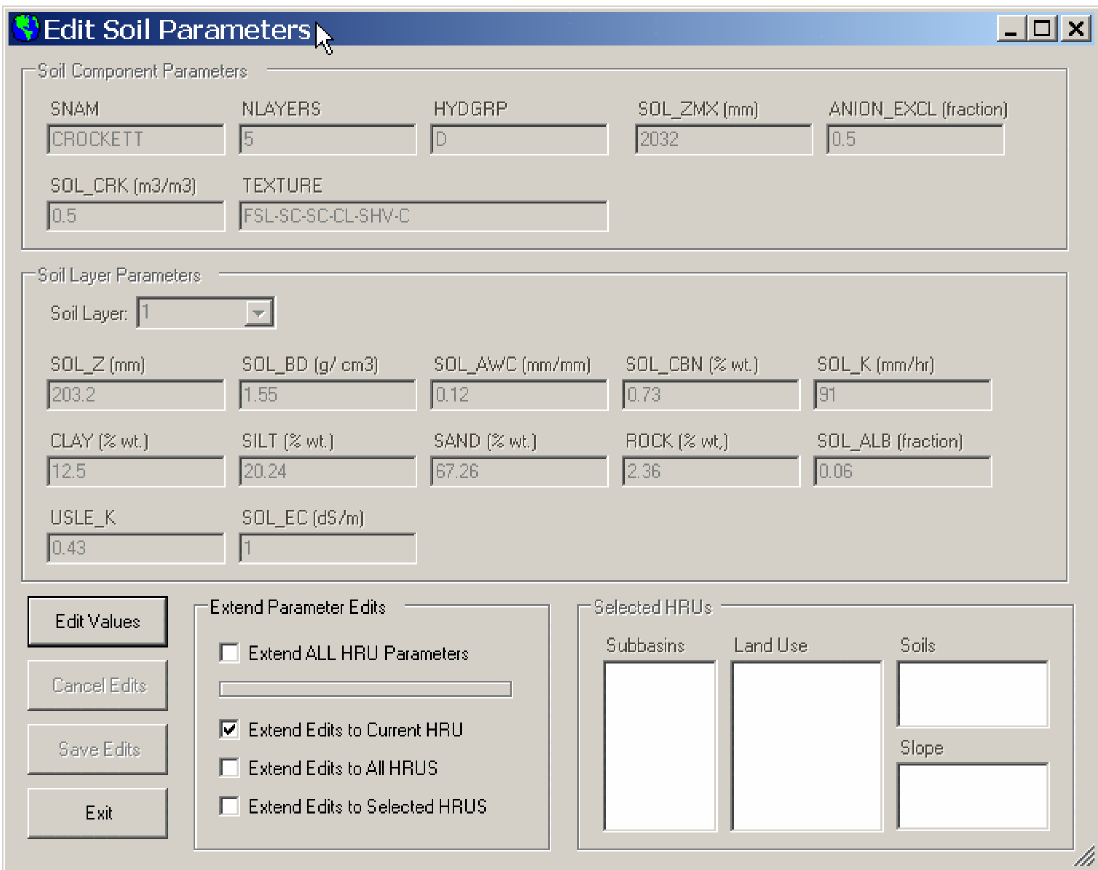


Figure 12.10

Editing Soil Parameters:

1. To edit the current parameters for the HRU, click the **Edit Values** button. The dialog is now in Edit mode. The controls for editing the HRU become enabled (Figure 12.11). You can now make changes to any of the soil parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to

save the edits you have made, click the **Cancel Edits** button, and the parameters for your HRU will revert back to their original values.

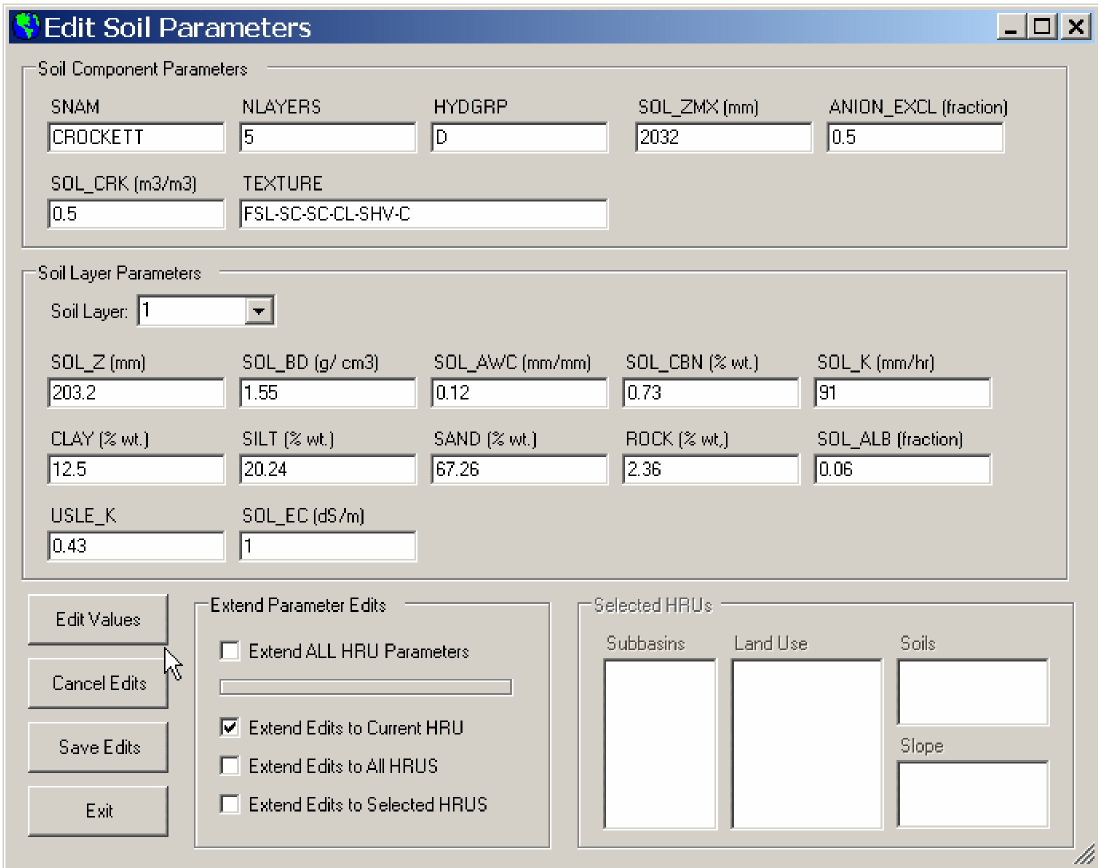


Figure 12.11

2. Initially, the parameters for the **Soil Layer Properties** are displayed for soil layer 1. The user can change the current soil layer by selecting a different layer from the **Soil Layer** combo box. As you change the soil layer, the parameters in the **Soil Layer Parameters** section will also change (Figure 12.12).

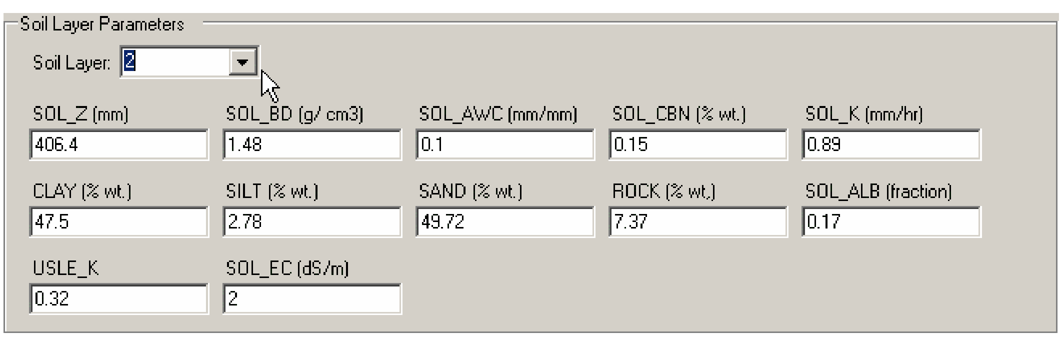


Figure 12.12

3. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

> Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

4. If a value is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.13. Click **OK** and the parameter is reset to the previous value.

Figure 12.13

5. While editing soil parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Soil Parameters** dialog are written to the “sol” table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional HRUs.

   a. **Extend ALL HRU Parameters**: By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected HRUs when edits are saved. If the user decides to check this option, then ALL the soil parameters in the current HRU will be applied to the selected HRUs when the edits are saved.

   b. **Extend Edits to Current HRU**: If this option is checked, then the edits made will only be applied to the current HRU.

c. **Extend Edits to All HRUs**: If this option is checked, then the edits made will be applied to ALL the HRUs in the watershed.

d. **Extend Edits to Selected HRUs**: If this option is checked, then the edits made will be applied to HRUs selected in the Selected HRUs section. HRUs are selected by:

   i. **Select Subbasins**: Land uses for selected subbasin will populate the Land Use list box

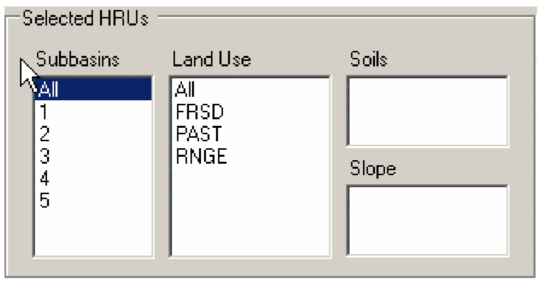


Figure 12.14

   ii. **Select Land Use**: Soils for the selected land uses within the selected subbasins will populate the soils list box.

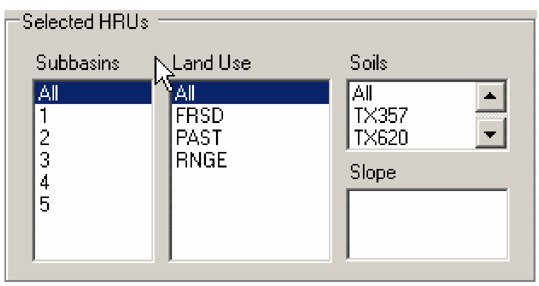


Figure 12.15

   iii. **Selected Soils**: Slope classes for the selected soils within the selected land uses within the selected subbasins will populate the Slope list box.

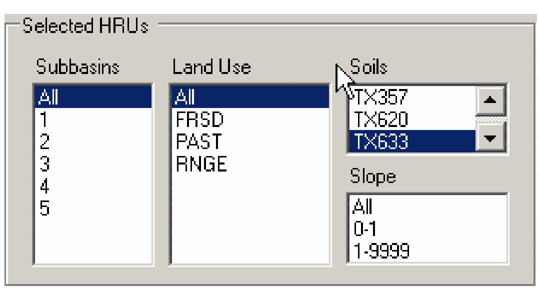


Figure 12.16

iv. **Select Slope Classes**: After selecting slope classes, you are can click **Save Edits**.

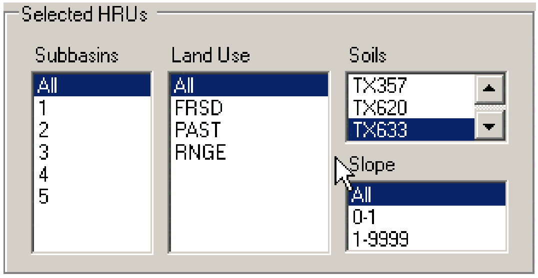


Figure 12.17

> Tip: Although the option to copy soil data to selected soil types is provided, you are strongly discouraged from using this option. Overwriting soil data of one soil series with that from a different soil series defeats the purpose of using the interface to analyze the soil and land use distribution.

3. Click **Save Edits**.

To exit the **Edit Soil Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new HRU to edit, or click **Cancel** to return the ArcSWAT project.

SECTION 12.2: EDIT WEATHER GENERATOR INPUT DATA (.WGN)

The **Edit Weather Generator** dialog is launched if the user selects .Wgn from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying parameters used to generate weather data for the subbasin selected (Figure 12.18). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 13. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected subbasin. All the controls for editing the data are not enabled (i.e., “grayed out”).

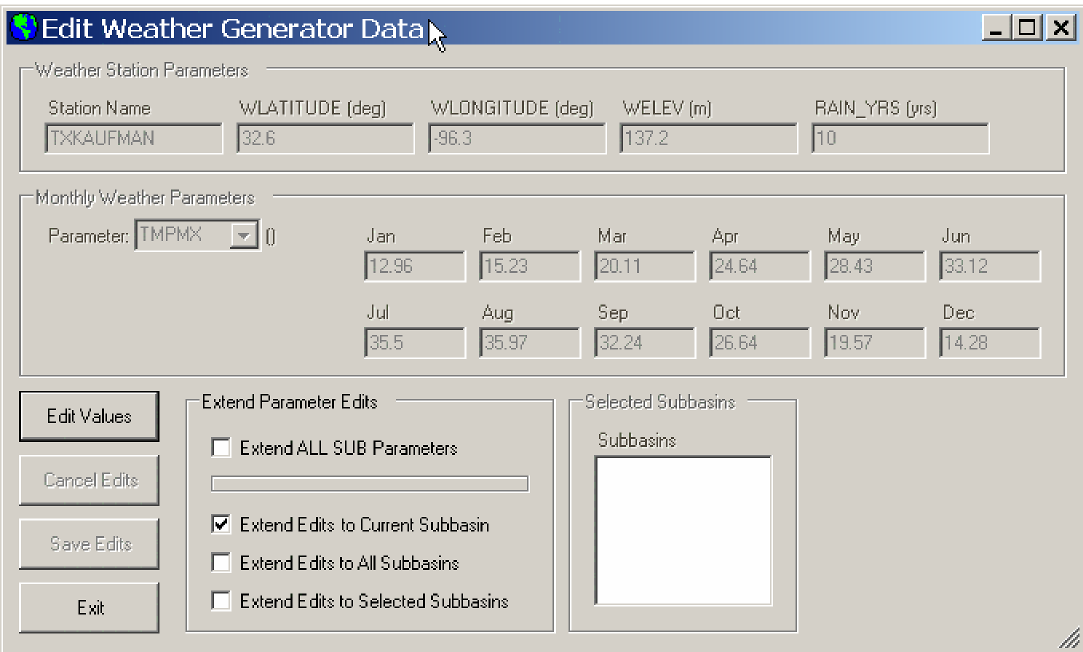


Figure 12.18

Editing Weather Generator Data:

1. To edit the current parameters for the subbasin, click the **Edit Values** button. The dialog is now in Edit mode. The controls for editing the HRU become enabled (Figure 12.19). You can now make changes to any of the parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your subbasin will revert back to their original values.

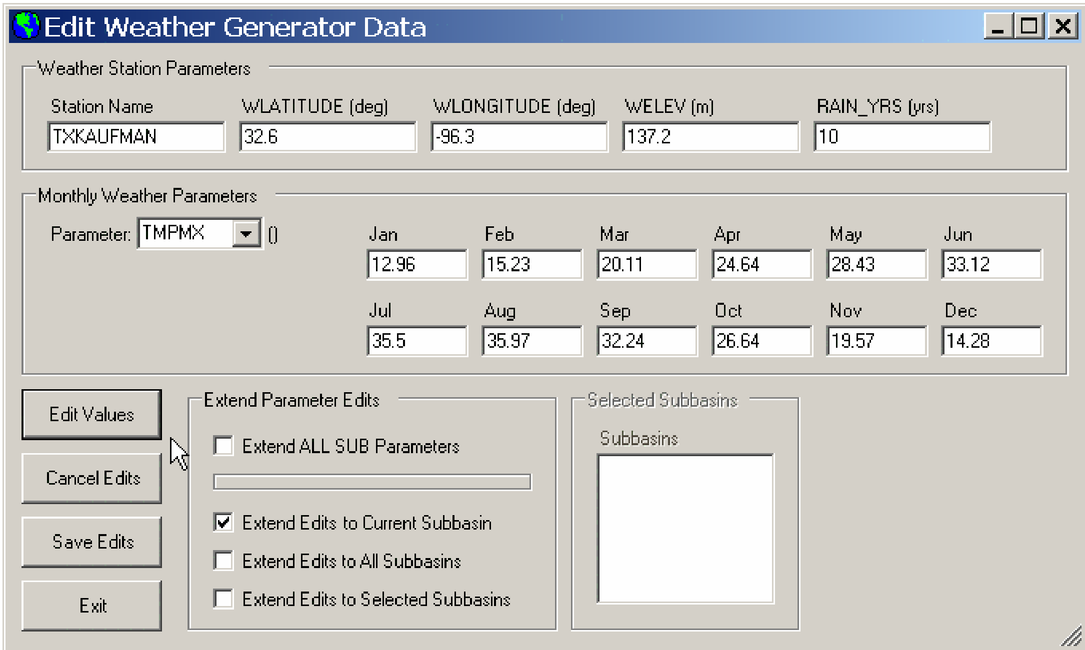


Figure 12.19

2. The data are separated into two groups:

   a. Weather Station Parameters: This set of parameters contains variables that require a single value. They describe the weather station location.

   b. Monthly Weather Parameters: These parameters are the individual monthly values for a selected weather parameter. The different weather parameters are accessed by selecting an item from the **Parameter** combo box. As you change the parameter value, the parameters in the **Monthly Weather Parameters** section will also change (Figure 12.20).

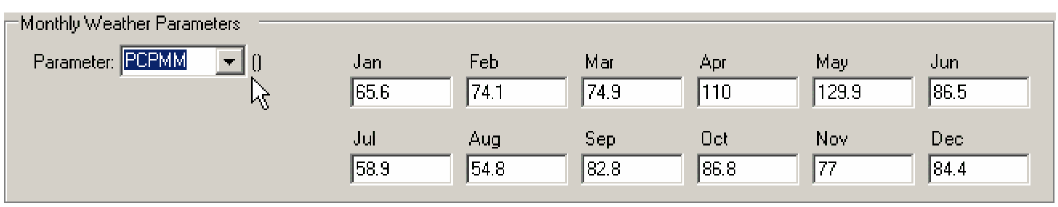


Figure 12.20

3. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

4. If a value is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.21. Click **OK** and the parameter is reset to the previous value.

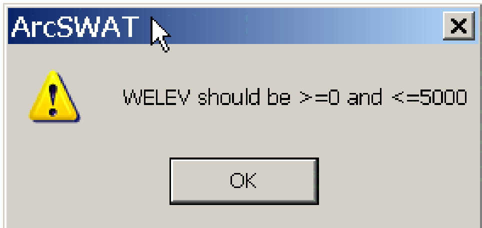


Figure 12.21

5. While editing weather generator parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Weather Generator Data** dialog are written to the “wgn” table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional subbasins.

   a. **Extend ALL SUB Parameters**: By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected subbasins when edits are saved. If the user decides to check this option, then ALL the weather generator parameters in the current subbasin will be applied to the selected subbasins when the edits are saved.

   b. **Extend Edits to Current Subbasin**: If this option is checked, then the edits made will only be applied to the current subbasin.

   c. **Extend Edits to All Subbasins**: If this option is checked, then the edits made will be applied to ALL the subbasins in the watershed.

   d. **Extend Edits to Selected Subbasins**: If this option is checked, then the edits made will be applied to subbasins selected in the Selected

Subbasins section. Subbasins are selected by making a selection from the Subbasins list box (Figure 12.22).

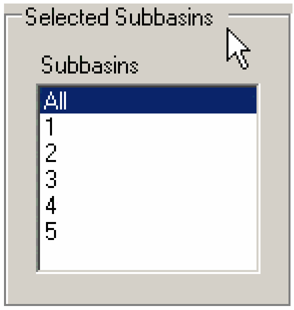


Figure 12.22

3. Click **Save Edits**.

To exit the **Edit Weather Generator Data** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new subbasin or HRU to edit, or click **Cancel** to return the ArcSWAT project.

SECTION 12.3: EDIT SUBBASIN GENERAL INPUT DATA (.SUB)

The **Edit Subbasin Parameters** dialog is launched if the user selects .Sub from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying general subbasin parameters dealing with elevation bands, climate change, and tributary channels for the subbasin selected (Figure 12.23). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 6. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected subbasin. All the controls for editing the data are not enabled (i.e., “grayed out”).

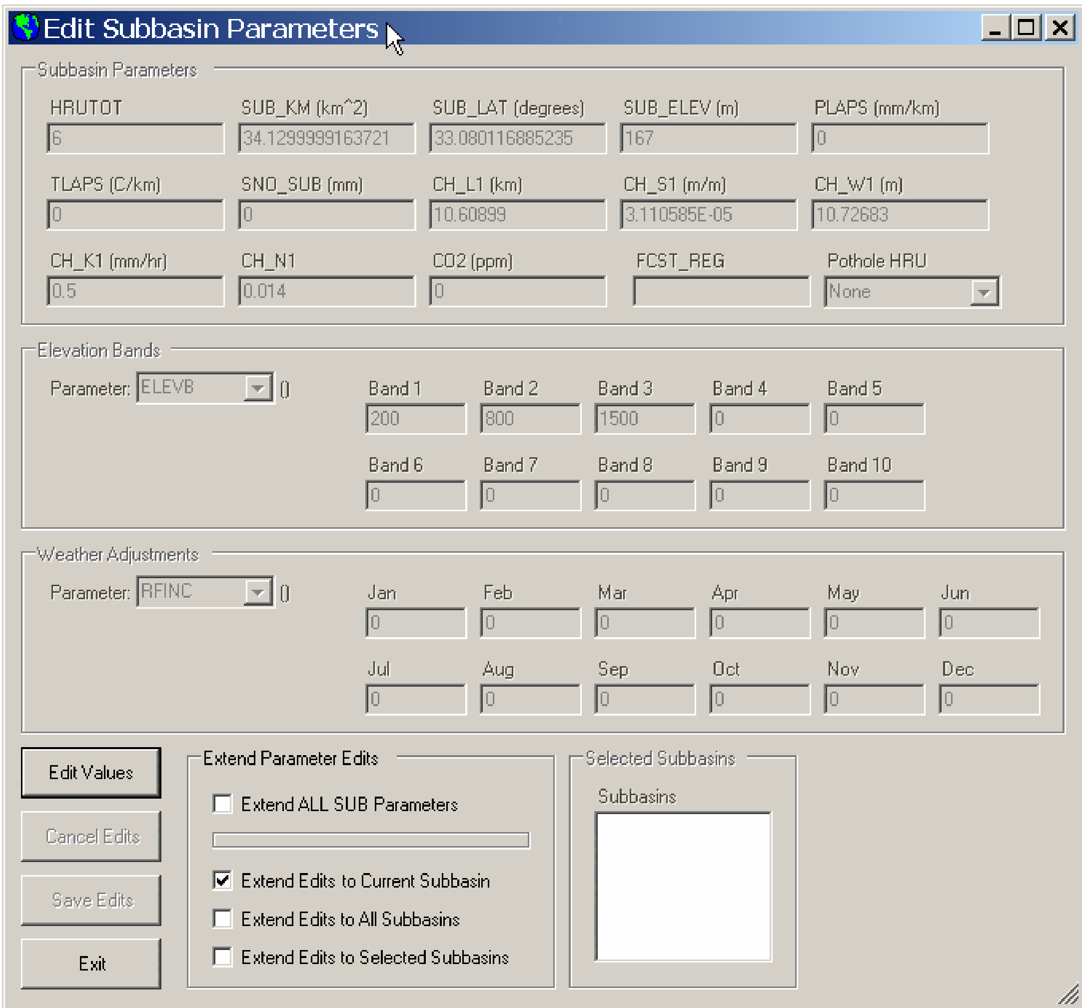


Figure 12.23

Editing Subbasin Data:

1. To edit the current parameters for the subbasin, click the **Edit Values** button. The dialog is now in *Edit* mode. The controls for editing the subbasin become enabled (Figure 12.24). You can now make changes to any of the parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your subbasin will revert back to their original values.

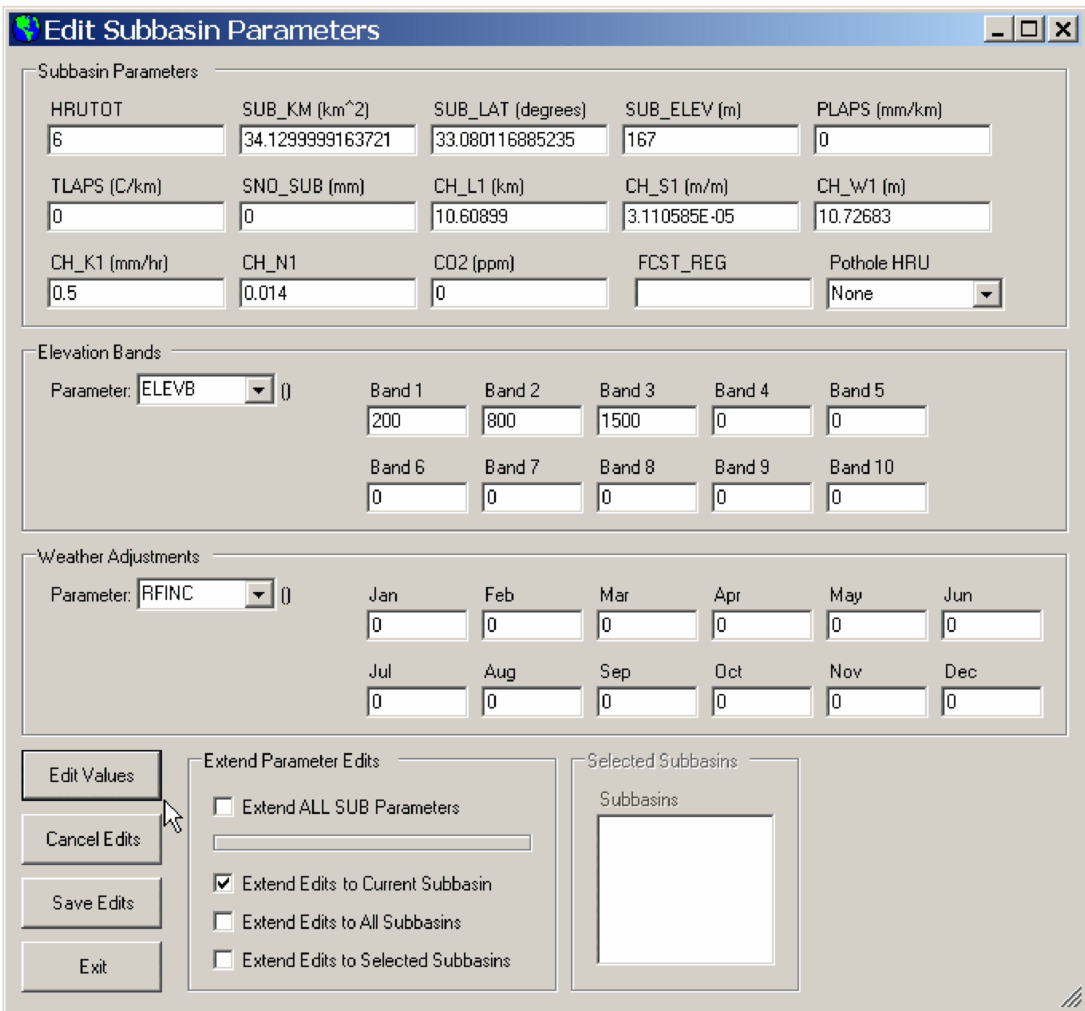


Figure 12.24

2. The data are separated into three groups:

   a. Subbasin Parameters: This set of parameters contains variables that require a single value.

b. Elevation Bands: These parameters are those required for every elevation defined in the subbasin. The different elevation band parameters are accessed by selecting an item from the **Parameter** combo box. As you change the parameter value, the parameters in the **Elevation Bands** section will also change (Figure 12.25).

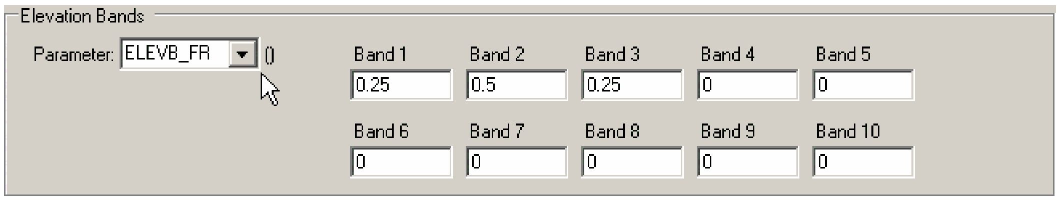


Figure 12.25

c. Weather Adjustments: These parameters are precipitation adjustments required for every month. The different weather adjustment parameters are accessed by selecting an item from the **Parameter** combo box. As you change the parameter value, the parameters in the **Weather Adjustments** section will also change (Figure 12.26).

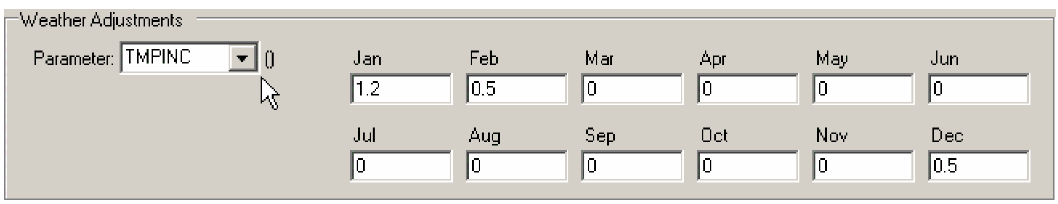


Figure 12.26

3. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown. These tool tips are provided only in the Subbasin Parameters section

4. If a values is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.27. Click **OK** and the parameter is reset to the previous value.

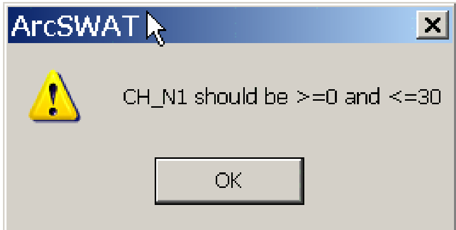


Figure 12.27

5. While editing subbasin parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Subbasin Parameters** dialog are written to the "sub" table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional subbasins.

   a. **Extend ALL SUB Parameters**: By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected subbasins when edits are saved. If the user decides to check this option, then ALL the subbasin parameters in the current subbasin will be applied to the selected subbasins when the edits are saved.

   b. **Extend Edits to Current Subbasin**: If this option is checked, then the edits made will only be applied to the current subbasin.

   c. **Extend Edits to All Subbasins**: If this option is checked, then the edits made will be applied to ALL the subbasins in the watershed.

   d. **Extend Edits to Selected Subbasins**: If this option is checked, then the edits made will be applied to subbasins selected in the Selected Subbasins section. Subbasins are selected by making a selection from the Subbasins list box (Figure 12.28).

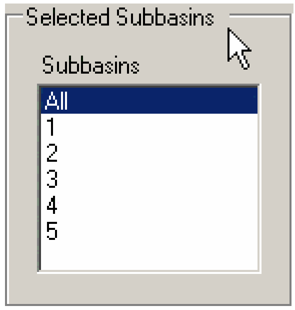


Figure 12.28

3. Click **Save Edits**.

To exit the **Edit Subbasin Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new subbasin or HRU to edit, or click **Cancel** to return the ArcSWAT project.

SECTION 12.4: EDIT HRU GENERAL INPUT DATA (.HRU)

The **Edit HRU Parameters** dialog is launched if the user selects .Hru from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying general HRU parameters dealing with surface and subsurface water flow, erosion, and management inputs related to the simulation of urban areas, irrigation, tile drains and potholes for the HRU selected (Figure 12.29). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 19. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected HRU. All the controls for editing the data are not enabled (i.e., “grayed out”).

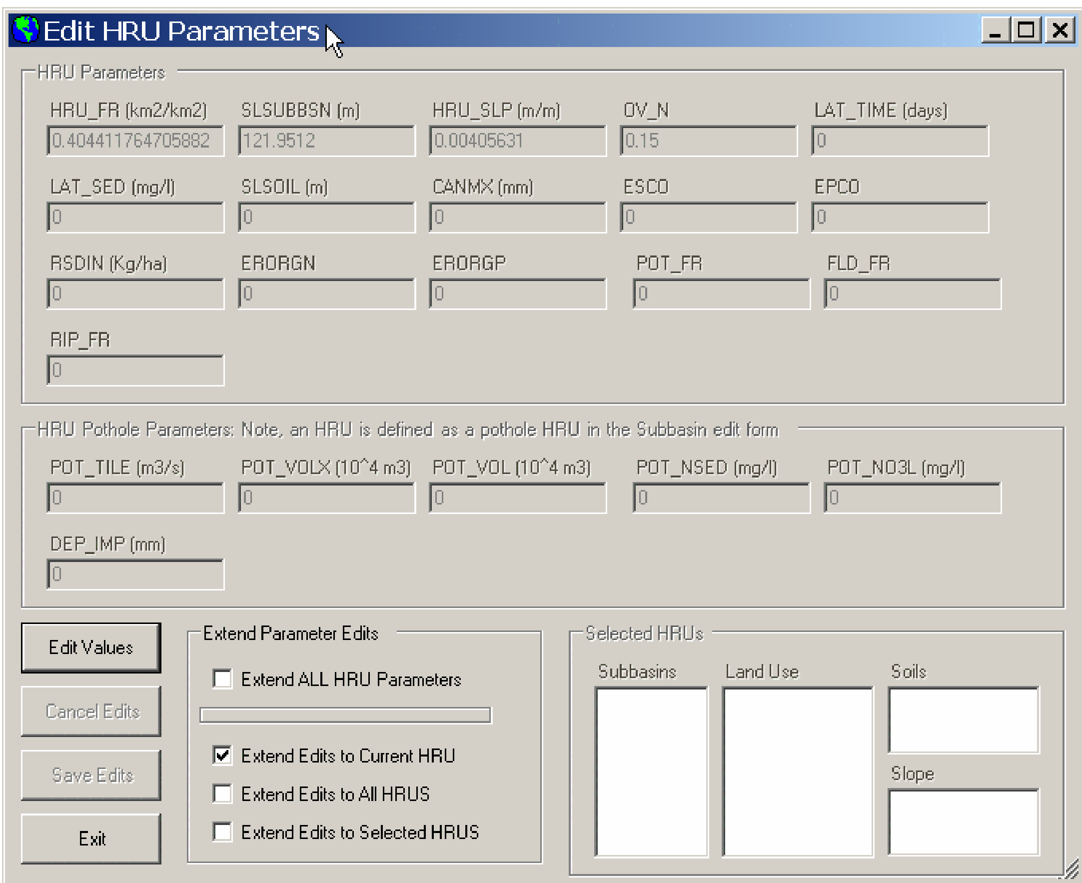


Figure 12.29

Editing HRU Parameters:

1. To edit the current parameters for the HRU, click the **Edit Values** button. The dialog is now in *Edit* mode. The controls for editing the HRU become enabled (Figure 12.30). You can now make changes to any of the soil

parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your HRU will revert back to their original values.

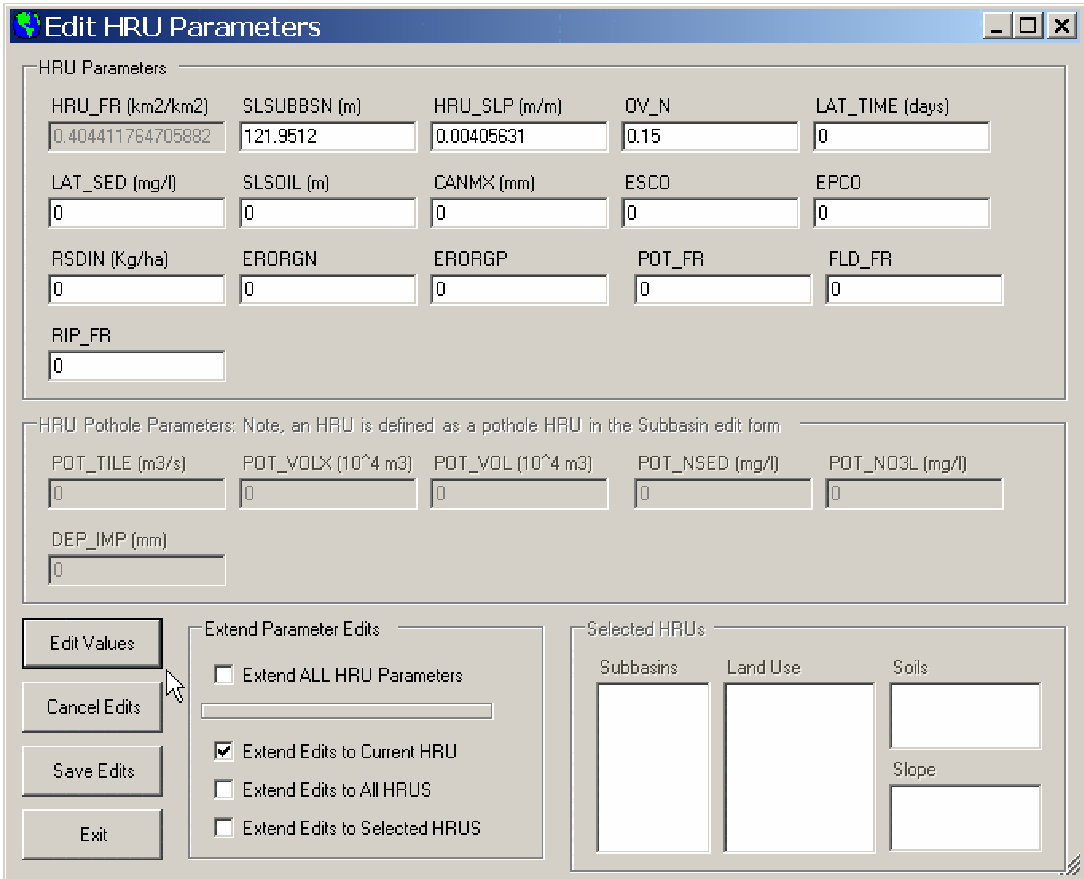


Figure 12.30

2. The data are separated into two groups:

   a. HRU Parameters: These parameters will always be required for an HRU.

   b. HRU Pothole Parameters: These parameters will only be required if the user has defined the current HRU as a pothole HRU in the Edit Subbasin Parameters dialog.

3. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

4. If a values is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.13. Click OK and the parameter is reset to the previous value.

Figure 12.31

5. While editing HRU parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Note: The parameter HRU_FR cannot be edited.

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Soil Parameters** dialog are written to the "hru" table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional HRUs.

    a. **Extend ALL HRU Parameters**: By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected HRUs when edits are saved. If the user decides to check this option, then ALL the hru parameters in the current HRU will be applied to the selected HRUs when the edits are saved.

    b. **Extend Edits to Current HRU**: If this option is checked, then the edits made will only be applied to the current HRU.

    c. **Extend Edits to All HRUs**: If this option is checked, then the edits made will be applied to ALL the HRUs in the watershed.

d. **Extend Edits to Selected HRUs**: If this option is checked, then the edits made will be applied to HRUs selected in the Selected HRUs section. HRUs are selected by:

i. **Select Subbasins**: Land uses for selected subbasin wil populate the Land Use list box

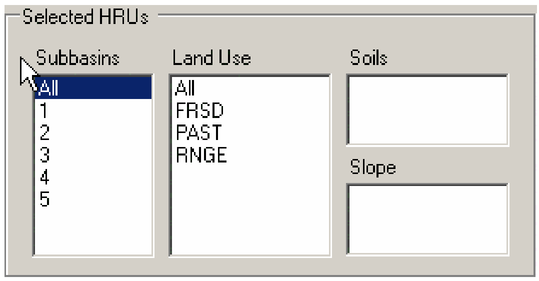


Figure 12.32

ii. **Select Land Use**: Soils for the selected land uses within the selected subbasins will populate the soils list box.

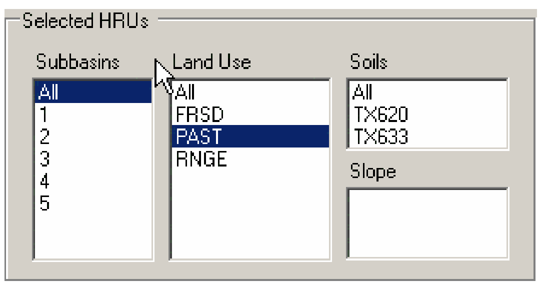


Figure 12.33

iii. **Selected Soils**: Slope classes for the selected soils within the selected land uses within the selected subbasins will populate the Slope list box.

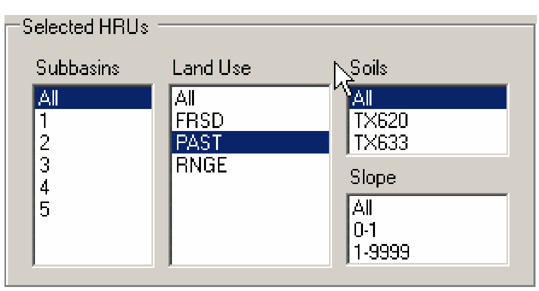


Figure 12.34

iv. **Select Slope Classes**: After selecting slope classes, you are can click Save Edits.

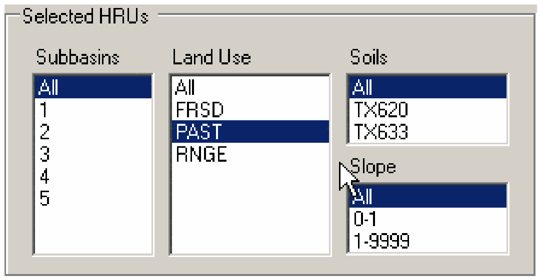


Figure 12.35

3. Click **Save Edits**.

To exit the **Edit HRU Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new HRU to edit, or click **Cancel** to return the ArcSWAT project.

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SECTION 12.5: EDIT MAIN CHANNEL INPUT DATA (.RTE)

The **Edit Channel Parameters** dialog is launched if the user selects .Rte from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying main channel parameters related to water and sediment transport for the subbasin selected (Figure 12.36). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 25. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected subbasin. All the controls for editing the data are not enabled (i.e., "grayed out").

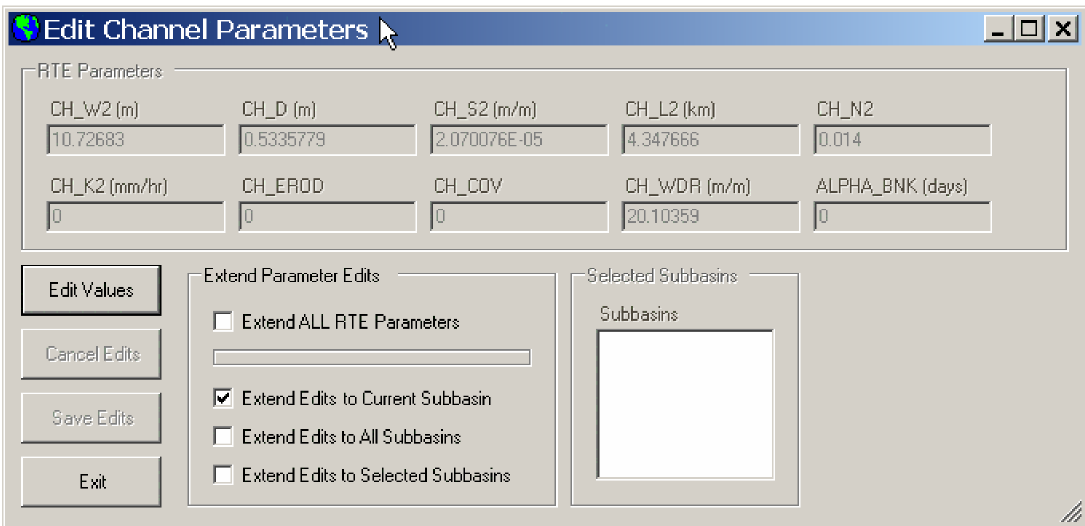


Figure 12.36

Editing Channel Data:

1. To edit the current channel parameters for the subbasin, click the Edit Values button. The dialog is now in Edit mode. The controls for editing the subbasin become enabled (Figure 12.37). You can now make changes to any of the parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the Save Edits button. If you decide not to save the edits you have made, click the Cancel Edits button, and the parameters for your subbasin will revert back to their original values.

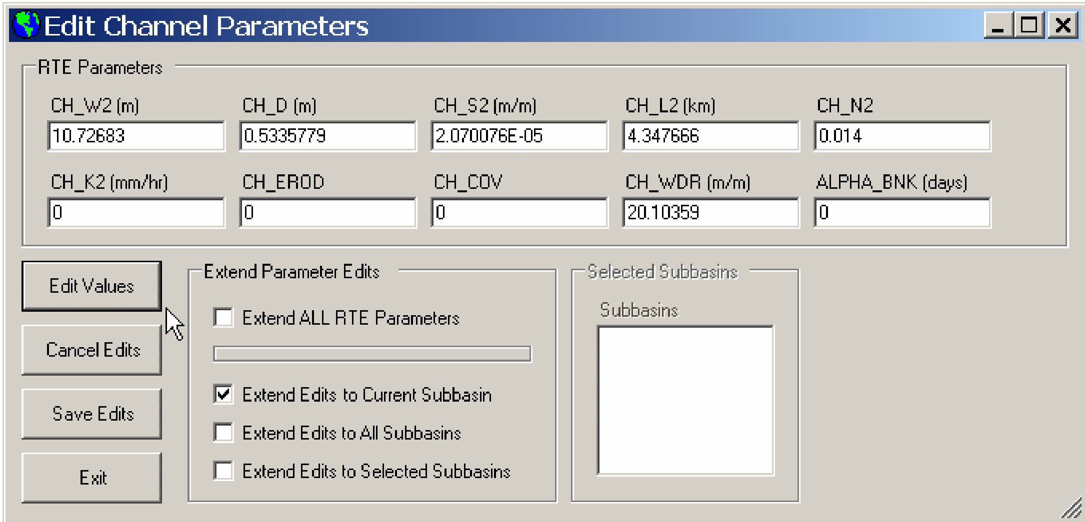


Figure 12.37

2. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

3. If a values is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.38. Click **OK** and the parameter is reset to the previous value.

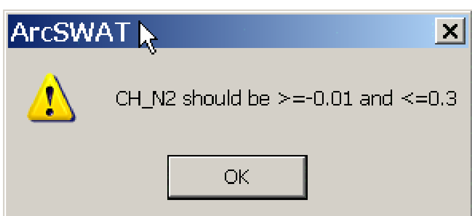


Figure 12.38

4. While editing channel parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Subbasin**

Parameters dialog are written to the "rte" table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional subbasins.

   a. **Extend ALL RTE Parameters**: By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected subbasins when edits are saved. If the user decides to check this option, then ALL the channel parameters in the current subbasin will be applied to the selected subbasins when the edits are saved.

   b. **Extend Edits to Current Subbasin**: If this option is checked, then the edits made will only be applied to the current subbasin.

   c. **Extend Edits to All Subbasins**: If this option is checked, then the edits made will be applied to ALL the subbasins in the watershed.

   d. **Extend Edits to Selected Subbasins**: If this option is checked, then the edits made will be applied to subbasins selected in the Selected Subbasins section. Subbasins are selected by making a selection from the Subbasins list box (Figure 12.28).

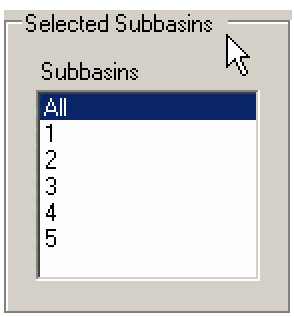


Figure 12.39

3. Click Save Edits.

To exit the **Edit Channel Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new subbasin or HRU to edit, or click **Cancel** to return the ArcSWAT project.

SECTION 12.6: EDIT GROUNDWATER INPUT DATA (.GW)

The **Edit Groundwater Parameters** dialog is launched if the user selects .Gw from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying groundwater parameters for the HRU selected (Figure 12.40). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 24. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected HRU. All the controls for editing the data are not enabled (i.e., "grayed out").

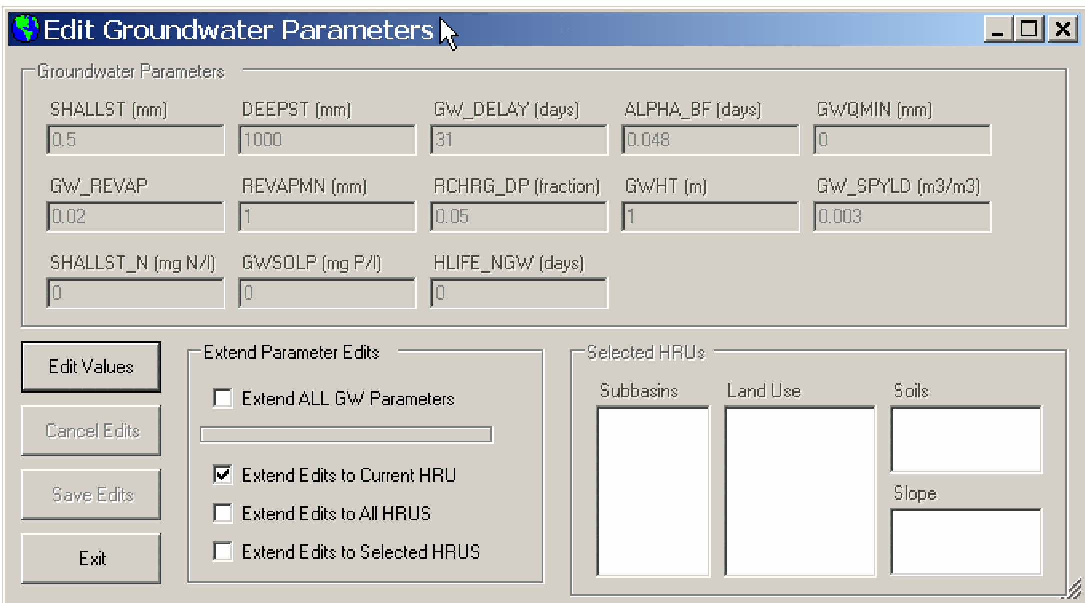


Figure 12.40

Editing Groundwater Parameters:

1. To edit the current parameters for the HRU, click the **Edit Values** button. The dialog is now in Edit mode. The controls for editing the HRU becomes enabled (Figure 12.41). You can now make changes to any of the groundwater parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your HRU will revert back to their original values.

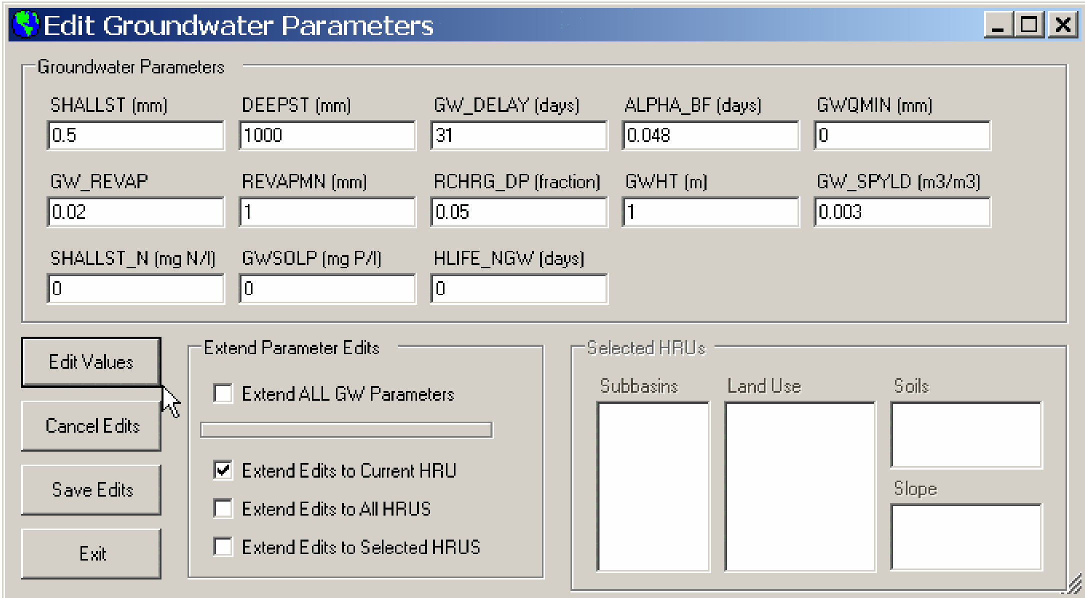


Figure 12.41

2. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

3. If a values is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.42. Click **OK** and the parameter is reset to the previous value.

Figure 12.42

4. While editing groundwater parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert to their previous values (i.e., the values before the editing session was initiated).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Soil Parameters** dialog are written to the "gw" table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional HRUs.

    a. **Extend ALL HRU Parameters**: By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected HRUs when edits are saved. If the user decides to check this option, then ALL the groundwater parameters in the current HRU will be applied to the selected HRUs when the edits are saved.

    b. **Extend Edits to Current HRU**: If this option is checked, then the edits made will only be applied to the current HRU.

    c. **Extend Edits to All HRUs**: If this option is checked, then the edits made will be applied to ALL the HRUs in the watershed.

    d. **Extend Edits to Selected HRUs**: If this option is checked, then the edits made will be applied to HRUs selected in the Selected HRUs section. HRUs are selected by:

        i. **Select Subbasins**: Land uses for selected subbasin wil populate the Land Use list box

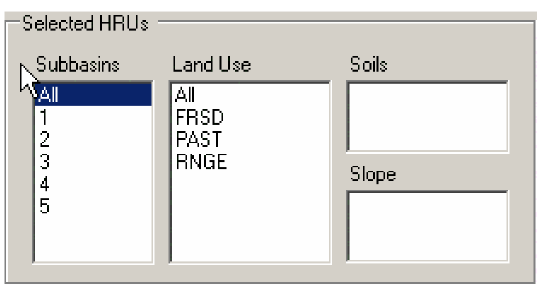


Figure 12.43

        ii. **Select Land Use**: Soils for the selected land uses within the selected subbasins will populate the soils list box.

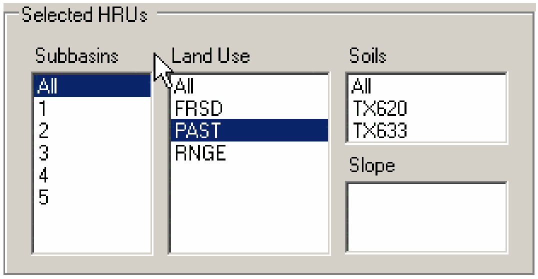


Figure 12.44

iii. **Selected Soils**: Slope classes for the selected soils within the selected land uses within the selected subbasins will populate the Slope list box.

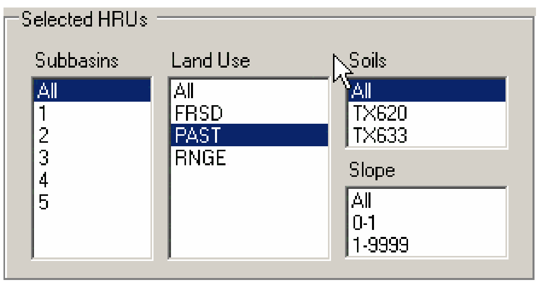


Figure 12.45

iv. **Select Slope Classes**: After selecting slope classes, you can click **Save Edits**.

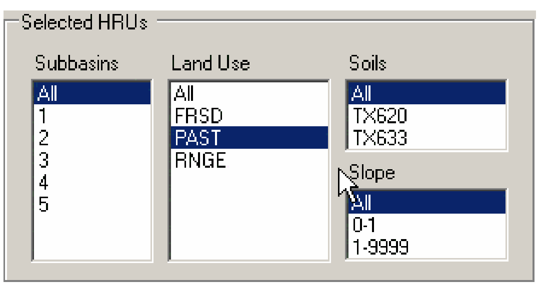


Figure 12.46

3. Click **Save Edits**.

To exit the **Edit Groundwater Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new HRU to edit, or click **Cancel** to return the ArcSWAT project.

SECTION 12.7: EDIT WATER USE INPUT DATA (.WUS)

The **Edit Water Use Parameters** dialog is launched if the user selects .Wus from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying consumptive water use parameters for the subbasin selected (Figure 12.47). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 21. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected subbasin. All the controls for editing the data are not enabled (i.e., "grayed out").

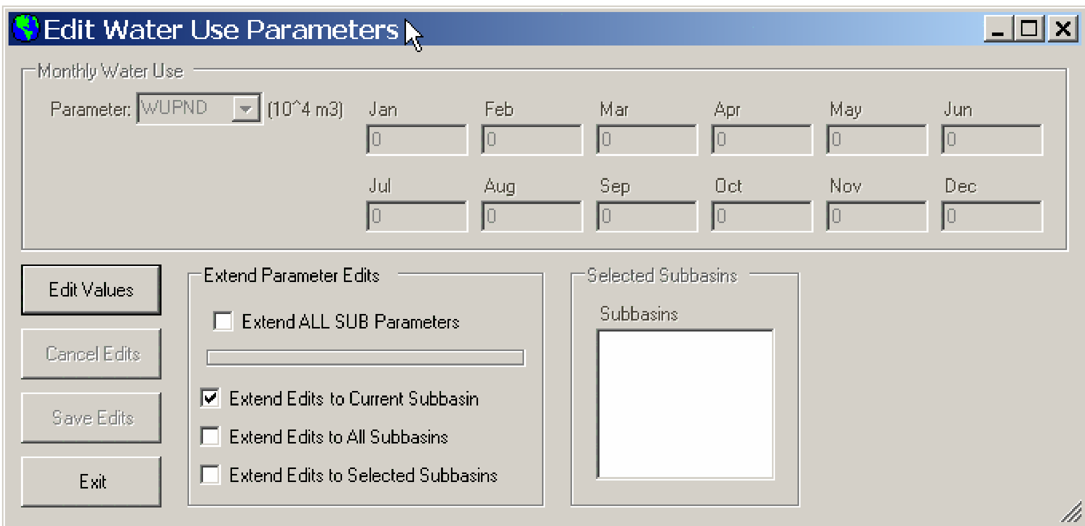


Figure 12.47

Editing Water Use Data:

1. To edit the current parameters for the subbasin, click the **Edit Values** button. The dialog is now in *Edit* mode. The controls for editing the subbasin become enabled (Figure 12.48). You can now make changes to any of the parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your subbasin will revert back to their original values.

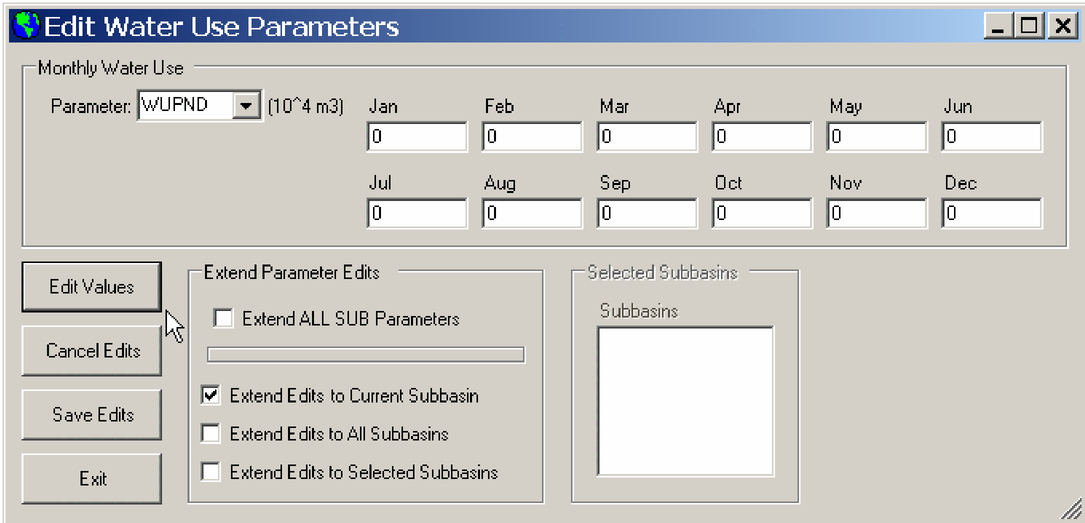


Figure 12.48

2. Select the Monthly Water Use parameter to modify from the **Parameter** combo box. The values for the selected parameter can then be edited for each month by typing into the individual month text boxes (Jan, Feb, Mar, etc.).

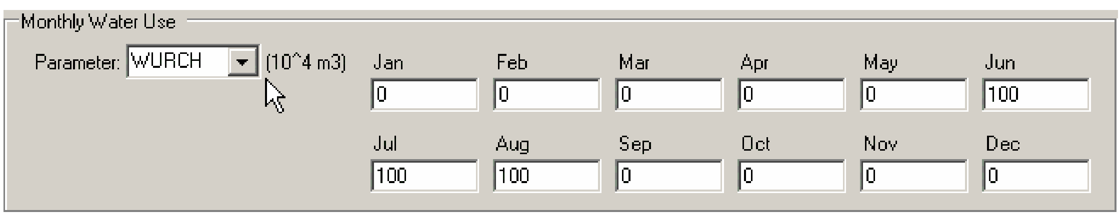


Figure 12.49

3. Select a different parameter from the **Parameter** combo box to modify the monthly values for additional parameters.

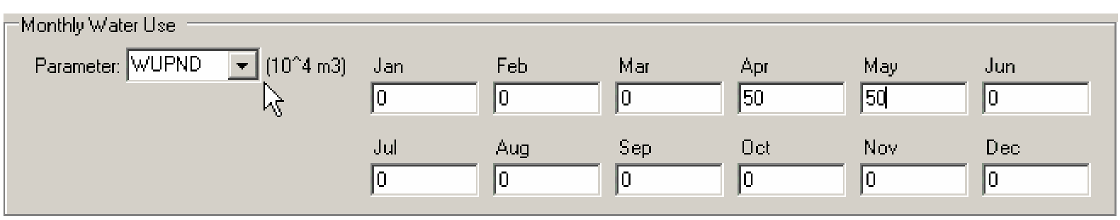


Figure 12.50

Note: If the cursor is placed on top of the **Parameter** combo box, a short help description (yellow label) appears and the range of variation for parameters is shown.

4. If a values is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.51. Click OK and the parameter is reset to the previous value.

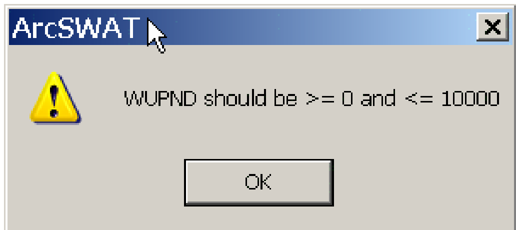


Figure 12.51

5. While editing water use parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Subbasin Parameters** dialog are written to the “wus” table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional subbasins.

   a. **Extend ALL SUB Parameters**: By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected subbasins when edits are saved. If the user decides to check this option, then ALL the subbasin parameters in the current subbasin will be applied to the selected subbasins when the edits are saved.

   b. **Extend Edits to Current Subbasin**: If this option is checked, then the edits made will only be applied to the current subbasin.

   c. **Extend Edits to All Subbasins**: If this option is checked, then the edits made will be applied to ALL the subbasins in the watershed.

   d. **Extend Edits to Selected Subbasins**: If this option is checked, then the edits made will be applied to subbasins selected in the Selected

Subbasins section. Subbasins are selected by making a selection from the Subbasins list box (Figure 12.52).

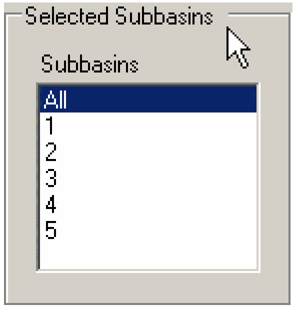


Figure 12.52

3. Click **Save Edits**.

To exit the **Edit Water Use Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new subbasin or HRU to edit, or click **Cancel** to return the ArcSWAT project.

SECTION 12.8: EDIT MANAGEMENT INPUT DATA (.MGT)

The **Edit Management Parameters** dialog is launched if the user selects .Mgt from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying the management parameters for the HRU selected (Figure 12.53). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 20. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected HRU. All the controls for editing the data are not enabled (i.e., "grayed out").

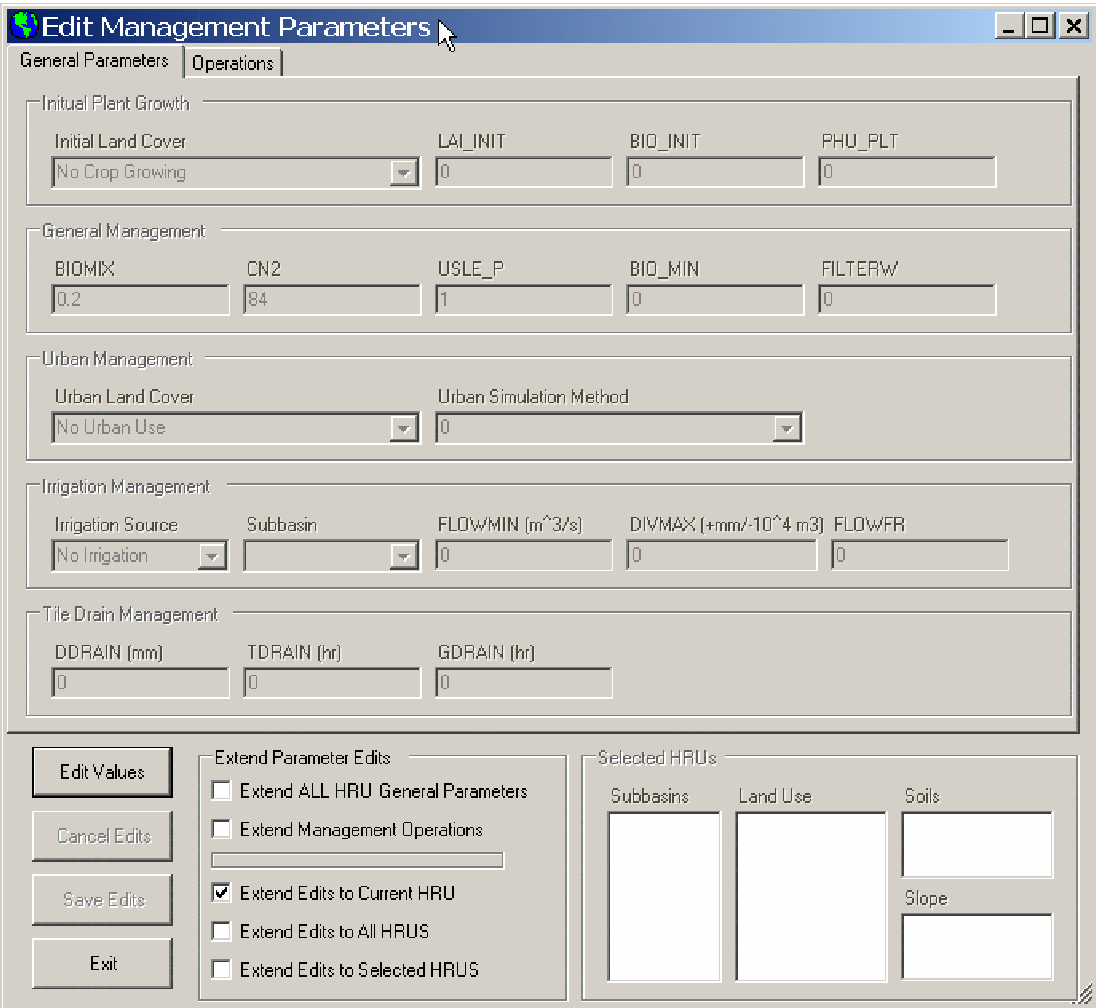


Figure 12.53

Editing General Management Parameters:

1. To edit the current parameters for the HRU, click the **Edit Values** button. The dialog is now in Edit mode. The controls for editing the HRU become enabled (Figure 12.54). You can now make changes to any of the general management parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your HRU will revert back to their original values.

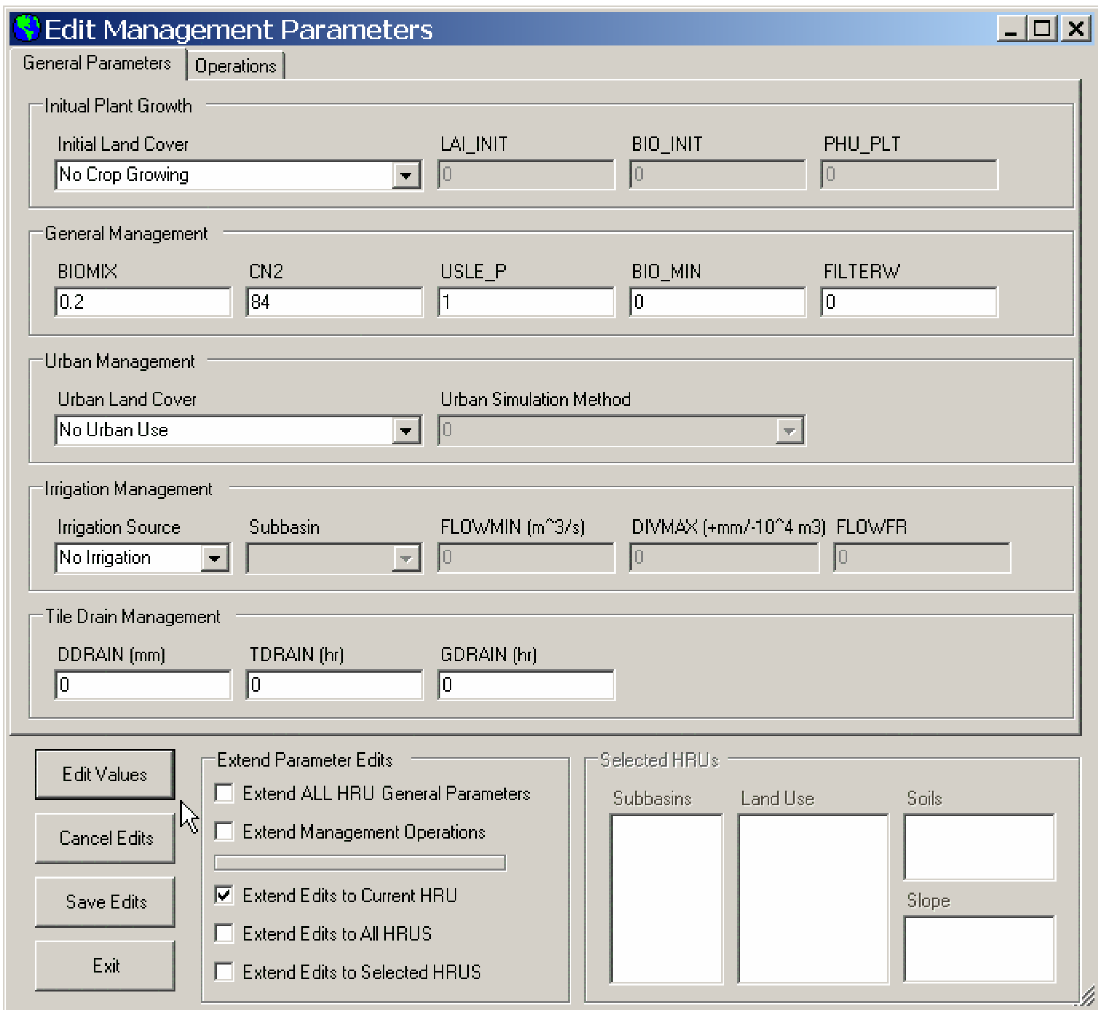


Figure 12.54

2. The **Edit Management Parameters** dialog contains two tabs. When the dialog first opens, the **General Parameters** tab is displayed. This tab contains parameters for initial conditions of the HRU, as well as "static" parameters that are only defined once to describe the HRU. The second tab, **Operations**, controls parameters that define scheduling of

management operations for the HRU. Editing these parameters will be discussed in the next section.

3. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

4. If a values is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.55. Click **OK** and the parameter is reset to the previous value.

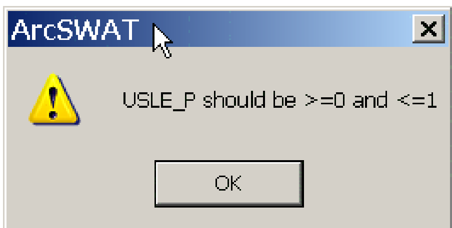


Figure 12.55

5. While editing general management parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Editing Management Operations:

1. Click on the **Operations** tab. The operations dialog is now open with the current management operations displayed (Figure 12.56).

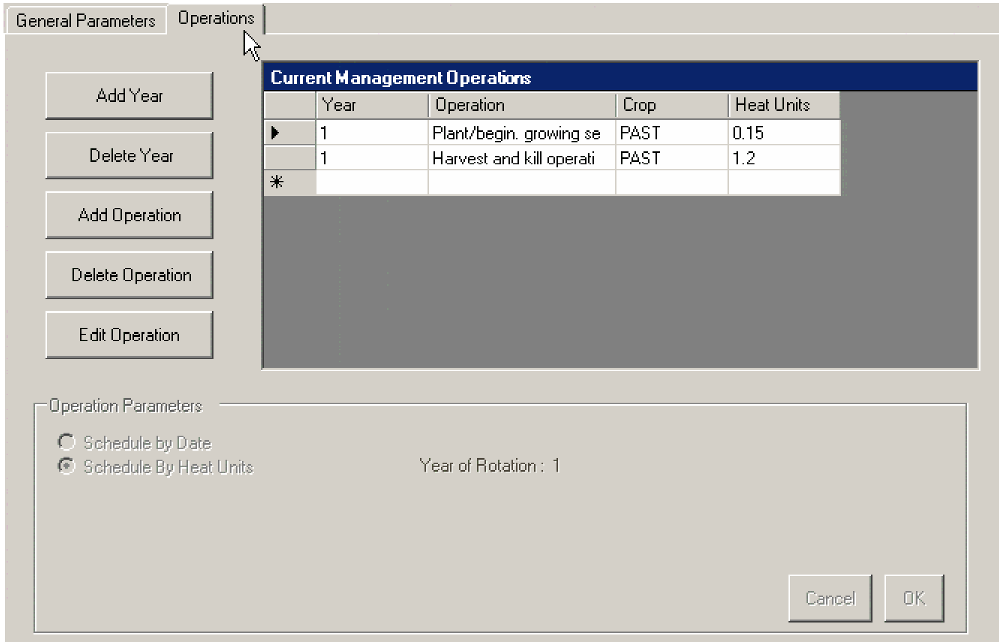


Figure 12.56

2. The **Current Management Operations** table displays the management operations in the current scenario (Figure 12.57)

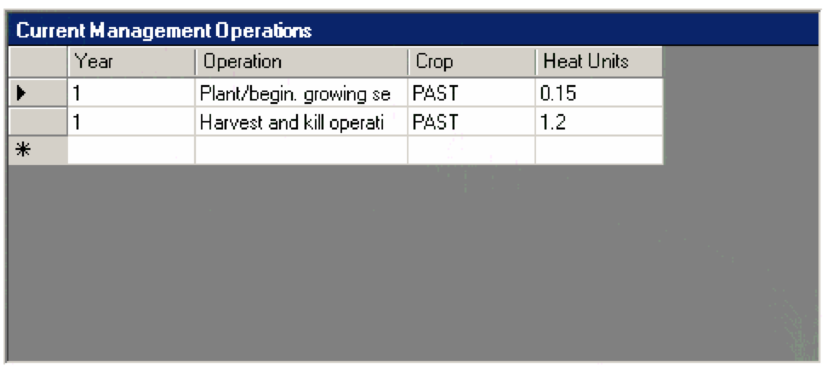


Figure 12.57

3. To the left of the **Current Management Operations** table are five buttons that control modifying the operations in the current scenario (Figure 12.58).

   a. **Add Year**: This command will add a new rotation year to the operation schedule.

   b. **Delete Year**: This command will delete the highlighted year from the operation schedule.

c. **Add Operation**: This command will add a new operation to the rotation year currently active.

d. **Delete Operation**: This command will delete the highlighted operation.

e. **Edit Operation**: This command will display the parameter values for the highlighted operation, allowing the user to modify the values.

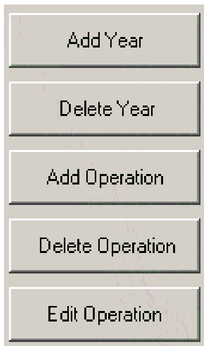


Figure 12.58

4. The **Operation Parameters** section (Figure 12.59) displays the parameters for the current management operation being edited (this section is initially grayed out since no operation is being edited). This section is enabled when editing an existing operation or adding a new one.

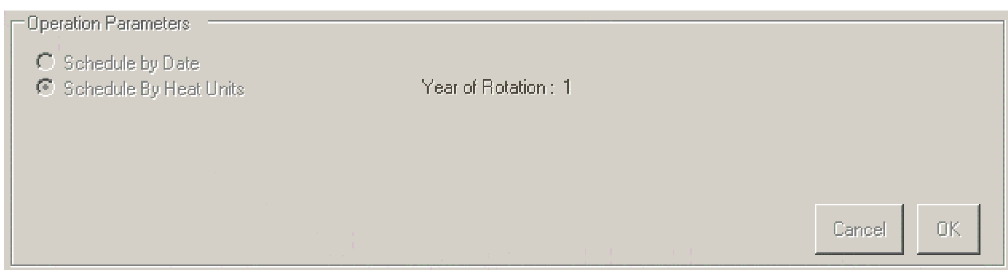


Figure 12.59

5. To add a rotation year:

a. Click the **Add Year** button

b. A "Plant/Begin Growing Season" operation will appear in the **Operation Parameters** section (Figure 12.60). By default, same "Plant/Begin Growing Season" parameters for the previous rotation year will appear in the dialog.

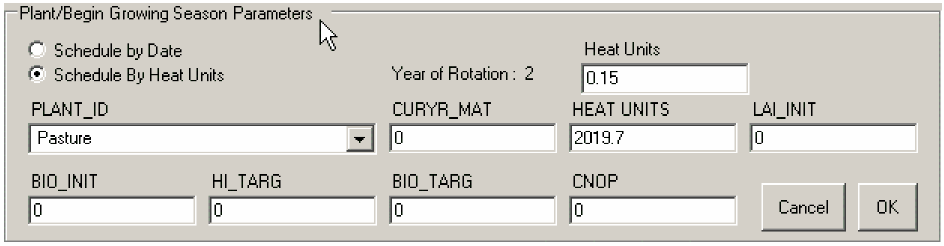


Figure 12.60

c. Edit the parameters of this operation if necessary.

d. Click the **OK** button to add this operation as the first operation in the new rotation year. The **Current Management Operations** table will be updated to reflect the beginning of the new rotation year (Figure 12.61).

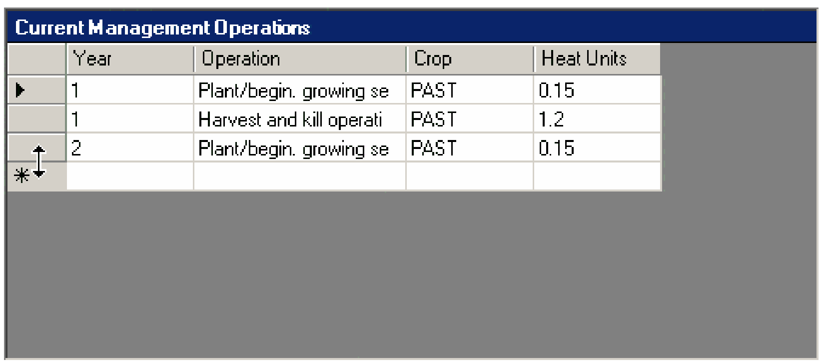


Figure 12.61

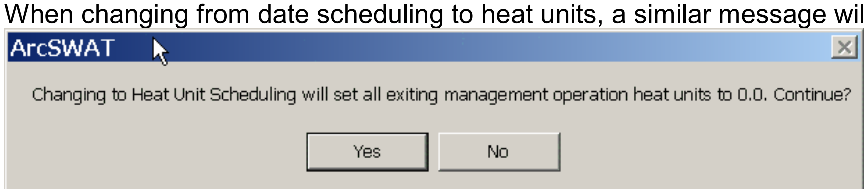
e. Click the **Cancel** button to cancel adding the operation and new rotation year.

Note: Operation-specific information must be scheduled by date or by plant growth stage (i.e. heat units). The interface will allow different types of scheduling to be used in different HRUs within the watershed, but for a given HRU, all operations must be scheduled exclusively by date or by plant growth stage (i.e., heat units). The default management operations are scheduled by heat units. To change the type of scheduling from heat units to date (or date to heat units), click the appropriate radio button while editing or adding an operation.

A message will pop up, indicating that all the dates for the current set of operations will be reset.

Click “Yes” to continue or “No” to abort the operation.

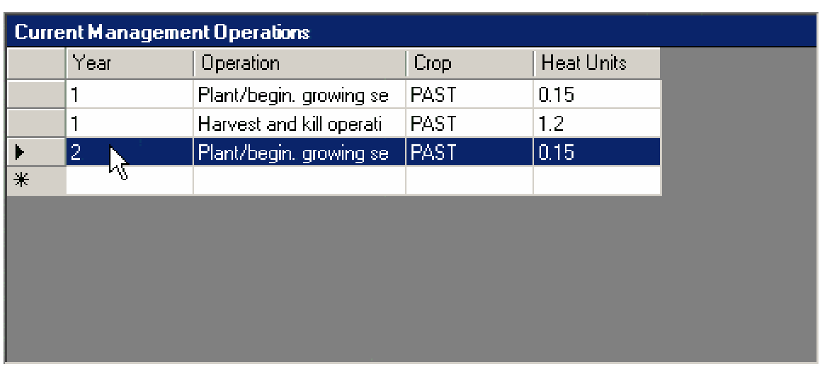
When changing from date scheduling to heat units, a similar message will pop up.



Note: When scheduling with heat units, the values used to schedule the operations between the time of planting and the time at which the land cover is killed are fractions of total accumulated plant heat units. Outside this growing period, the values used to schedule operations are fractions of annual, base-zero, heat units. Chapter 17 in the SWAT 2005 Theoretical Documentation explains heat unit scheduling in detail.

6. To delete a rotation year:

   a. Select a row from the **Current Management Operations** table containing an operation for the year to be deleted (Figure 12.62).



Current Management Operations

Year	Operation	Crop	Heat Units
1	Plant/begin. growing se	PAST	0.15
1	Harvest and kill operati	PAST	1.2
2	Plant/begin. growing se	PAST	0.15

Figure 12.62

b. Click the **Delete Year** button.

c. A message will appear to make sure you want to continue.

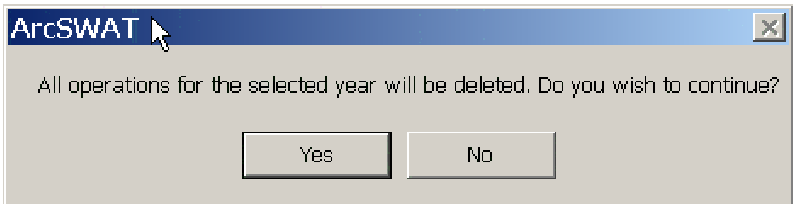


Figure 12.63

d. The **Current Management Operations** table is updated with the removed year (Figure 12.64).

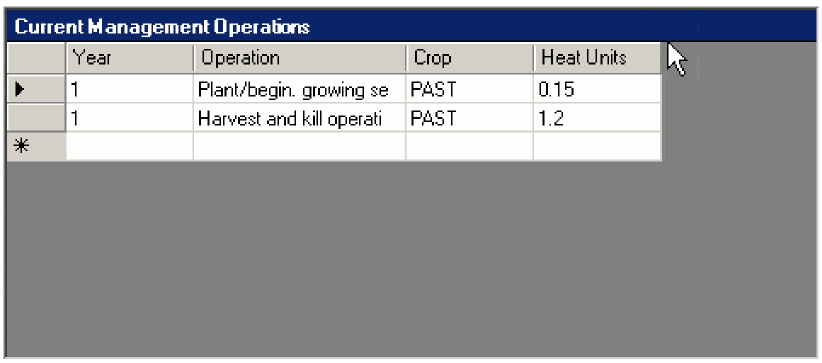


Figure 12.64

7. To add an operation:

a. Select a row in the **Current Management Operations** table that represents the rotation year you want to add an operation to (Figure 12.65).

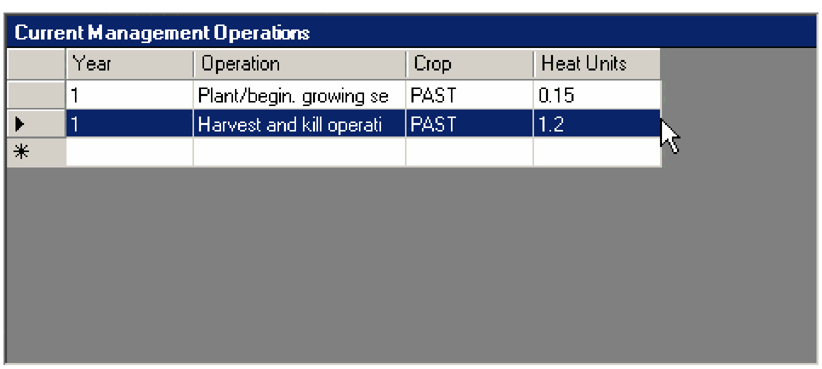


Figure 12.65

b. Click the **Add Operation** button. The Add operation dialog will appear. From the list box, select the operation you want to add and click **OK** (Figure 12.66). Click Cancel to abort the operation.

Figure 12.66

c. The parameters for the operation selected will appear in the **Operation Parameters** section of the **Edit Management Parameters** dialog (Figure 12.67).

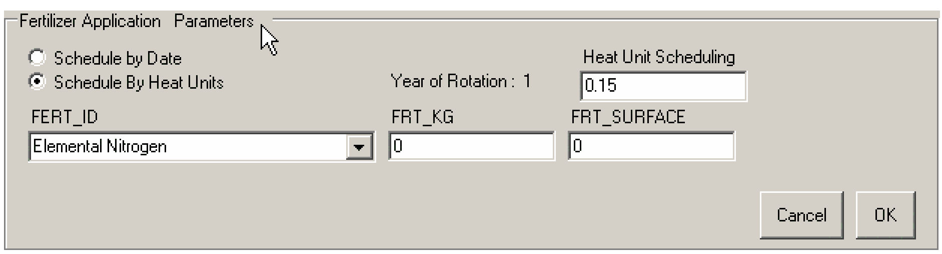


Figure 12.67

d. Specify the parameters for the operation, and then click **OK**. The new operation will then appear in the **Current Management Operations** table (Figure 12.68). To cancel adding the new operation, click the **Cancel** button.

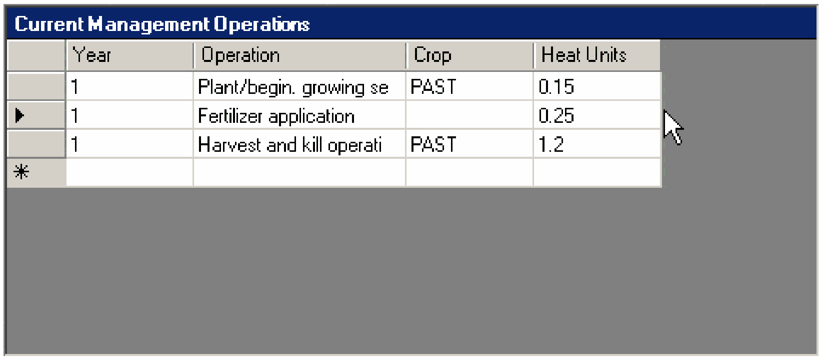


Figure 12.68

e. Each management operation will have different parameters to specify. The **Operation Parameters** interface for each of the available management operations are as follows:

   i. Plant/begin growing season:

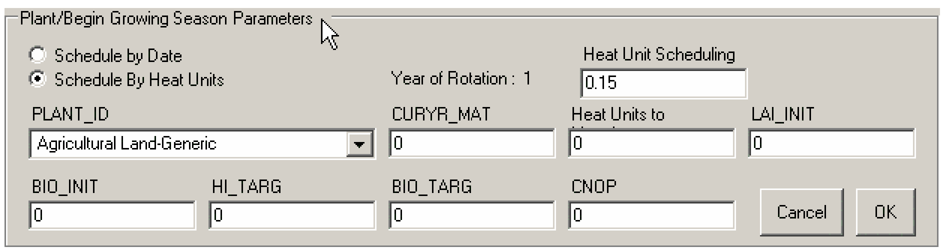


Figure 12.69

The **PLANT_ID** combo box will allow the user to select a crop from the SWAT crop database.

   ii. Irrigation:

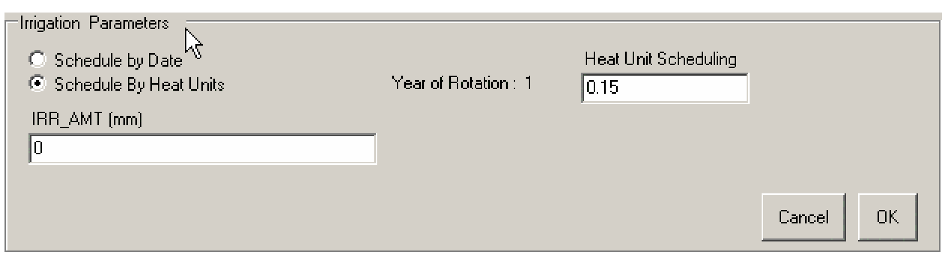


Figure 12.70

   iii. Fertilizer application:

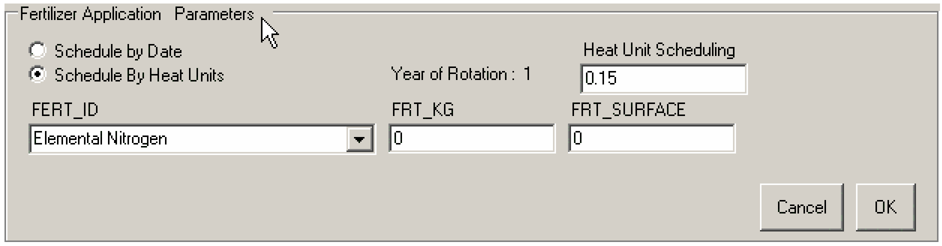


Figure 12.71

The **FERT_ID** combo box will allow the user to select a fertilizer from the SWAT fertilizer database.

iv. Pesticide application

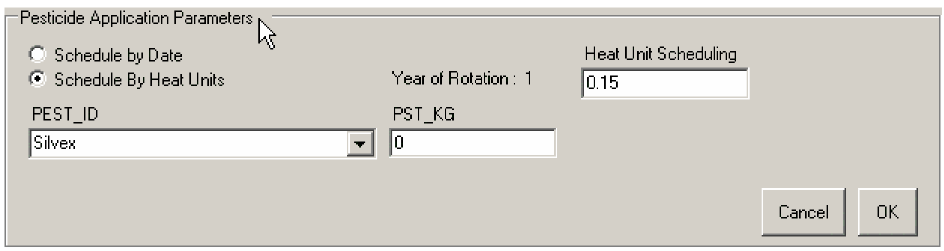


Figure 12.72

The **PEST_ID** combo box will allow the user to select a pesticide from the SWAT pesticide database.

v. Harvest and kill operation:

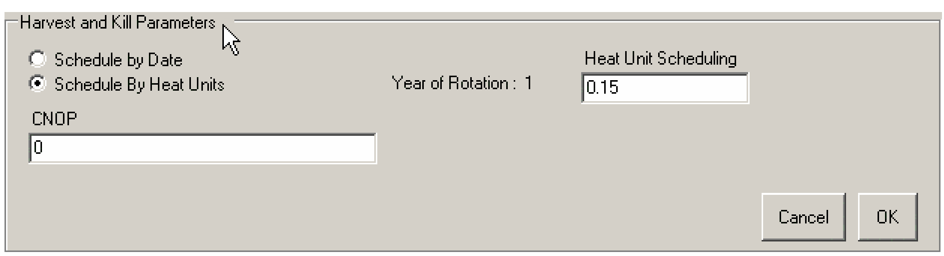


Figure 12.73

vi. Tillage:

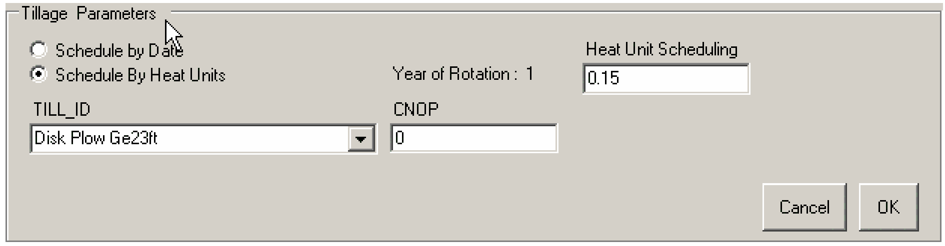


Figure 12.74

The **TILL_ID** combo box wil allow the user to select a tillage operation from the SWAT tillage database.

vii. Harvest only:

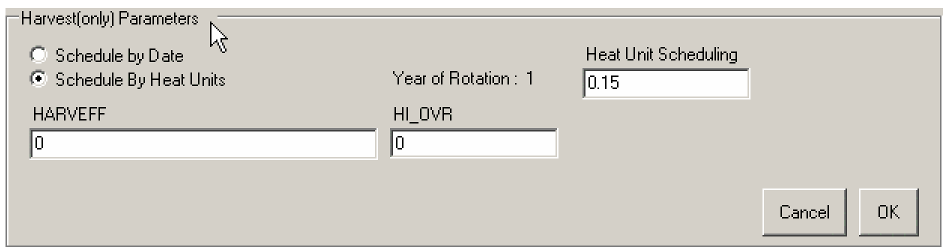


Figure 12.75

viii. Kill/end of growing season:

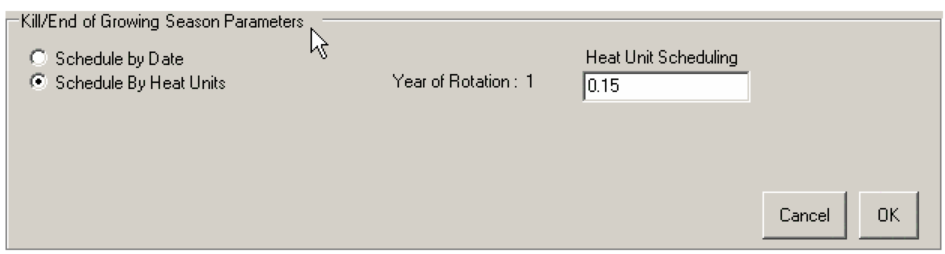


Figure 12.76

ix. Grazing:

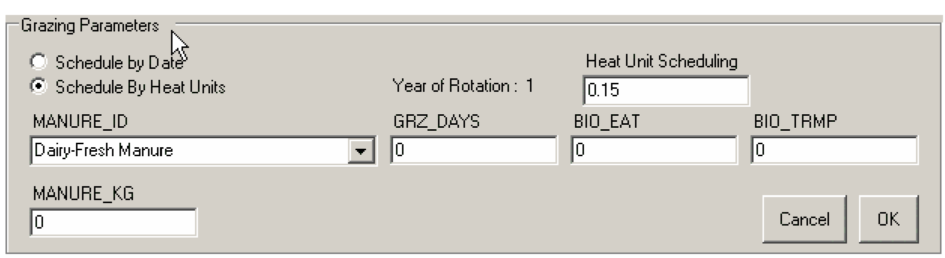


Figure 12.77

The **MANURE_ID** combo box wil allow the user to select a manure from the SWAT manure database.

x. Auto-irrigation

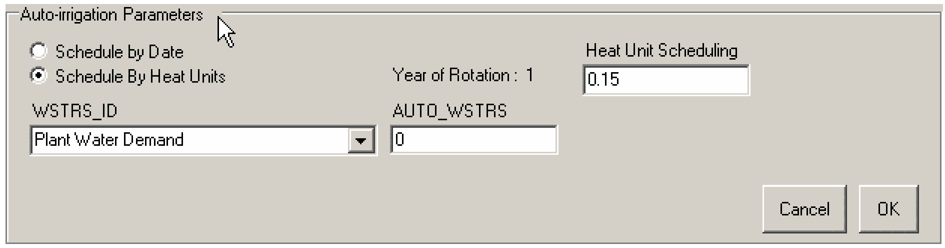


Figure 12.78

xi. Auto-fertilization

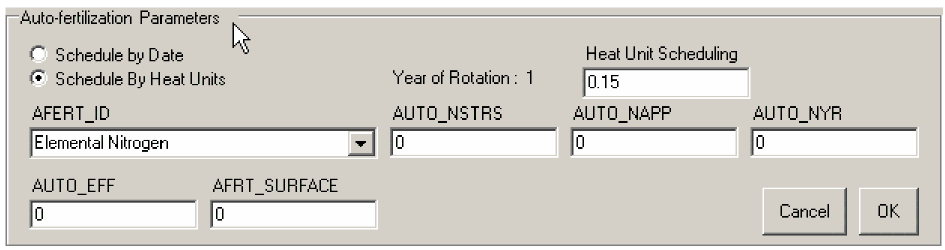


Figure 12.79

The **AFERT_ID** combo box wil allow the user to select a fertilizer from the SWAT fertilizer database.

xii. Street sweeping:

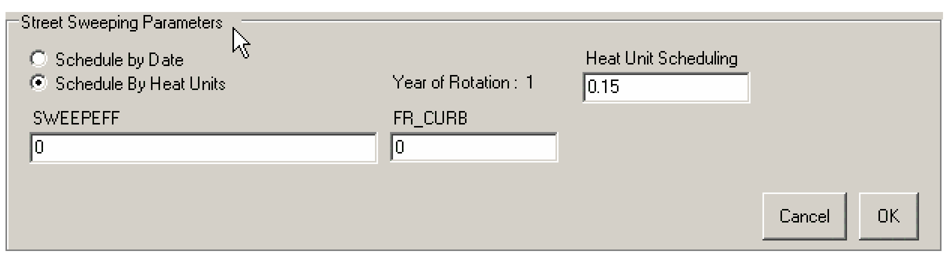


Figure 12.80

xiii. Release/impound

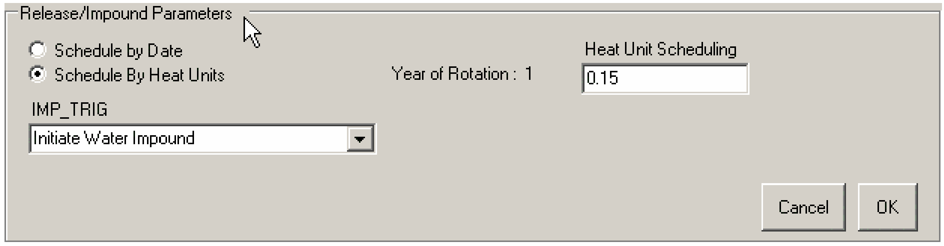


Figure 12.81

xiv. Continuous fertilization

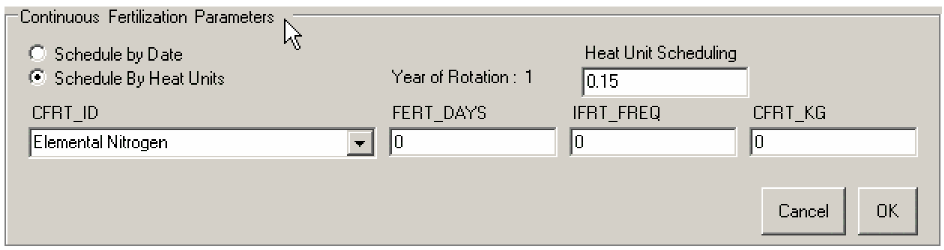


Figure 12.82

The **CFRT_ID** combo box wil allow the user to select a fertilizer from the SWAT fertilizer database.

8. To delete an operation:

a. Select the operation you wish to delete in the **Current Management Operations** table (Figure 12.83)

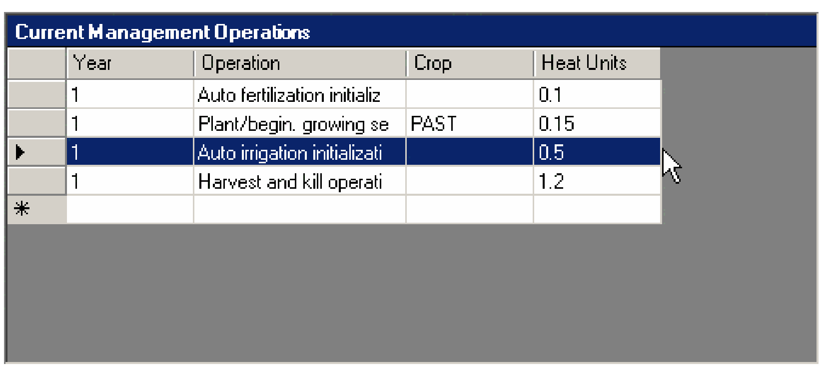


Figure 12.83

b. Click the **Delete Operation** button.

9. To edit an operation:

a. Select the operation you wish to delete in the **Current Management Operations** table (Figure 12.84).

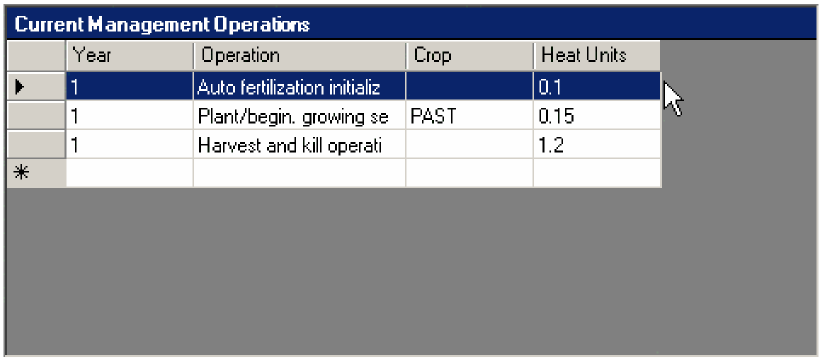


Figure 12.84

b. Click the **Edit Operation** button. The parameters for the selected operation will appear in the **Operation Parameters** section (Figure 12.85).

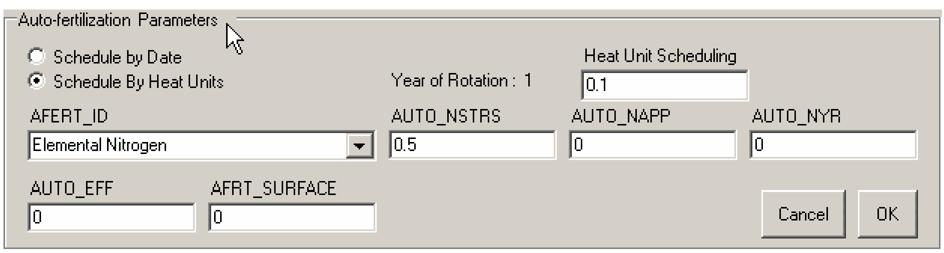


Figure 12.85

c. The Operations Parameters section will contain the same management operation input form when editing the operations as when adding an operation (Figures 12.69 – 12.82).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Management Parameters** dialog are written to the “mgt1” and “mgt2” tables in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional HRUs.

a. **Extend ALL HRU General Parameters**: This option pertains to the parameters defined on the **General Parameters** tab. By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected HRUs when edits are saved. If the user decides to check this option, then ALL the general management parameters in the current HRU will be applied to the selected HRUs when the edits are saved.

b. **Extend Management Operations**: This option pertains to the management operations scenario defined on the **Operations** tab. By default, this option will NOT be checked. This indicates that only the general management parameters will be extended to the selected HRUs. If the use checks this option, then the entire management operations scenario defined for the current HRU (including the crop planted) will be extended to the selected HRUs when edits are saved.

Note: Applying the Extend Management Operations is a useful technique for assigning a common operations schedule to a large number of HRUs at one time.

c. **Extend Edits to Current HRU**: If this option is checked, then the edits made will only be applied to the current HRU.

d. **Extend Edits to All HRUs**: If this option is checked, then the edits made will be applied to ALL the HRUs in the watershed.

e. **Extend Edits to Selected HRUs**: If this option is checked, then the edits made will be applied to HRUs selected in the Selected HRUs section. HRUs are selected by:

i. **Select Subbasins**: Land uses for selected subbasin wil populate the Land Use list box

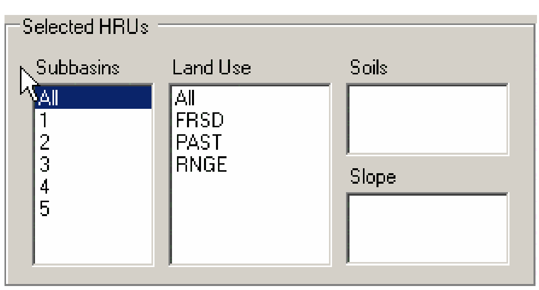


Figure 12.86

ii. **Select Land Use**: Soils for the selected land uses within the selected subbasins will populate the soils list box.

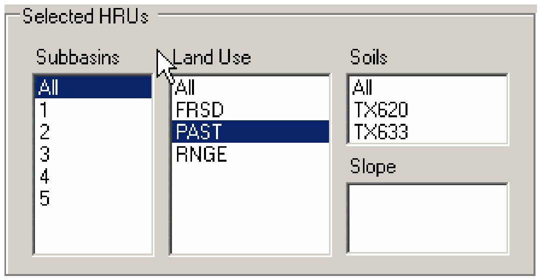


Figure 12.87

iii. **Selected Soils**: Slope classes for the selected soils within the selected land uses within the selected subbasins will populate the Slope list box.

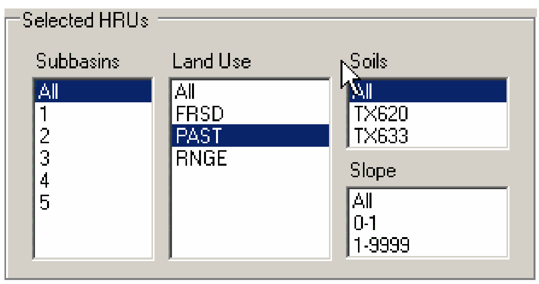


Figure 12.88

iv. **Select Slope Classes**: After selecting slope classes, you can click **Save Edits**.

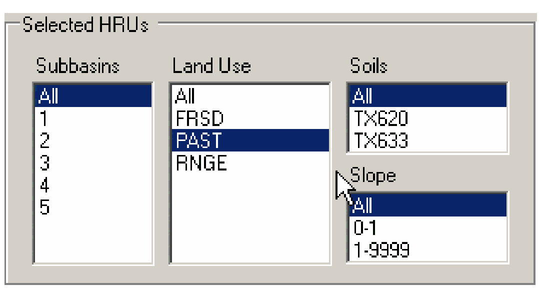


Figure 12.89

3. **Click Save Edits**.

To exit the **Edit Management Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new HRU to edit, or click **Cancel** to return the ArcSWAT project.

SECTION 12.9: EDIT SOIL CHEMICAL INPUT DATA (.CHM)

The **Edit Soil Chemical Parameters** dialog is launched if the user selects .Chm from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying soil chemical parameters for the HRU selected (Figure 12.90). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 23. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected HRU. All the controls for editing the data are not enabled (i.e., “grayed out”).

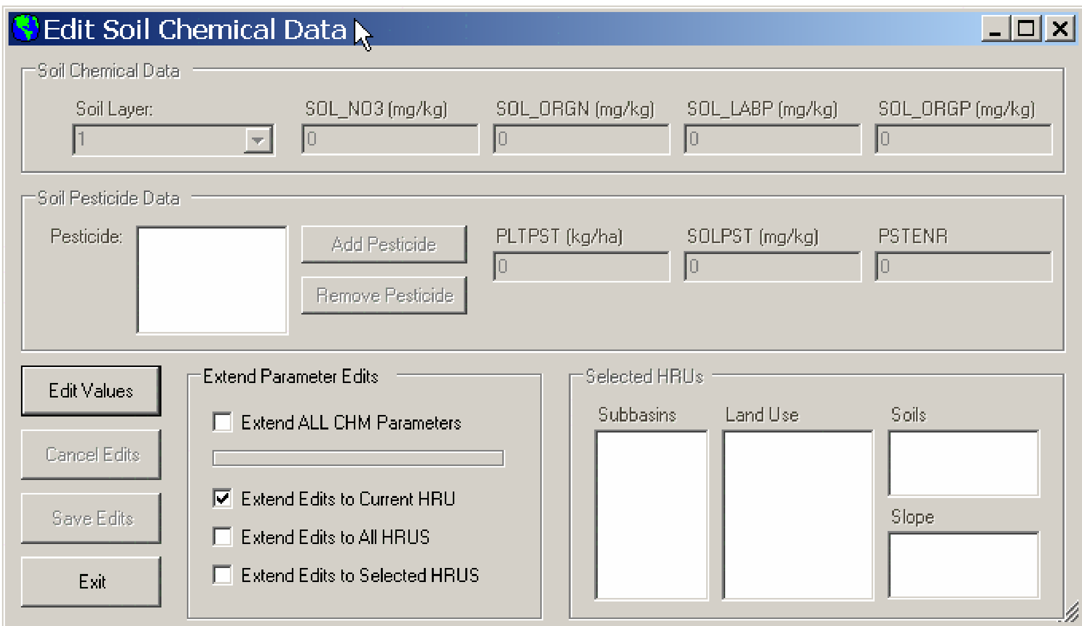


Figure 12.90

Editing Soil Chemical Parameters:

1. To edit the current parameters for the HRU, click the **Edit Values** button. The dialog is now in *Edit* mode. The controls for editing the HRU become enabled (Figure 12.91). You can now make changes to any of the soil chemical parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your HRU will revert back to their original values.

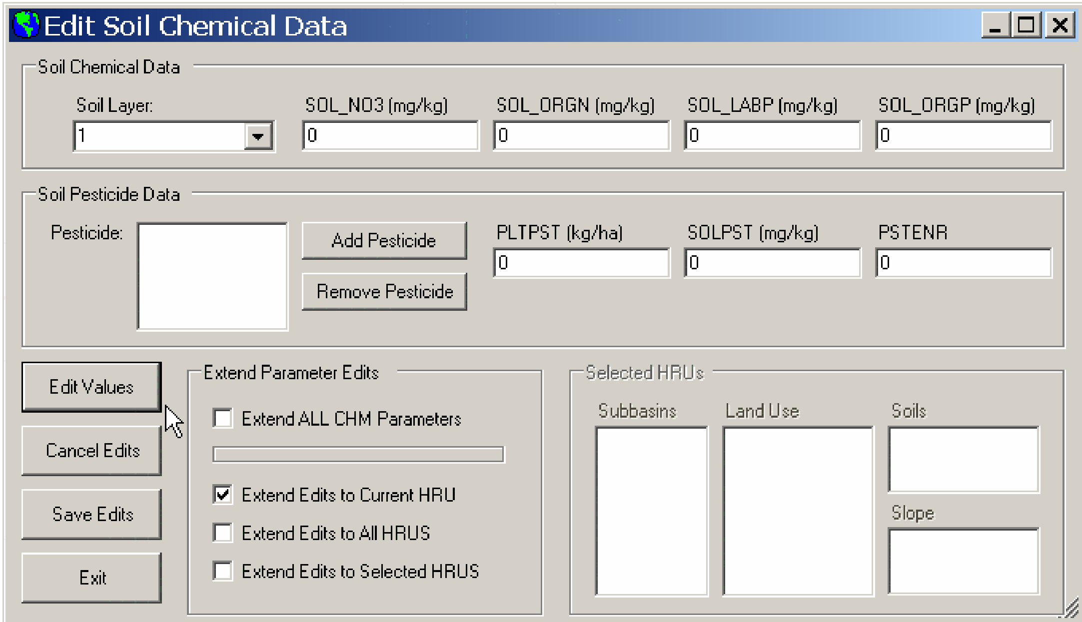


Figure 12.91

2. The parameters are split into two groups:

a. Soil Chemical Data: Initially, these parameters are displayed for soil layer 1. The user can change the current soil layer by selecting a different layer from the **Soil Layer** combo box. As you change the soil layer, the parameters in the **Soil Layer Parameters** section will also change (Figure 12.92).

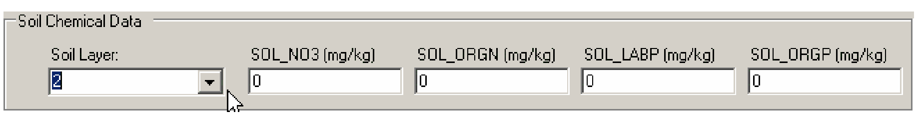


Figure 12.92

b. Soil Pesticide Data: This section allows the user to add or remove pesticides that exist within the soil or vegetation prior to the beginning of a model run.

i. To add a pesticide, click the Add Pesticide button (Figure 12.93).

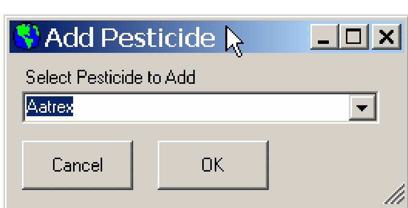


Figure 12.93

ii. Select the pesticide of interest from the combo box and click **OK**.

iii. The selected pesticide will be added to the **Pesticide** list box. The parameters related to that pesticide can then be edited (Figure12.94)

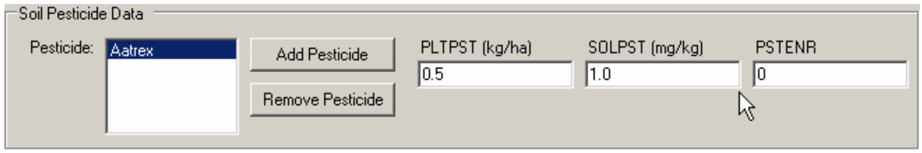


Figure 12.94

iv. To remove a pesticide, select the pesticide from the **Pesticide** list box in the **Soil Pesticide Data** section of the **Edit Soil Chemical Data** dialog. Then click the **Remove Pesticide** button.

3. Modify parameters in both the **Soil Chemical Data** and **Soil Pesticide Data** sections by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

4. If a values is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.95. Click **OK** and the parameter is reset to the previous value.

Figure 12.95

5. While editing soil chemical parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Soil Parameters** dialog are written to the “chm” table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional HRUs.

   a. **Extend ALL HRU Parameters**: By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected HRUs when edits are saved. If the user decides to check this option, then ALL the soil chemical parameters in the current HRU will be applied to the selected HRUs when the edits are saved.

   b. **Extend Edits to Current HRU:** If this option is checked, then the edits made will only be applied to the current HRU.

   c. **Extend Edits to All HRUs**: If this option is checked, then the edits made will be applied to ALL the HRUs in the watershed.

   d. **Extend Edits to Selected HRUs:** If this option is checked, then the edits made will be applied to HRUs selected in the Selected HRUs section. HRUs are selected by:

      i. **Select Subbasins:** Land uses for selected subbasin will populate the Land Use list box

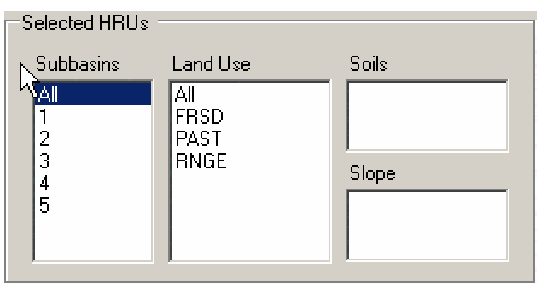


Figure 12.96

      ii. **Select Land Use:** Soils for the selected land uses within the selected subbasins will populate the soils list box.

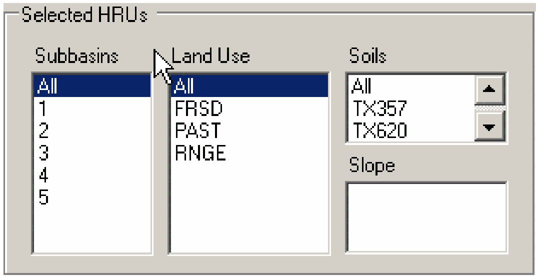


Figure 12.97

iii. **Selected Soils:** Slope classes for the selected soils within the selected land uses within the selected subbasins will populate the Slope list box.

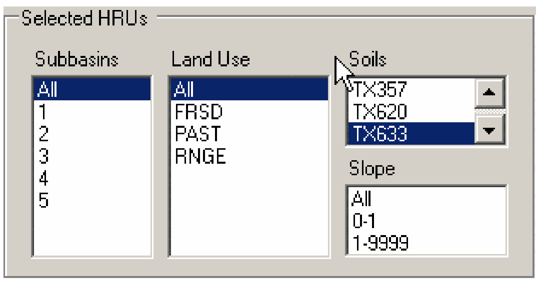


Figure 12.98

iv. **Select Slope Classes:** After selecting slope classes, you are can click **Save Edits**.

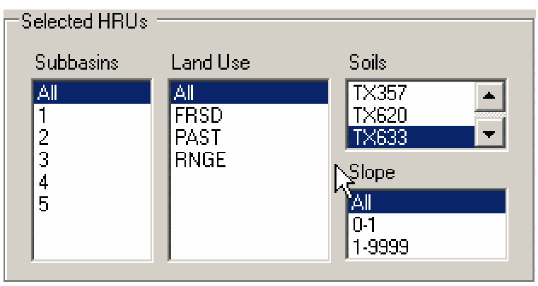


Figure 12.99

3. Click **Save Edits**.

To exit the **Edit Soil Chemical Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new HRU to edit, or click **Cancel** to return the ArcSWAT project.

SECTION 12.10: EDIT POND/WETLAND INPUT DATA (.PND)

The **Edit Pond/Wetland Parameters** dialog is launched if the user selects .Pnd from the **SWAT Input Table** combo box on the **Edit Subbasin Inputs** dialog (Figure 12.9). The dialog will open, displaying subbasin impoundment parameters for the subbasin selected (Figure 12.100). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 28. When the dialog initially appears, the dialog is in *View* mode. This allows the user to view the current parameters for the selected subbasin. All the controls for editing the data are not enabled (i.e., “grayed out”).

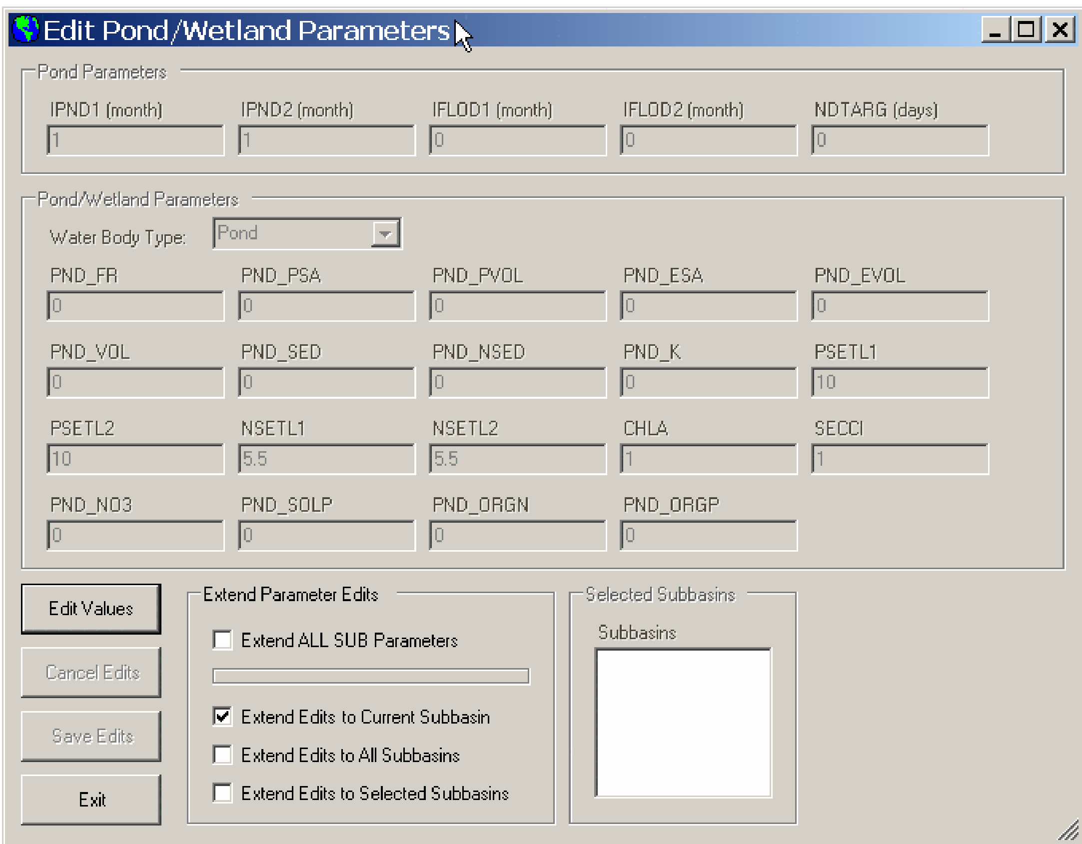


Figure 12.100

Editing Pond/Wetland Data:

1. To edit the current parameters for the subbasin, click the **Edit Values** button. The dialog is now in *Edit* mode. The controls for editing the subbasin become enabled (Figure 12.101). You can now make changes to any of the parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you

decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your subbasin will revert back to their original values.

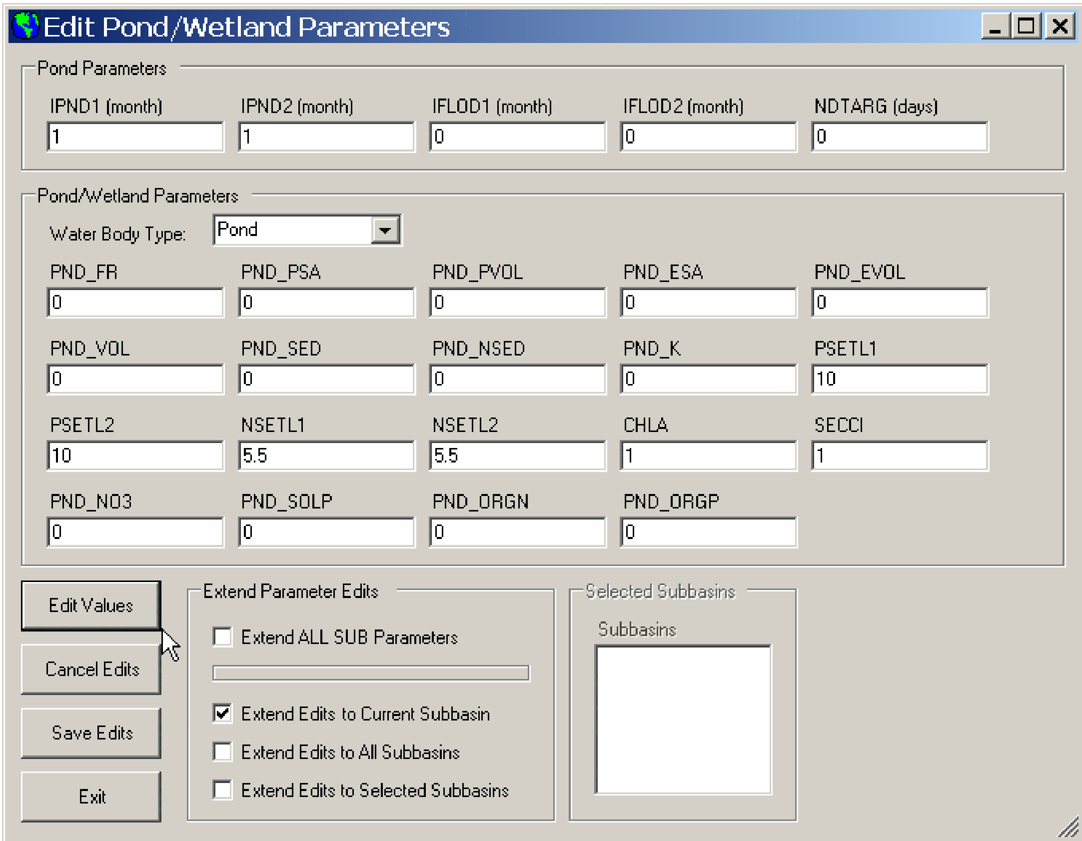


Figure 12.101

2. The data are separated into two groups:

   a. Pond Parameters: This set of parameters contains variables that are required only for ponds.

   b. Pond/Wetland Parameters: These parameters are required for both ponds and wetlands. Choose either “Pond” or “Wetland” from the **Water Body Type** combo box. As you change the water body type, the parameters in the **Pond/Wetland Parameters** section will also change (Figure 12.102), allowing the user to enter the parameters for the specified water body type.

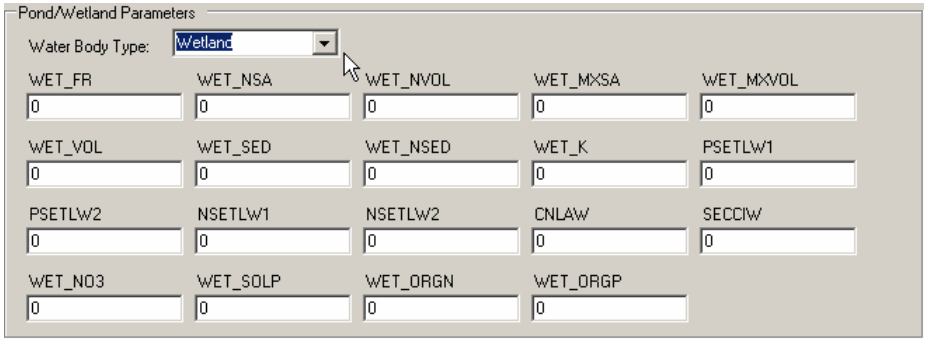


Figure 12.102

3. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

4. If a value is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.103. Click OK and the parameter is reset to the previous value.

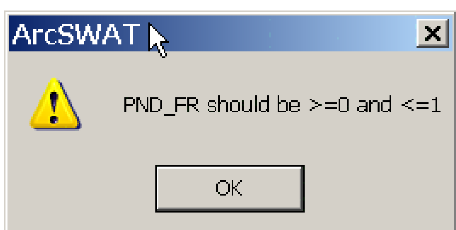


Figure 12.103

5. While editing pond/wetland parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Subbasin Parameters** dialog are written to the “pnd” table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional subbasins.

a. **Extend ALL SUB Parameters**: By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected subbasins when edits are saved. If the user decides to check this option, then ALL the pond/wetland parameters in the current subbasin will be applied to the selected subbasins when the edits are saved.

b. **Extend Edits to Current Subbasin:** If this option is checked, then the edits made will only be applied to the current subbasin.

c. **Extend Edits to All Subbasins**: If this option is checked, then the edits made will be applied to ALL the subbasins in the watershed.

d. **Extend Edits to Selected Subbasins:** If this option is checked, then the edits made will be applied to subbasins selected in the Selected Subbasins section. Subbasins are selected by making a selection from the Subbasins list box (Figure 12.104).

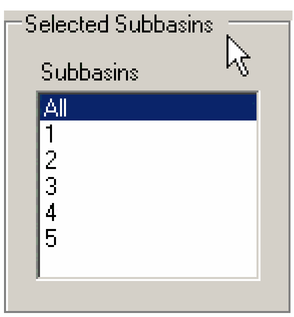


Figure 12.104

3. Click **Save Edits.**

To exit the **Edit Pond/Wetland Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new subbasin or HRU to edit, or click **Cancel** to return to the ArcSWAT project.

SECTION 12.11: EDIT STREAM WATER QUALITY INPUT DATA (.SWQ)

The Edit Stream Water Quality Parameters dialog is launched if the user selects .Swq from the SWAT Input Table combo box on the Edit Subbasin Inputs dialog (Figure 12.9). The dialog will open, displaying stream water quality parameters for the subbasin selected (Figure 12.105). A complete description of the variables is provided in the Soil and Water Assessment Tool User's Manual, Version 2005, Chapter 27. When the dialog initially appears, the dialog is in View mode. This allows the user to view the current parameters for the selected subbasin. All the controls for editing the data are not enabled (i.e., “grayed out”).

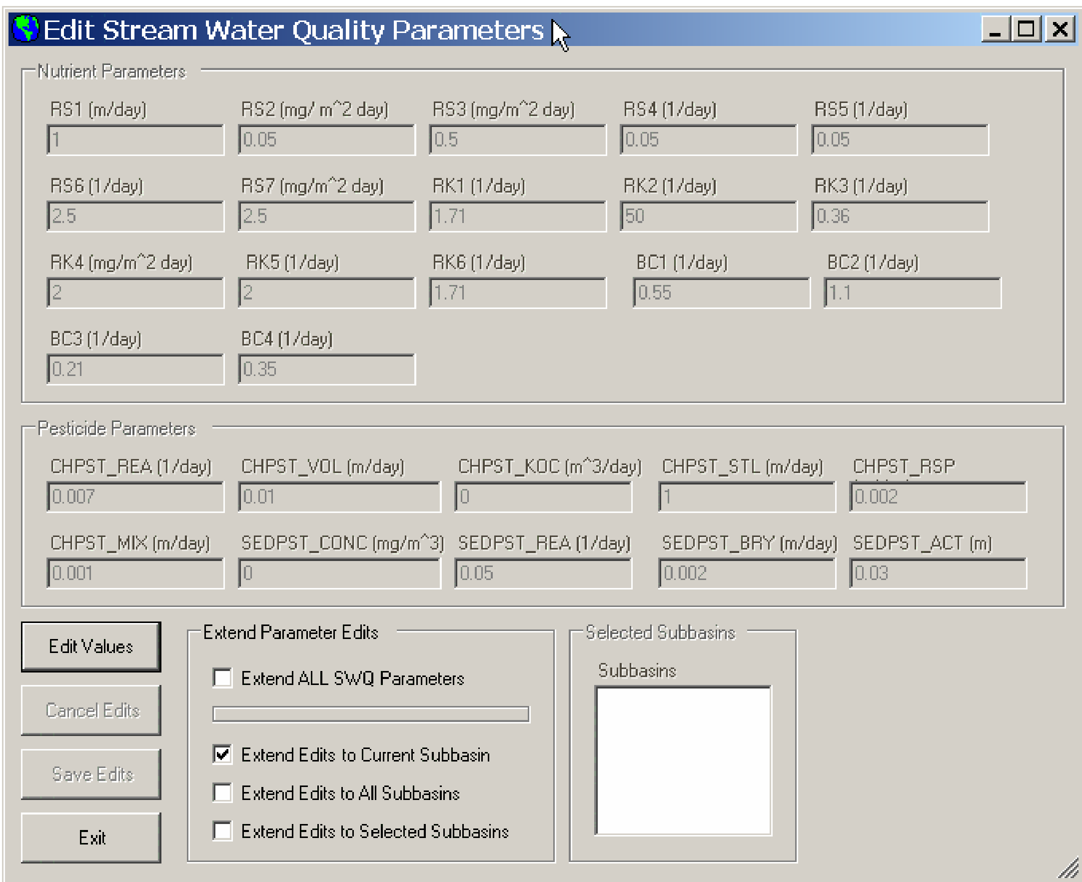


Figure 12.105

Editing Stream Water Quality Data:

1. To edit the current parameters for the subbasin, click the **Edit Values** button. The dialog is now in *Edit* mode. The controls for editing the subbasin become enabled (Figure 12.106). You can now make changes to any of the parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you

decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your subbasin will revert back to their original values.

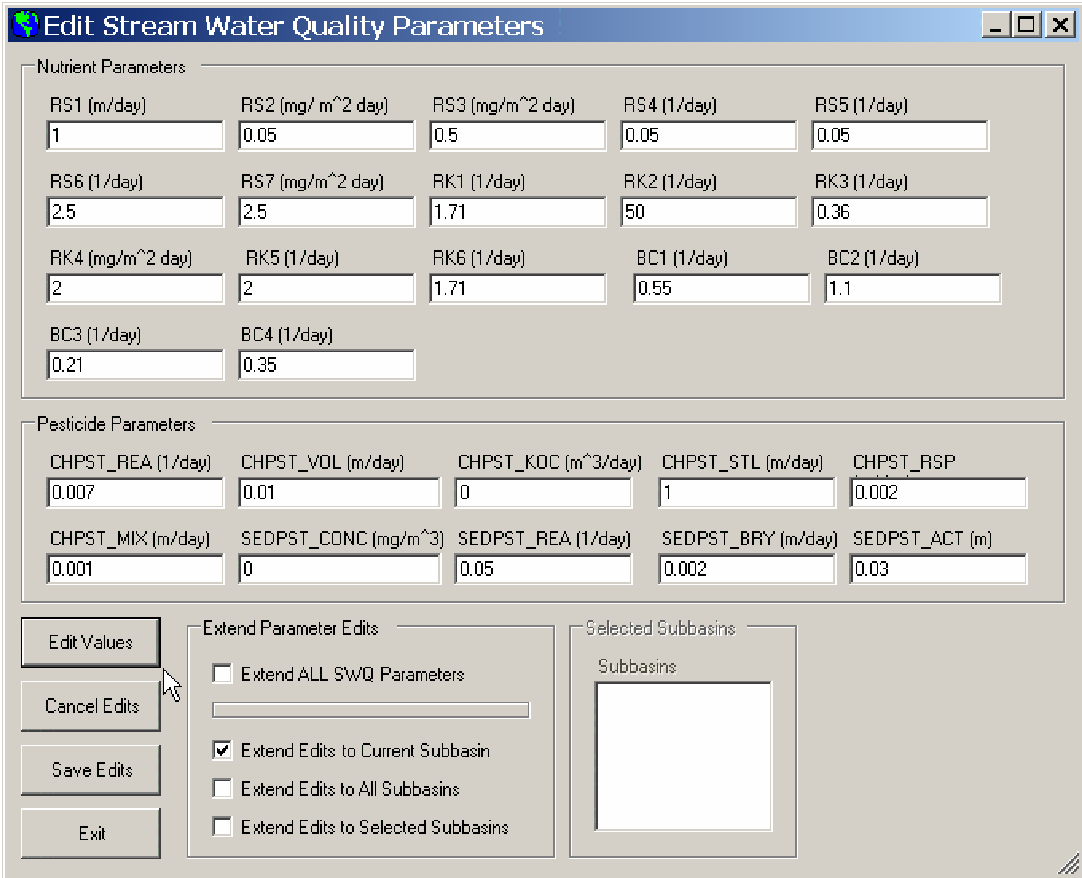


Figure 12.106

2. The data are separated into two groups:

   a. Nutrient Parameters: This set of parameters contains variables that are required for nutrient modeling.

   b. Pesticide Parameters: This set of parameters contains variables that are required for pesticide modeling.

3. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

4. If a values is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 12.107. Click **OK** and the parameter is reset to the previous value.

Figure 12.107

5. While editing stream water quality parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

Saving Parameter Edits:

1. Saving parameter edits is accomplished by clicking the **Save Edits** button. When this occurs, the parameter values in your **Edit Subbasin Parameters** dialog are written to the "swq" table in the SWAT Project Geodatabase.

2. Extending Parameter Edits: There are several options available for extending the edits made to additional subbasins.

   a. **Extend ALL SUB Parameters:** By default, this option will NOT be checked. This indicates that ONLY the parameters that were modified during the current edit session will be extended to the selected subbasins when edits are saved. If the user decides to check this option, then ALL the stream water quality parameters in the current subbasin will be applied to the selected subbasins when the edits are saved.

   b. **Extend Edits to Current Subbasin**: If this option is checked, then the edits made will only be applied to the current subbasin.

   c. **Extend Edits to All Subbasins**: If this option is checked, then the edits made will be applied to ALL the subbasins in the watershed.

   d. **Extend Edits to Selected Subbasins:** If this option is checked, then the edits made will be applied to subbasins selected in the Selected Subbasins section. Subbasins are selected by making a selection from the Subbasins list box (Figure 12.108).

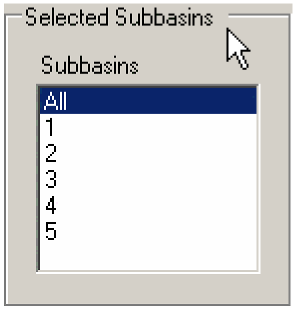


Figure 12.108

3. Click Save Edits.

To exit the **Edit Stream Water Quality Parameters** dialog, click the **Exit** button. The interface will return to the **Edit Subbasin Inputs** dialog (Figure 12.9). You may now either select a new subbasin or HRU to edit, or click **Cancel** to return to the ArcSWAT project.

SECTION 12.12: REWRITING WATERSHED INPUT FILES

If subbasin input tables are edited, then they must also be written to the ASCII format input files read by the SWAT model. The last item in the **Edit SWAT Input** menu is **Re-Write SWAT Input Files** (Figure 12.109).

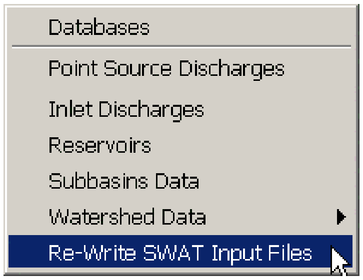


Figure 12.109

Selecting **Re-Write SWAT Input Files** will open a new dialog that will allow the user to select the input files to rewrite (Figure 12.110)

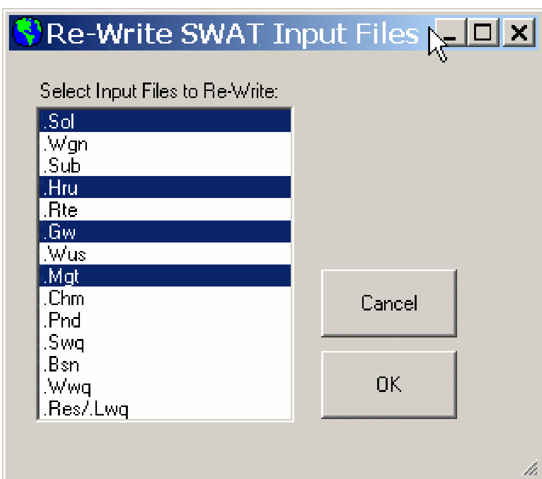


Figure 12.110

Note: Both subbasin and watershed level input files are listed in the Re-Write SWAT Input Files dialog.

Any file that was edited using the SWAT Input Editors **MUST** be rewritten. Select the input files to rewrite, and then click the **OK** button to write the files. When the files have been successfully written, a message box will appear (Figure 12.111).

Figure 12.111

Click the Cancel button on the **Re-Write SWAT Input Files** dialog to return to the ArcSWAT project.

Note: If the user chooses to edit the SWAT input tables in the SWAT Project geodatabase outside of the ArcSWAT interface, then they must re-write the SWAT ascii input files by choosing the Re-Write SWAT Input Files option from the Edit SWAT Input menu and choose the appropriate SWAT files to re-write.

SECTION 13: INPUT MODIFICATION—WATERSHED

The **Edit SWAT Input** menu allows you to edit the SWAT model databases and the watershed database files containing the current inputs for the SWAT model. Select the **Edit SWAT Input** menu using the mouse. Seven items are listed on the **Edit Input** menu (Figure 13.1).

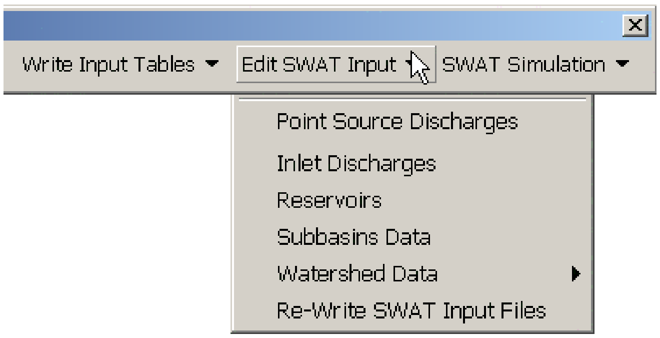


Figure 13.1

The sixth item of the **Edit SWAT Input** menu allows the user to edit watershed-level parameters/inputs. Edits made to watershed data using the ArcSWAT interface are reflected only in the current SWAT project.

Select the **Watershed Data** command on the **Edit SWAT Input** menu (Figure 13.2) to display the watershed-level input file options. This item is enabled only once the default input tables are created (see Section 8).

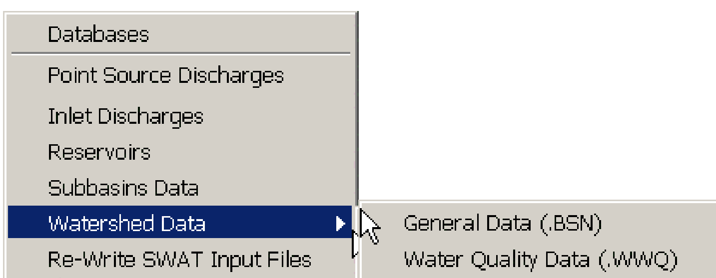


Figure 13.2

The following sections review each of the SWAT input editors for watershed-level parameters.

SECTION 13.1: GENERAL WATERSHED PARAMETERS (.BSN)

The **Edit General Watershed Parameters** dialog is launched if the user selects “General Data (.BSN)” from the **Watershed Data** item on the **Edit SWAT Input** menu (Figure 13.2). The dialog will open, displaying the general basin data for the watershed (Figure 13.3). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 4. When the dialog initially appears, the dialog is in *View* mode. This allows the user to view the current parameters for the selected HRU. All the controls for editing the data are not enabled (i.e., “grayed out”).

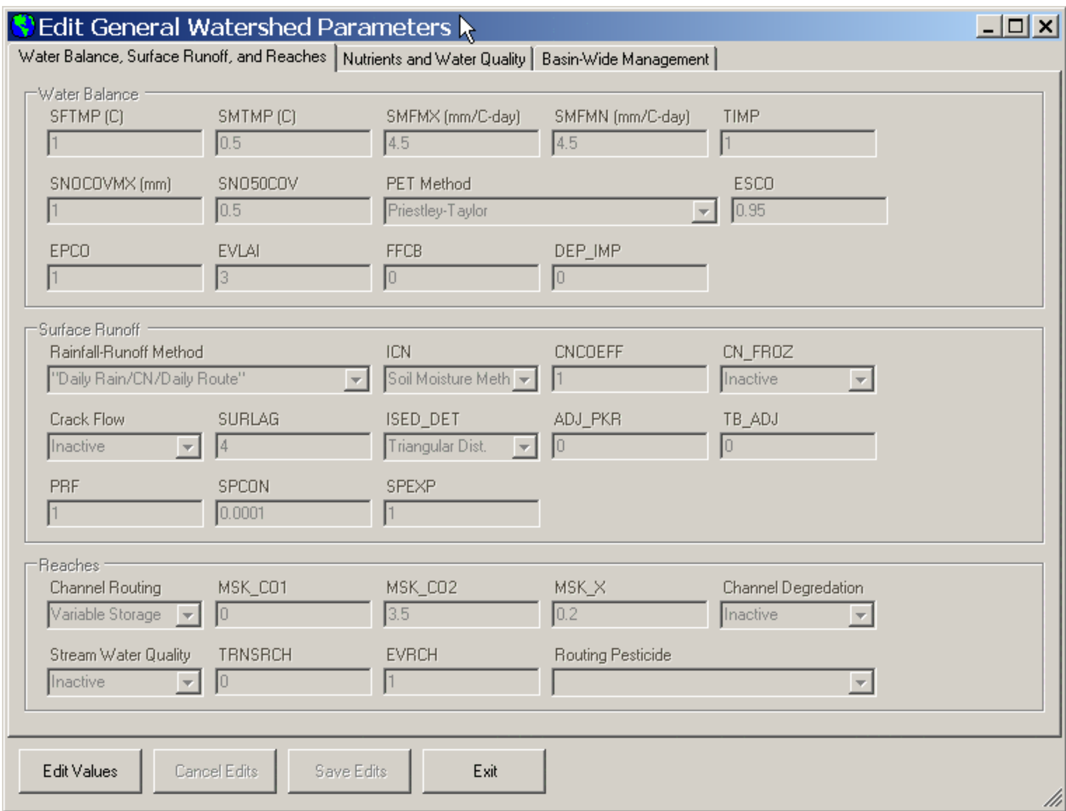


Figure 13.3

Editing General Watershed Parameters:

1. To edit the current parameters for the watershed, click the **Edit Values** button. The dialog is now in *Edit* mode. The controls for editing the watershed become enabled (Figure 13.4). You can now make changes to any of the parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your watershed will revert back to their

original values.

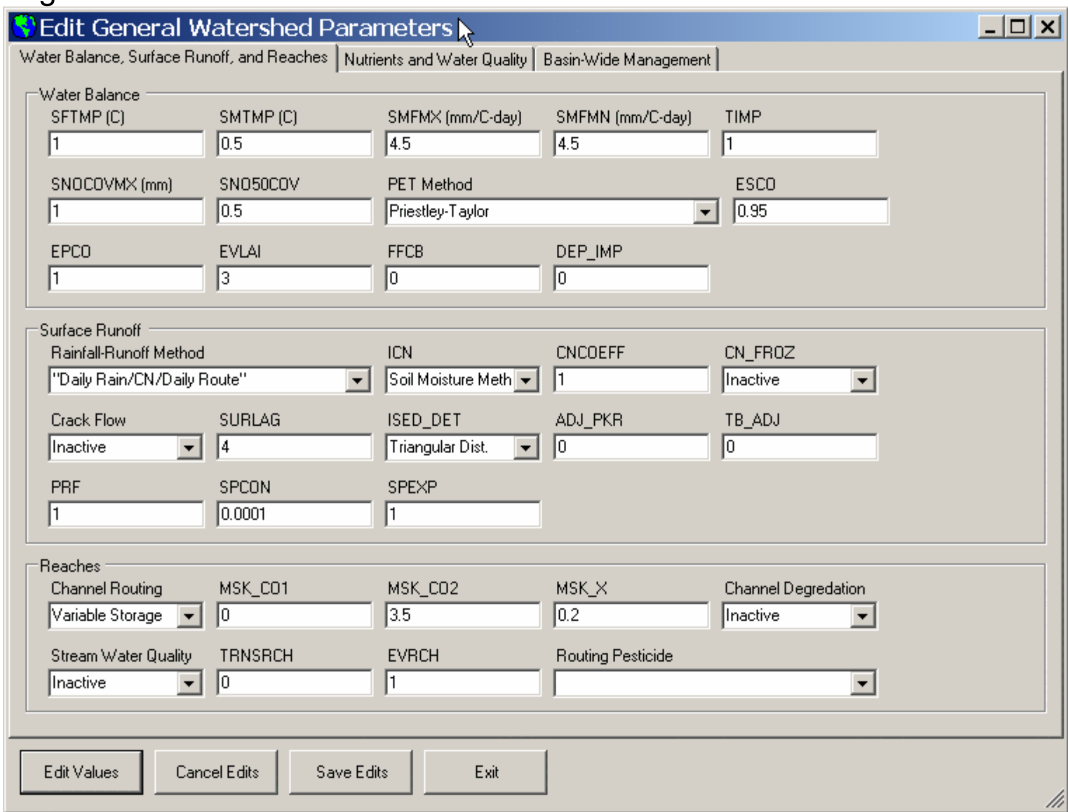


Figure 13.4

2. There are three tabs of data for the general watershed parameters:

   a. Water balance, Surface Runoff, and Reaches: These parameters impact the hydrologic components of the model (Figure 13.4).

   b. Nutrients and Water Quality: These parameters impact the water quality components of the model (Figure 13.5).

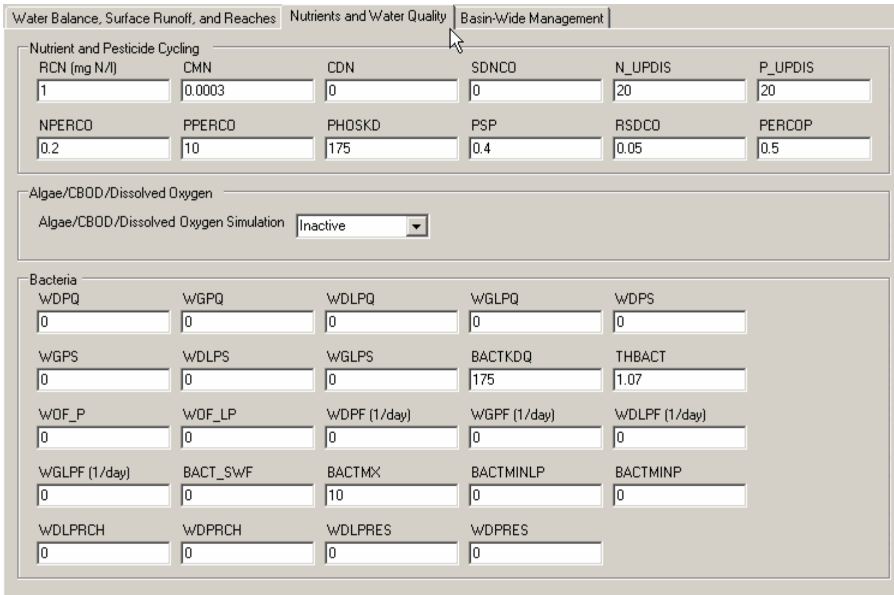


Figure 13.5

c. Basin-Wide Management: These impact management options basin-wide (Figure 13.6).

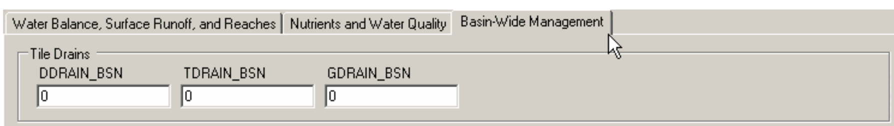


Figure 13.6

3. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

4. If a value is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 13.7 Click **OK** and the parameter is reset to the previous value.

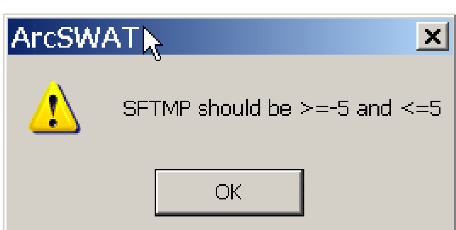


Figure 13.7

5. While editing watershed parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

6. Click **Save Edits**. The new General Watershed Parameters will be written to the “bsn” table in the SWAT Project Geodatabase.

7. To exit the **Edit General Watershed Parameters** dialog, click the **Exit** button. The interface will return to the ArcSWAT project.

SECTION 13.2: WATERSHED WATER QUALITY PARAMETERS (.WWQ)

The **Edit Watershed Water Quality Parameters** dialog is launched if the user selects “Water Quality Data (.Wwq)” from the **Watershed Data** item on the **Edit SWAT Input** menu (Figure 13.2). The dialog will open, displaying the watershed water quality parameters for the watershed (Figure 13.8). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 26. When the dialog initially appears, the dialog is in *View* mode. This allows the user to view the current parameters for the selected HRU. All the controls for editing the data are not enabled (i.e., “grayed out”).

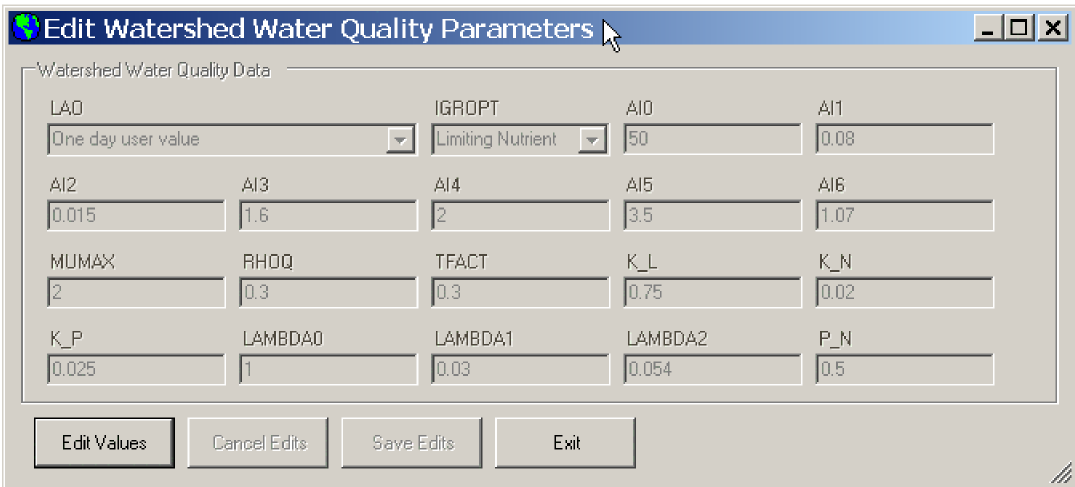


Figure 13.8

Editing Watershed Water Quality Parameters:

1. To edit the current parameters for the watershed, click the **Edit Values** button. The dialog is now in *Edit* mode. The controls for editing the watershed become enabled (Figure 13.9). You can now make changes to any of the parameters in the dialog. Your edits will not be saved to the SWAT Project Geodatabase until you click the **Save Edits** button. If you decide not to save the edits you have made, click the **Cancel Edits** button, and the parameters for your watershed will revert back to their

original values.

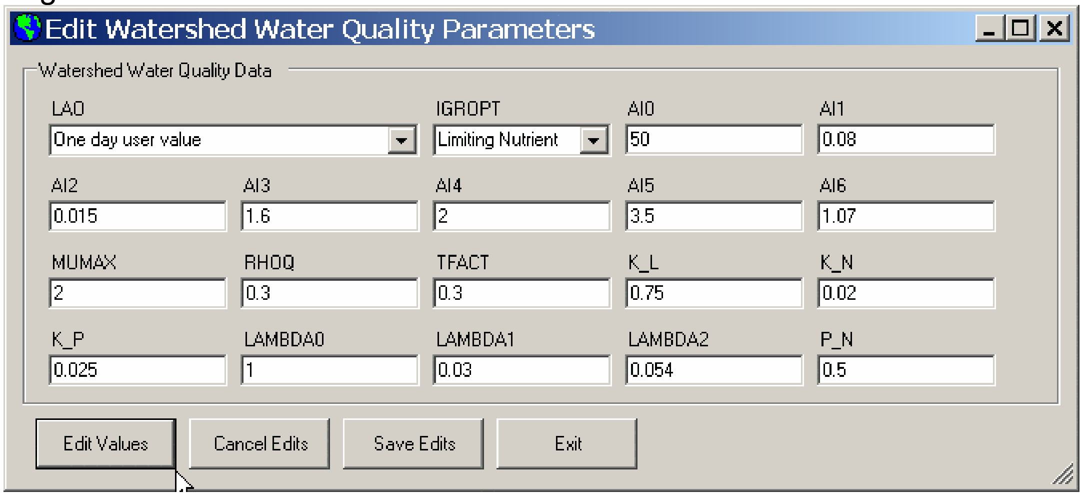


Figure 13.9

2. Modify a parameter by typing the new value in the text box corresponding to the parameter of interest.

Note: If the cursor is placed on top of any text box or button, a short help description (tooltip) appears and the range of variation for the parameter is shown.

3. If a value is entered for a parameter that is outside its valid range, an error message will appear as shown if Figure 13.10 Click **OK** and the parameter is reset to the previous value.

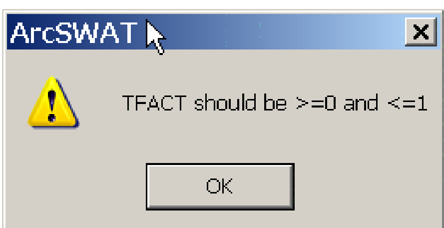


Figure 13.10

4. While editing watershed parameters, if you are ever dissatisfied with your changes, you may click **Cancel Edits** button, and all the parameters will revert back to their previous values (i.e., the values before the editing session was initiated).

5. Click **Save Edits**. The new Watershed Water Quality Parameters will be written to the “wwq” table in the SWAT Project Geodatabase.

6. To exit the **Edit Watershed Water Quality Parameters** dialog, click the Exit button. The interface will return to the ArcSWAT project.

SECTION 13.3: REWRITING WATERSHED INPUT FILES

If watershed input tables are edited, then they must also be written to the ASCII format input files read by the SWAT model. The last item in the **Edit SWAT Input** menu is **Re-Write SWAT Input Files** (Figure 13.10).

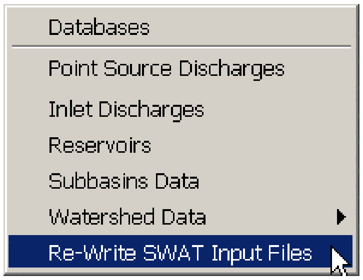


Figure 13.10

Selecting **Re-Write SWAT Input Files** will open a new dialog that will allow the user to select the input files to rewrite (Figure 13.11)

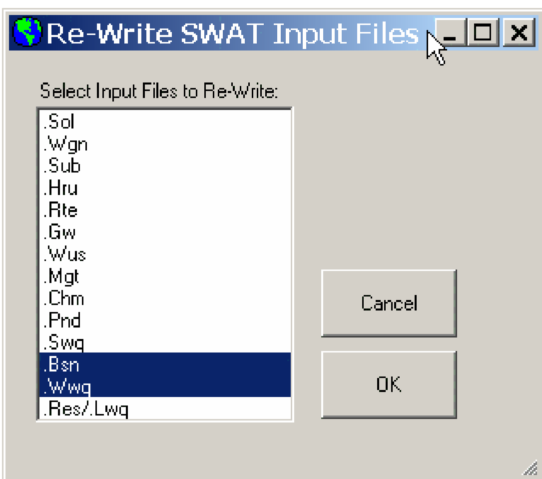


Figure 13.11

Note: Both subbasin and watershed level input files are listed in the **Re-Write SWAT Input Files** dialog.

Any file that was edited using the SWAT Input Editors **MUST** be rewritten. Select the input files to rewrite, and then click the **OK** button to write the files. When the files have been successfully written, a message box will appear (Figure 13.12).

Figure 13.12

Click the Cancel button on the **Re-Write SWAT Input Files** dialog to return to the ArcSWAT project.

SECTION 14: SWAT SIMULATION

The SWAT Simulation menu allows you to finalize the set up of input for the SWAT model and run the SWAT model, perform sensitivity analysis, and perform auto-calibration. Five items are listed on the SWAT Simulation menu (Figure 14.1).

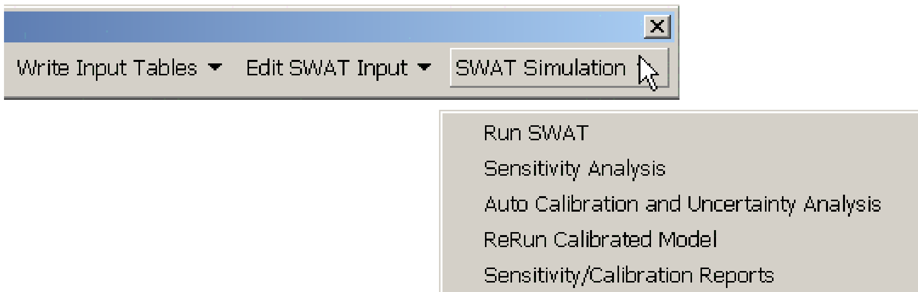


Figure 14.1

SECTION 14.1: RUN SWAT

The first command in the **SWAT Simulation** menu allows the user to set up and run the SWAT model.

1. Select **Run SWAT** from the **SWAT Simulation** menu (Figure 14.2).

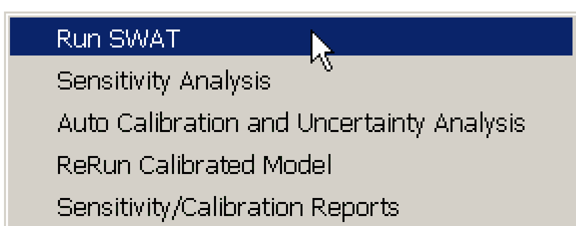


Figure 14.2

2. The Set Up and Run SWAT model simulation dialog box is displayed. (Figure 14.3).

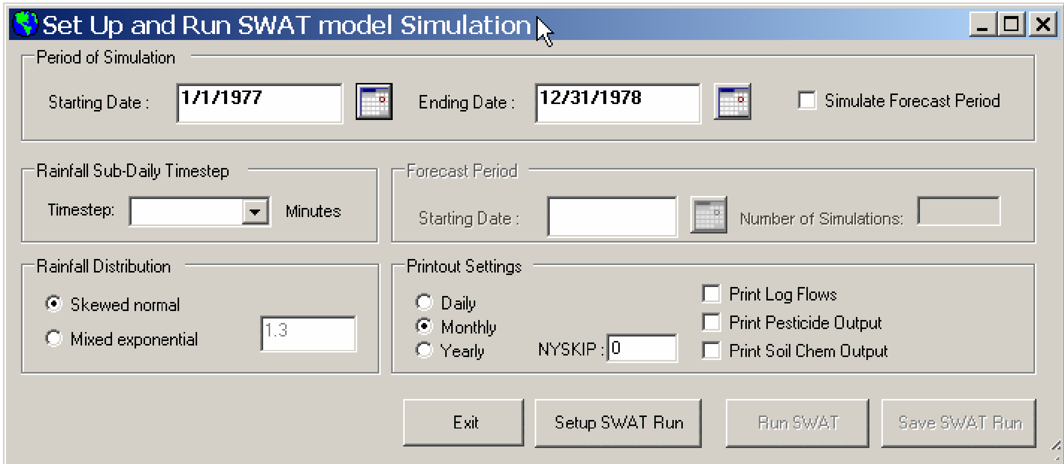


Figure 14.3

3. The dialog box contains several sections in which the user defines the option to be used in the simulation of various processes.

   a. Period of Simulation. In this section the user specifies the starting and ending dates of the simulation using the calendar buttons to the right of each text box (Figure 14.4). Clicking on a calendar button will launch a calendar dialog so that the user can choose a date (Figure 14.5).

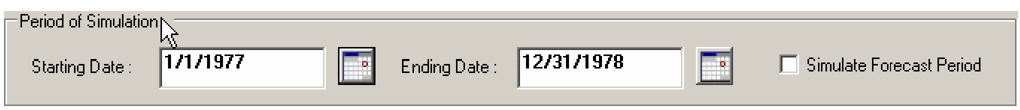


Figure 14.4

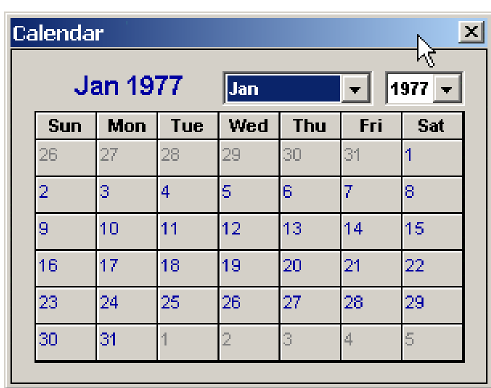


Figure 14.5

The **Simulate Forecast Period** check box can be checked if the user is running a forecast simulation.

Note: To run a forecast simulation, the user is required to prepare a forecast weather (.cst) file outside the ArcSWAT interface. The format of this file is discussed in the Soil and Water Assessment Tool User's Manual, Version 2005, Chapter 14. In addition, the user must have specified the forecast region ("FCST_REG") parameter for each subbasin using the **Subbasin Parameter Edit** dialog.

b. Forecast Period: This section will become enabled if the user checks the **Simulate Forecast Period** check box, or if a forecast period has already been defined for the SWAT simulation (Figure 14.6).

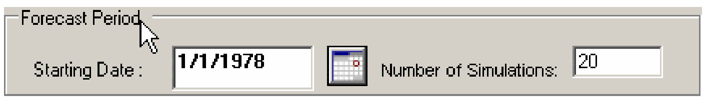


Figure 14.6

c. Rainfall Sub-Daily Time step: This section allows the user to define the time step of sub-daily precipitation data sub-daily data is being used in the simulation (Figure 14.7).

Figure 14.7

d. Rainfall Distribution: In this section, the user selects the distribution used to generate precipitation data. The user may choose between two options, **Skewed normal** or **Mixed exponential** using the respective radio button. When **Mixed exponential** is selected, a text box is enabled for the user to specify the exponent (Figure 14.8)

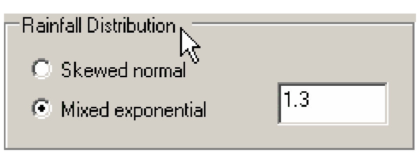


Figure 14.8

See *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 3 for more information about these options.

e. Printout Settings: This section controls the frequency of print output, and the printing of optional output files (Figure 14.9).

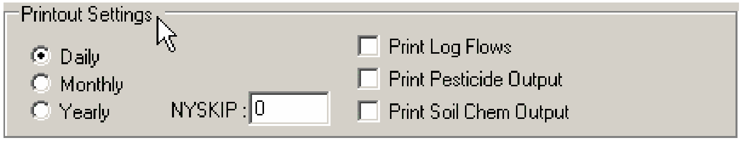


Figure 14.9

4. Once all options and parameters are defined. Click the **Setup SWAT Run** button. This button generates the final input files based on the settings defined in the **Set Up and Run SWAT model Simulation** dialog box. The main tasks performed during this process include preparing the watershed master control file ("file.cio"), and preparing reservoir outflow, point source and inlet discharge data. An error massage will notify the user of any problems. If final setup succeeds, the following message will appear (Figure 14.10).

Figure 14.10

5. Once the Setup of the SWAT input files is complete, the Run SWAT button becomes enabled (Figure 14.11).

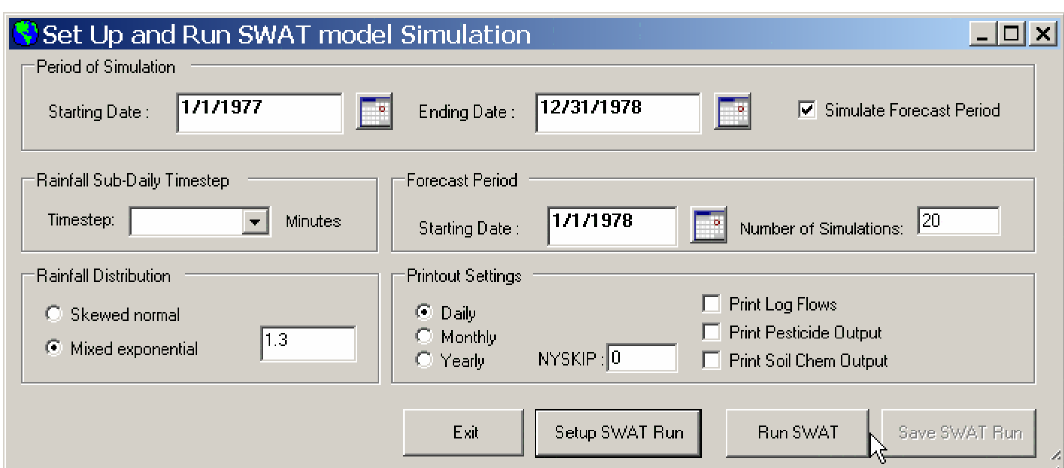


Figure 14.11

6. Now, the user can run the model. Click the **Run SWAT** button.

7. When the SWAT simulation terminates, one of two message boxes will be displayed:

   a. If the simulation terminated before the entire simulation period was completed, a message box will notify the user of a run failure (Figure 14.12).

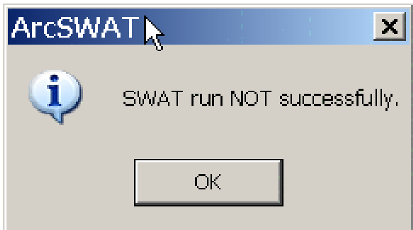


Figure 14.12

Click **OK**. Review inputs before attempting a new run.

Note: To debug a simulation: 1. Copy swat2005.exe from the avswatpr directory to the txtinout directory for the project. 2. Open a DOS command prompt window. Change to the project txtinout directory and run swat2005.exe 3. The error message will remain visible and will specify the line of code where the model is crashing. The user can use the source code to identify the problem or send the error message to technical support for assistance in locating the problem.

   b. If the simulation terminates properly, a message box will notify the user of a successful run (Figure 14.13).

Figure 14.13

Click **OK**. The SWAT run is now complete!

8. The **Save SWAT Run** button is now enabled.

9. (Optional) To save the SWAT simulation into a permanent folder:

a. Click the Save SWAT Run button. A dialog appears prompting the user to enter a name for the run (Figure 14.14)

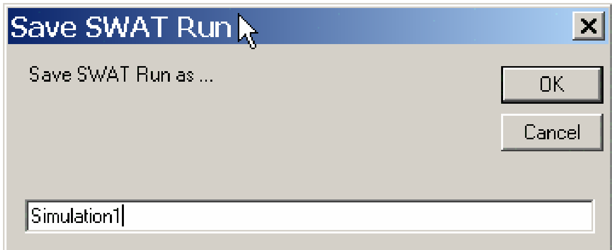


Figure 14.14

b. The simulation will be saved in a folder within the SWATProject\Scenarions\ folder. The SWAT Project Geodatabase is copied into the TablesIn folder and the ASCII input files are copied into the TxtInOut folder. A message box will appear if the simulation is successfully saved (Figure 14.15)

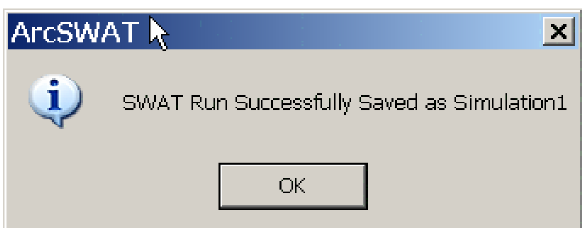


Figure 14.15

Note: In order to proceed with sensitivity analysis or auto-calibration, the SWAT simulation must be saved into a permanent folder.

SECTION 14.2: SENSITIVITY ANALYSIS

The second command in the **SWAT Simulation** menu launches the SWAT **Sensitivity Analysis** dialog. Sensitivity analysis can be run with or without observed data. Running sensitivity analysis without observed data will produce output describing the sensitivity the predicted model outputs to changes in specified model parameters. Running sensitivity analysis with observed data will additionally produce output describing the sensitivity of the model error to changes in the specified model parameters. For a full discussion of the sensitivity analysis options for SWAT, refer to the *Sensitivity, Auto-calibration, uncertainty and model evaluation in SWAT 2005* manual.

1. Select **Sensitivity Analysis** from the SWAT Simulation menu (Figure 14.16)

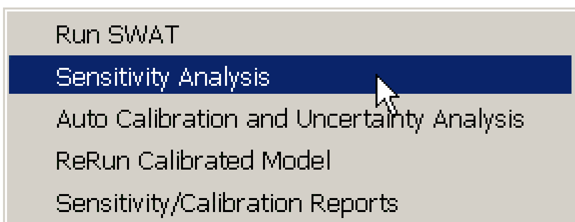


Figure 14.16

2. The Sensitivity Analysis dialog is displayed (Figure 14.17).

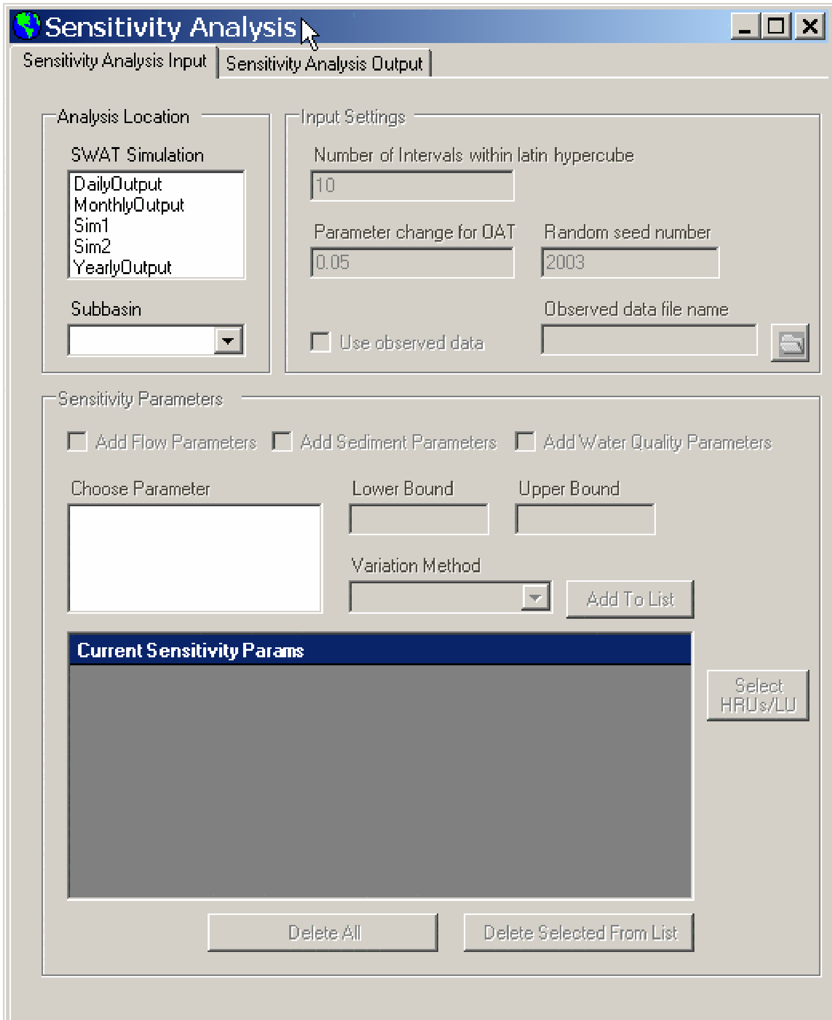


Figure 14.17

Sensitivity Analysis Input

Sensitivity analysis input is defined on the first tab of the Sensitivity Analysis dialog. This tab contains sections for defining the analysis location, the algorithm input settings, and the SWAT model parameters to be evaluated.

1. Select a simulation from the **SWAT Simulation** list box to run sensitivity analysis on (Figure 14.18).

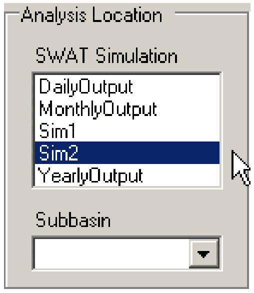


Figure 14.18

2. A message will appear asking that you select a subbasin to perform the sensitivity analysis on (Figure 14.19).

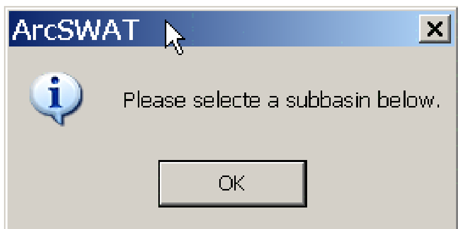


Figure 14.19

3. Select a subbasin from the Subbasin Combo box (Figure 14.20)

Figure 14.20

4. The **Input Settings** section is now enabled (Figure 14.21). If observed data will be used in the analysis, check the **Use observed data** check box, and click on the file browse button to browse for an observed data file (refer to the *Sensitivity, Auto-calibration, uncertainty and model evaluation in SWAT 2005* details on input settings and observed data file formatting). Observed data files should end with a ".dat" extension.

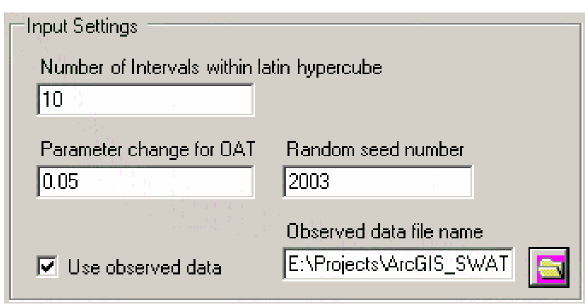


Figure 14.21

5. After selecting a subbasin for analysis, the **Sensitivity Parameters** section will also become enabled (Figure 14.22). This section allows users to choose which parameters' sensitivity will be evaluated.

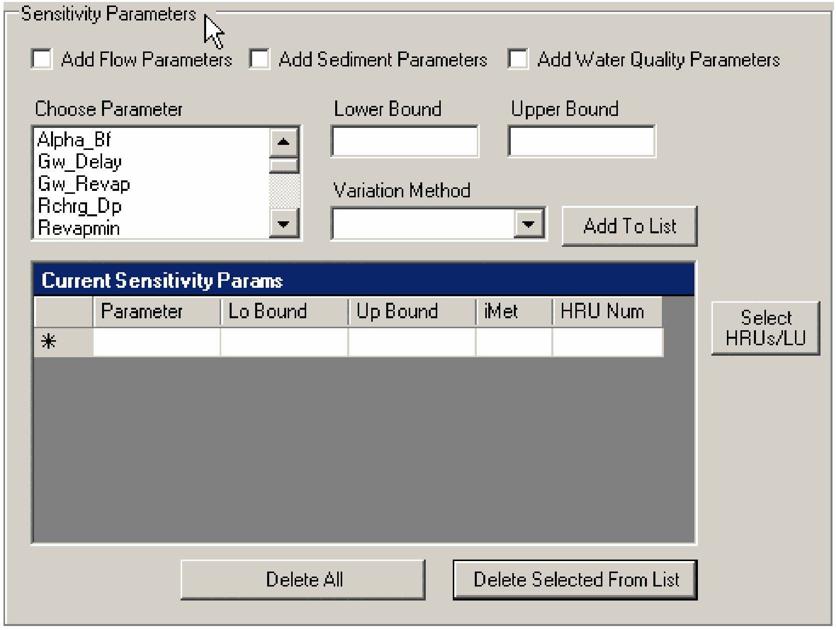


Figure 14.22

There are two ways in which parameters may be selected: individually, or as parameter groups.

a. Individual parameter selection:

i. Select a parameter from the **Choose Parameter** list box. The default **Lower Bound, Upper Bound,** and **Variation Method** values will be populated (Figure 14.23). Modify the bounds and variation method if desired, then click the **Add To List** button to add the parameter to the **Current Sensitivity Params** table.

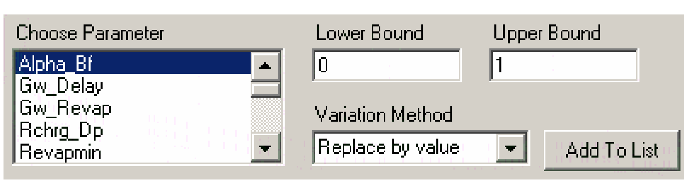


Figure 14.23

ii. The **Current Sensitivity Params** table will be updated with the new parameter added (Figure 14.24).

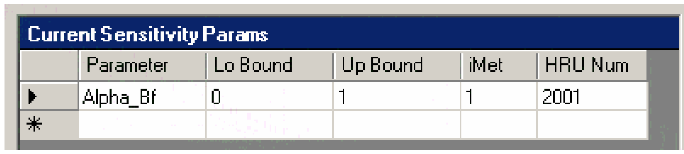


Figure 14.24

b. Group parameter selection:

i. To add an entire group of parameters that affects flow, sediment, or water quality output, check one of the parameter group check boxes at the tip of the Sensitivity Parameters section (Figure 14.25).

Figure 14.25

ii. After checking a box, all the parameters will appear in the **Current Sensitivity Params** table with their default bounds and variation methods (Figure 14.26).

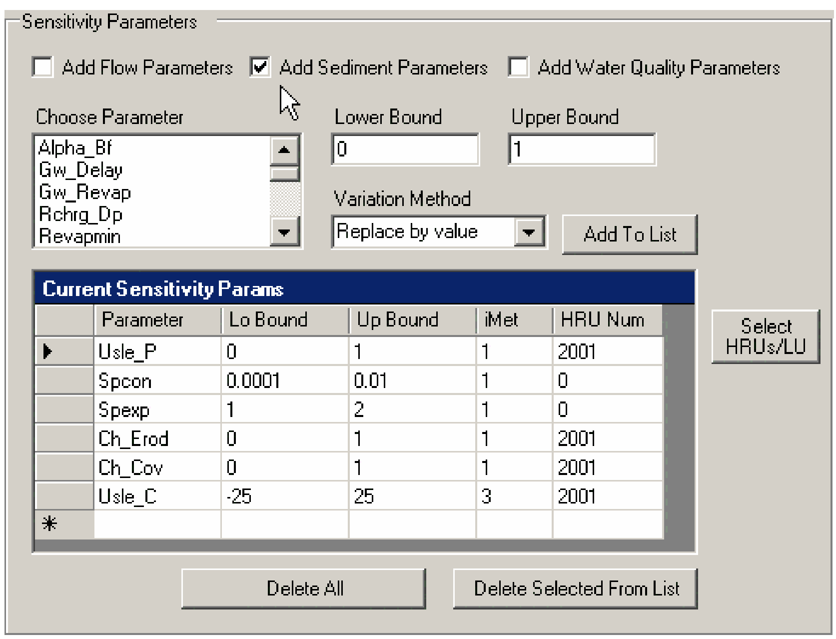


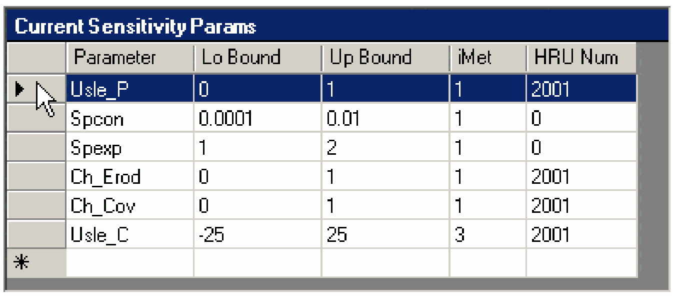
Figure 14.26

iii. If a check box becomes unchecked, then the parameters in that group are removed from the **Current Sensitivity Params** table.

6. Modifying the HRUs, subbasins, or crops that a parameter variation is applied to: By default, parameter variations are applied to all HRUs,

subbasins, or crops in the watershed. This is indicated by a value of “2001” for the **HRU Num** field in the **Current Sensitivity Params** table (an **HRU Num** value of “0” indicates that the parameter is a watershed-level parameter which can never be varied at the HRU, subbasin, or crop level). This setting may be modified so that only user-defined HRUs, subbasins, or crops experience the parameter variations during the sensitivity analysis. To make these modifications:

a. Select the parameter of interest from the **Current Sensitivity Params** table (Figure 14.27)



Current Sensitivity Params

Parameter	Lo Bound	Up Bound	iMet	HRU Num
Usle_P	0	1	1	2001
Spcon	0.0001	0.01	1	0
Spexp	1	2	1	0
Ch_Erod	0	1	1	2001
Ch_Cov	0	1	1	2001
Usle_C	-25	25	3	2001

Figure 14.27

b. Click the **Select HRUs/LU** button 

. The Sensitivity/Auto-Calibration HRUs dialog will open (Figure 14.28).

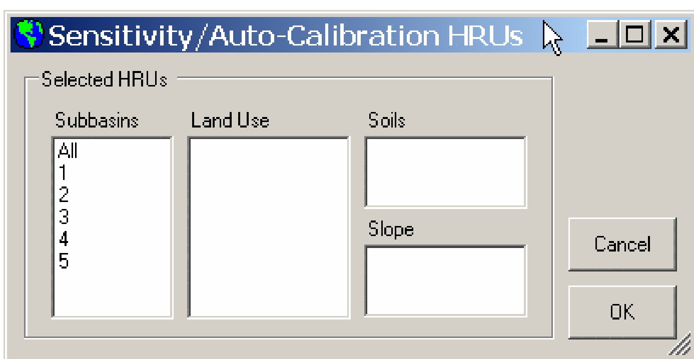


Figure 14.28

c. Select the HRUs of interest by choosing the **Subbasins, Land Use, Soils,** and **Slope** classes from the list boxes (Figure 14.29). Then, click OK.

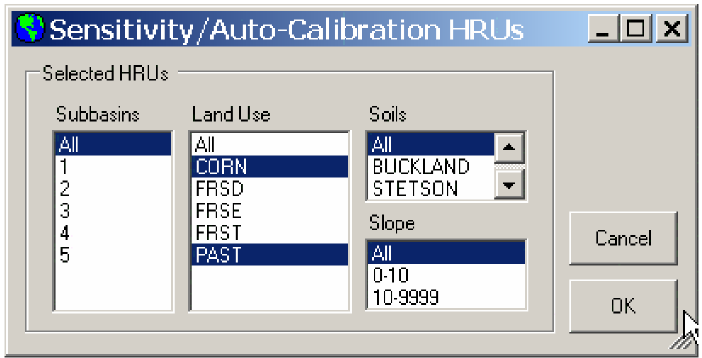
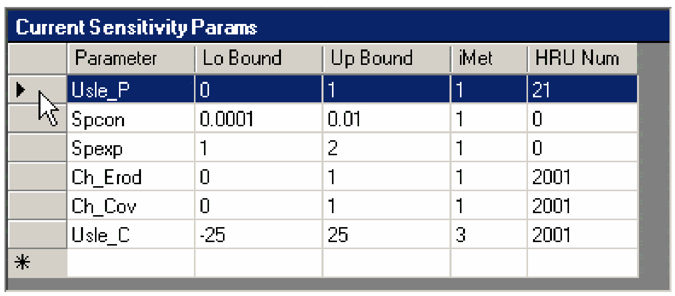


Figure 14.29

d. The number of HRUs selected is reported, and the **Current Sensitivity Params** table is updated (Figure 14.30).



Current Sensitivity Params

Parameter	Lo Bound	Up Bound	iMet	HRU Num
Usle_P	0	1	1	21
Spcon	0.0001	0.01	1	0
Spexp	1	2	1	0
Ch_Erod	0	1	1	2001
Ch_Cov	0	1	1	2001
Usle_C	-25	25	3	2001

Figure 14.30

e. Note: If a parameter can only be varied by subbasin or crop, then the **Sensitivity/Auto-Calibration HRUs** dialog will be limited to selecting only subbasins or crops as required. A full discussion of which parameters can be varied by HRU, subbasin, or crop may be found in the *Sensitivity, Auto-calibration, uncertainty and model evaluation in SWAT 2005* manual.

7. To delete parameters from the **Current Sensitivity Params** table, either:

a. Select a single parameter to delete and click the **Delete Selected From List** button (Figure 14.31)

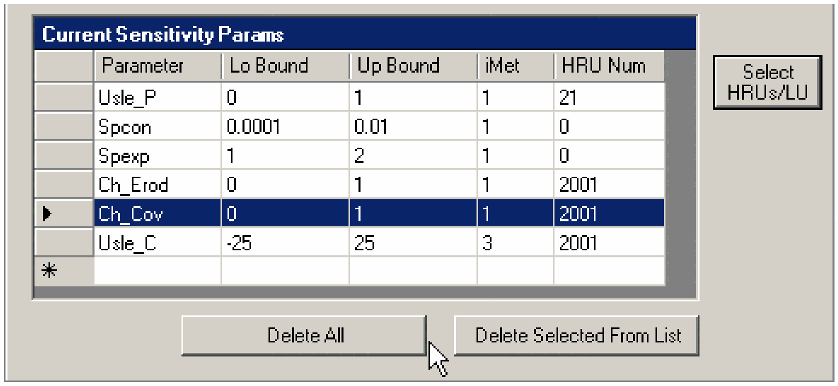


Figure 14.31

b. Click the **Delete All** button to delete all the current parameters.

Sensitivity Analysis Output

Sensitivity analysis output is defined on the second tab of the Sensitivity Analysis dialog (Figure 14.32). This tab contains sections for defining **Output Parameter Sensitivity** and the **Observed vs. Simulated Sensitivity**.

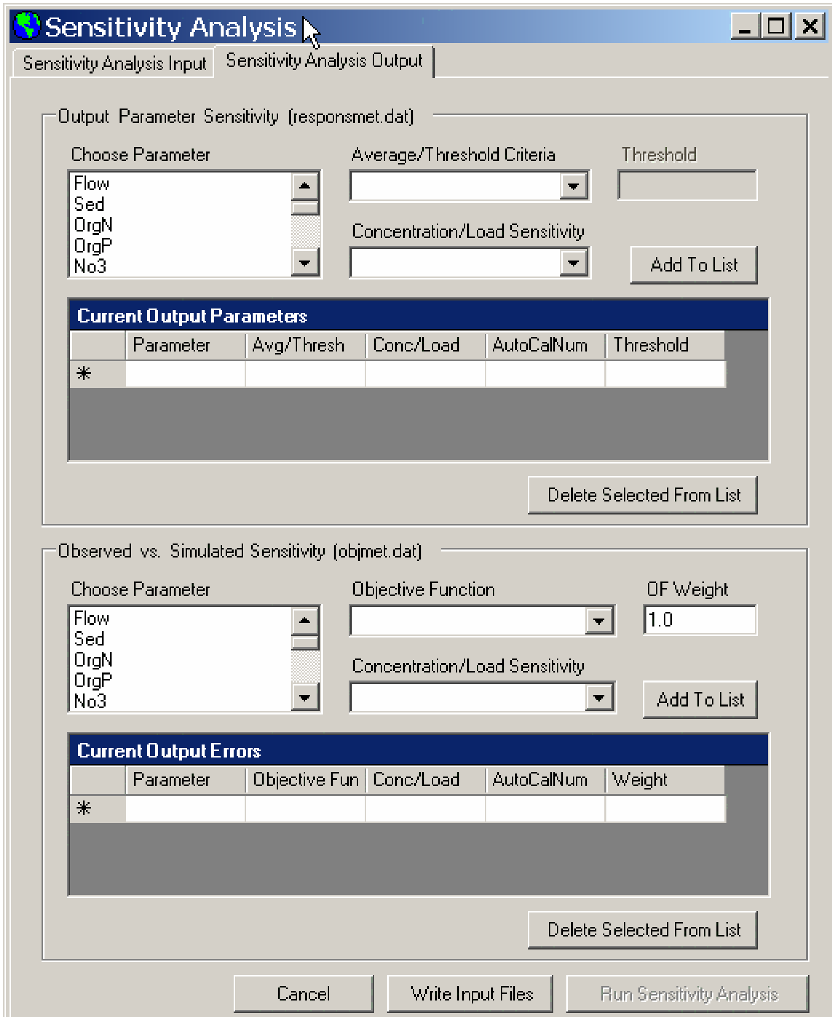


Figure 14.32

Output Parameter Sensitivity

This section defines model outputs whose sensitivity to changes in model parameters wil be evaluated.

1. Select an output parameter to evaluate from the **Choose Parameter** list box (Figure 14.33).

2. Select the **Average/Threshold Criteria** option.

3. Select the **Threshold** setting (Only if “Threshold” is selected from the **Average/Threshold Criteria** combo box).

4. Select the **Concentration/Load Sensitivity** option (only for parameters other than “Flow”).

5. Click the **Add To List** button. The new parameter is added to the **Current Output Parameters** table.

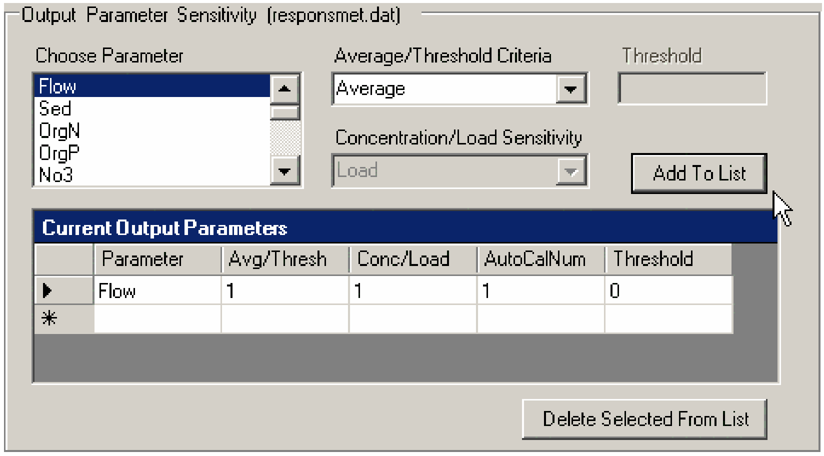


Figure 14.33

6. Repeat steps 1 through 5 for addition parameters to evaluate.

7. To delete a parameter from the **Current Output Parameters** table, select the parameter in the table and click the Delete Selected From List button (Figure 14.34)

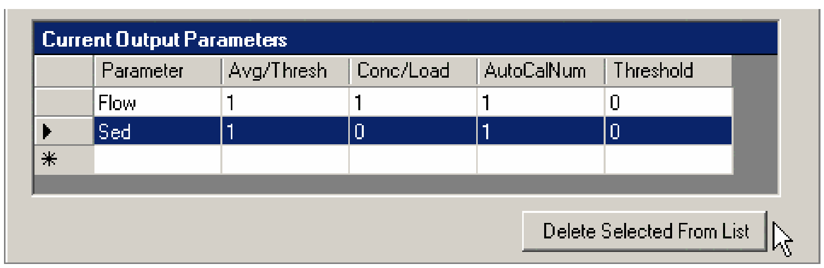


Figure 14.34

Observed vs. Simulated Sensitivity

This section defines observed vs. simulated errors whose sensitivity to changes in model parameters wil be evaluated.

1. Select an output parameter to evaluate from the **Choose Parameter** list box (Figure 14.35).

2. Select the **Objective Function** option.

3. Select the **OF Weight** setting. Choose weight of 1.0 unless multiple objective functions are to be used for the same model output parameter.

4. Select the **Concentration/Load Sensitivity** option (only for parameters other than “Flow”).

5. Click the **Add To List** button. The new parameter is added to the **Current Output Errors** table.

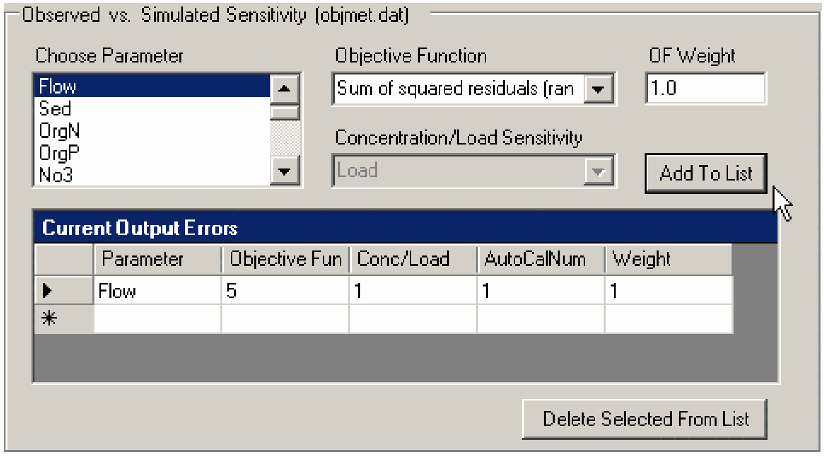


Figure 14.35

6. Repeat steps 1 through 5 for addition parameters to evaluate.

7. To delete a parameter from the **Current Output Parameters** table, select the parameter in the table and click the Delete Selected From List button (Figure 14.36)

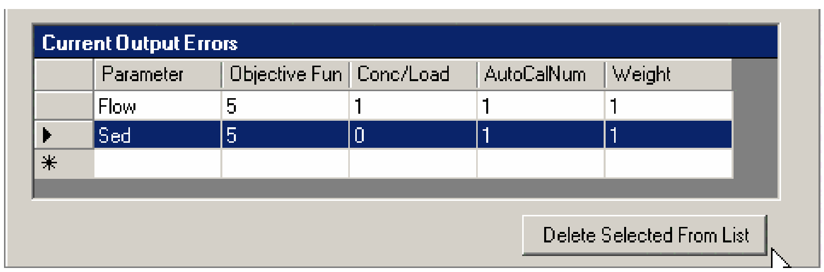


Figure 14.36

Run Sensitivity Analysis

To run the sensitivity analysis

1. Click the **Write Input Files** button. This will write the additional input files that SWAT 2005 will read during execution.

2. Click the **Run Sensitivity Analysis** button. The model runs will begin. You will be told how many times the model run for the analysis (Figure 14.37)

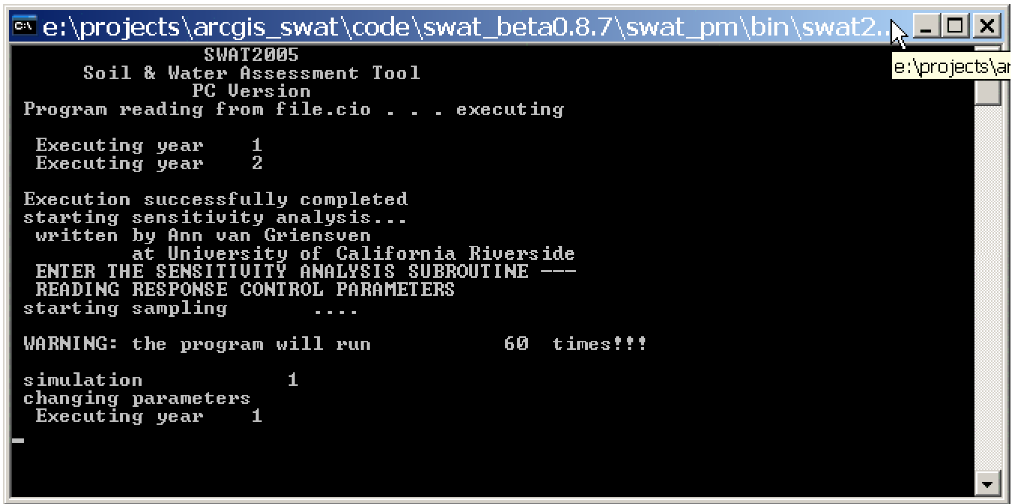


Figure 14.37

3. When completed, a message will appear indicating if the run was successful (Figure 14.38). You can now read the Sensitivity Analysis output reports (See section 14.5 of this document).

Figure 14.38

4. To exit the sensitivity analysis, click the **Cancel** button.

SECTION 14.3: AUTO CALIBRATION AND UNCERTAINTY ANALYSIS

The third command in the **SWAT Simulation** menu launches the **SWAT Auto-Calibration and Uncertainty** dialog. Auto-calibration must be run with observed data. For a full discussion of the auto-calibration and uncertainty analysis options for SWAT, refer to the *Sensitivity, Auto-calibration, uncertainty and model evaluation in SWAT 2005* manual.

1. Select **Auto-Calibration and Uncertainty Analysis** from the SWAT Simulation menu (Figure 14.39)

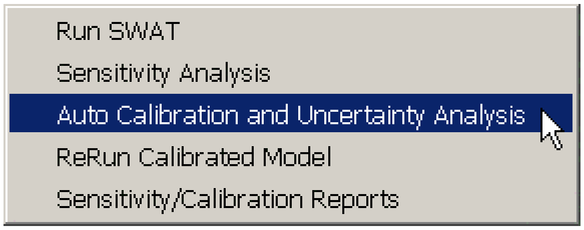


Figure 14.39

2. The Auto-Calibration and Uncertainty dialog is displayed (Figure 14.40).

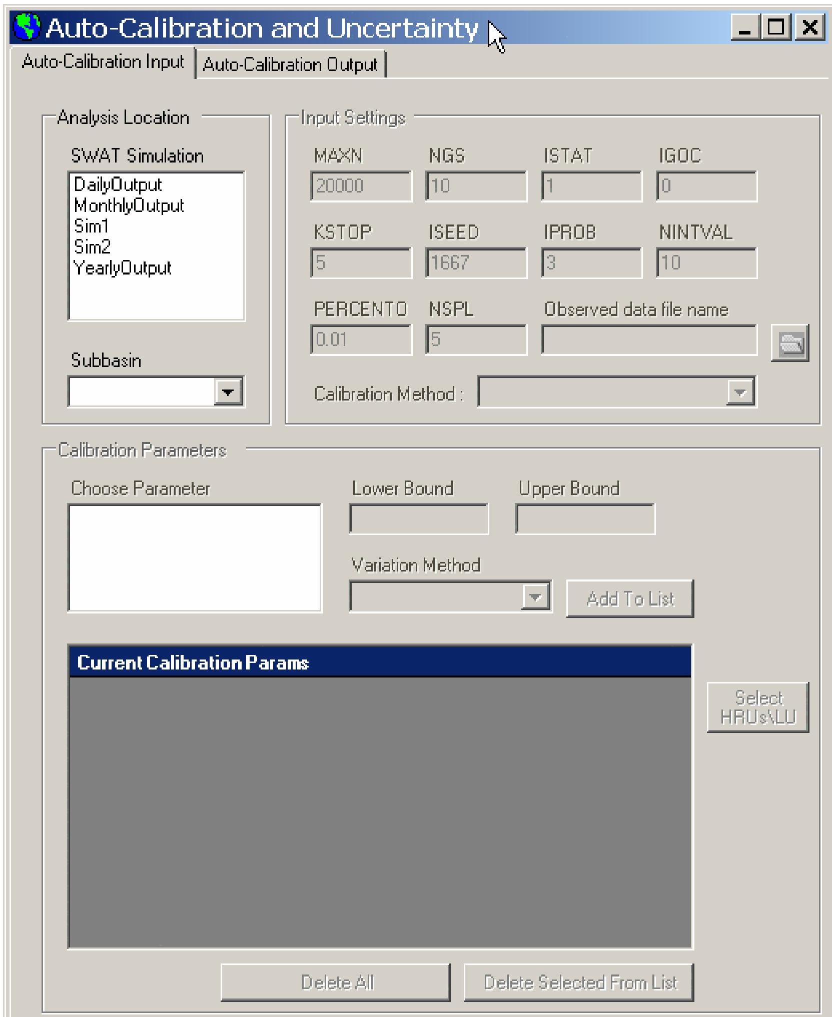


Figure 14.40

Auto-Calibration Input

Auto-calibration input is defined on the first tab of the **Auto-Calibration and Uncertainty** dialog. This tab contains sections for defining the analysis location, the algorithm input settings, and the SWAT model parameters to be calibrated.

1. Select a simulation from the **SWAT Simulation** list box to run calibration on (Figure 14.41).

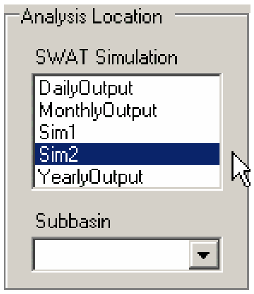


Figure 14.41

2. A message will appear asking that you select a subbasin to perform the sensitivity analysis on (Figure 14.42).

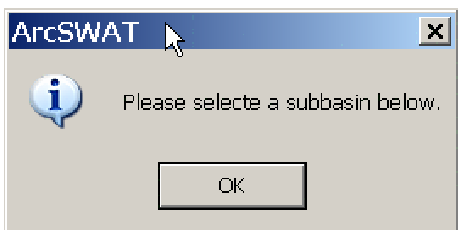


Figure 14.42

3. 3. Select a subbasin from the Subbasin Combo box (Figure 14.43)

Figure 14.43

4. The **Input Settings** section is now enabled (Figure 14.44). Default values for auto-calibration algorithm populate the input parameters. Users must select an observed data file using the file browse button to the right of the **Observed data file name** text box (refer to the *Sensitivity, Auto-calibration, uncertainty and model evaluation in SWAT 2005* details on input settings and observed data file formatting). Observed data files should end with a ".dat" extension.

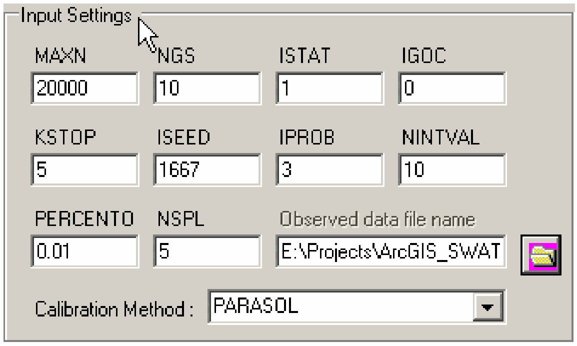


Figure 14.44

5. After selecting a subbasin for analysis, the **Calibration Parameters** section will also become enabled (Figure 14.45). This section allows users to choose which parameters will be calibrated.

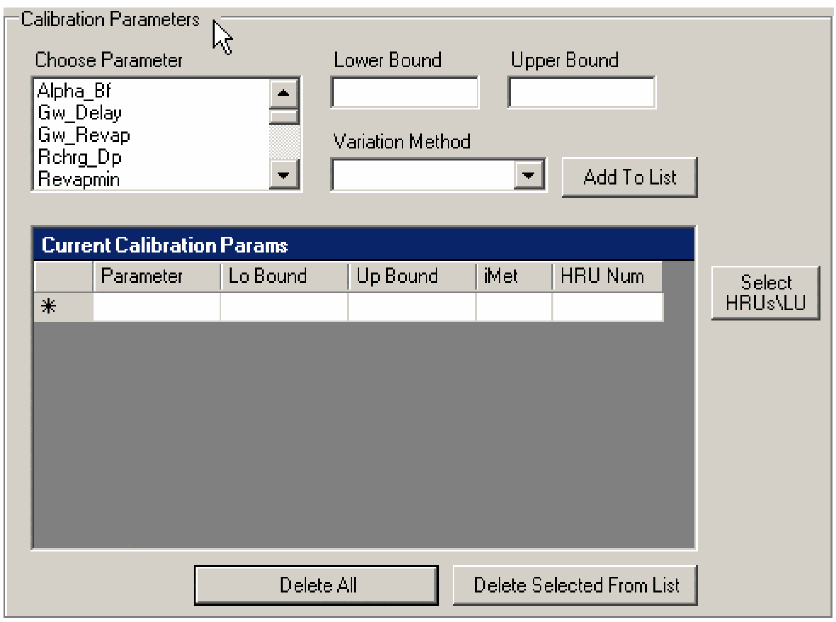


Figure 14.45

To add a parameter for calibration:

a. Select a parameter from the **Choose Parameter** list box. The default **Lower Bound, Upper Bound,** and **Variation Method** values will be populated (Figure 14.46). Modify the bounds and variation method if desired, and then click the **Add To List** button to add the parameter to the **Current Calibration Params** table.

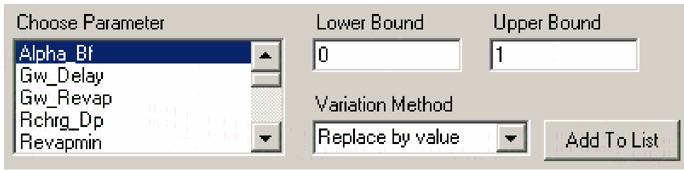
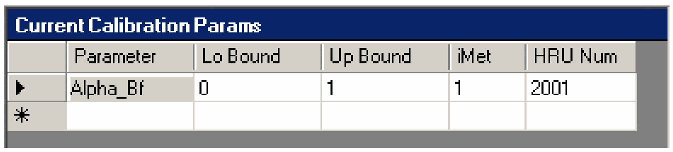


Figure 14.46

b. The **Current Sensitivity Params** table will be updated with the new parameter added (Figure 14.47).



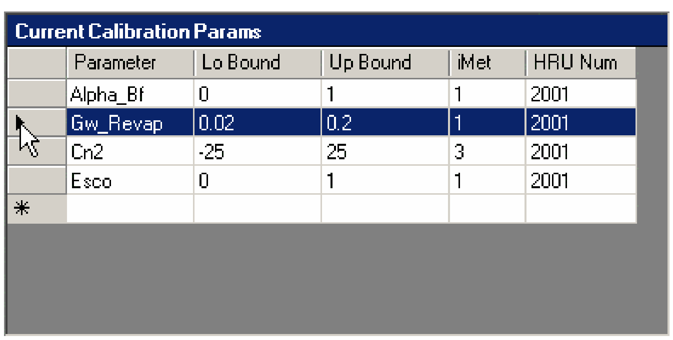
Current Calibration Params

	Parameter	Lo Bound	Up Bound	iMet	HRU Num
▶	Alpha_Bf	0	1	1	2001
*					

Figure 14.47

6. Modifying the HRUs, subbasins, or crops that a parameter variation is applied to: By default, parameter variations are applied to all HRUs, subbasins, or crops in the watershed. This is indicated by a value of "2001" for the **HRU Num** field in the **Current Calibration Params** table (an **HRU Num** value of "0" indicates that the parameter is a watershed-level parameter which can never be varied at the HRU, subbasin, or crop level). This setting may be modified so that only user-defined HRUs, subbasins, or crops experience the parameter variations during the sensitivity analysis. To make these modifications:

a. Select the parameter of interest from the **Current Calibration Params** table (Figure 14.48)



Current Calibration Params

	Parameter	Lo Bound	Up Bound	iMet	HRU Num
	Alpha_Bf	0	1	1	2001
▶	Gw_Revap	0.02	0.2	1	2001
	Cn2	-25	25	3	2001
	Esco	0	1	1	2001
*					

Figure 14.48

b. Click the **Select HRUs/LU** button 

. The Sensitivity/Auto-Calibration HRUs dialog will open (Figure 14.49).

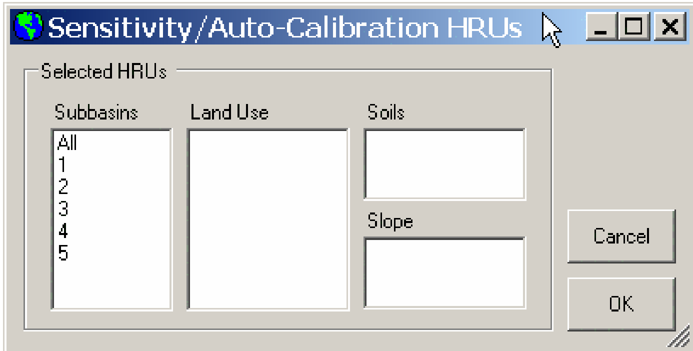


Figure 14.49

c. Select the HRUs of interest by choosing the **Subbasins, Land Use, Soils,** and **Slope** classes from the list boxes (Figure 14.50). Then, click OK.

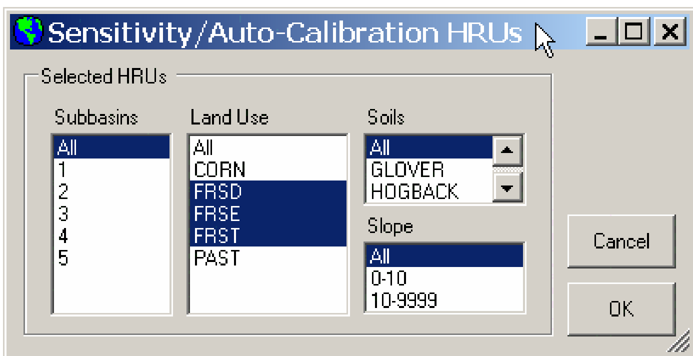
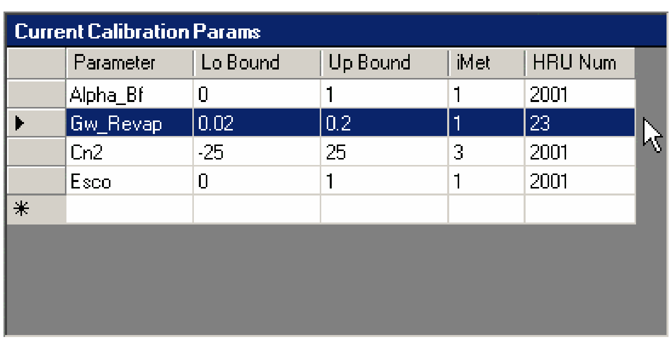


Figure 14.50

d. The number of HRUs selected is reported, and the **Current Calibration Params** table is updated (Figure 14.51).



Current Calibration Params

Parameter	Lo Bound	Up Bound	iMet	HRU Num
Alpha_Bf	0	1	1	2001
Gw_Revap	0.02	0.2	1	23
Cn2	-25	25	3	2001
Esco	0	1	1	2001

Figure 14.51

e. Note: If a parameter can only be varied by subbasin or crop, then the **Sensitivity/Auto-Calibration HRUs** dialog will be limited to selecting only subbasins or crops as required. A full discussion of which parameters can be varied by HRU, subbasin, or crop may be found in the *Sensitivity, Auto-calibration, uncertainty and model evaluation in SWAT 2005* manual.

7. To delete parameters from the **Current Calibration Params** table, either:

   a. Select a single parameter to delete and click the **Delete Selected From List** button (Figure 14.52)

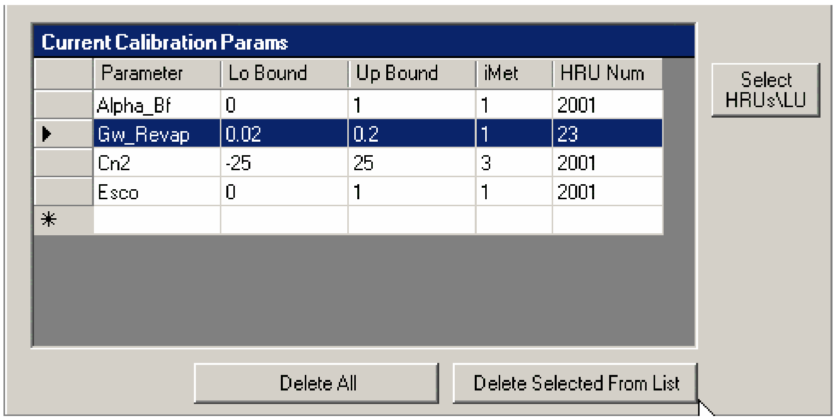


Figure 14.52

   b. Click the **Delete All** button to delete all the current parameters.

Auto-Calibration Output

Auto-Calibration output is defined on the second tab of the **Auto-Calibration and Uncertainty** dialog (Figure 14.53). This tab contains sections for defining **Calibration Output Evaluations** and **Model Output Evaluations**. The **Model Output Evaluations** section is optional for both PARASOL and SUNGLASSES optimization methods. However, the input in the **Model Output Evaluations** section has greater utility in the SUNGLASSES option where it is used in the calculation of uncertainty bounds. The **Calibration Output Evaluations** section is required for all optimization options.

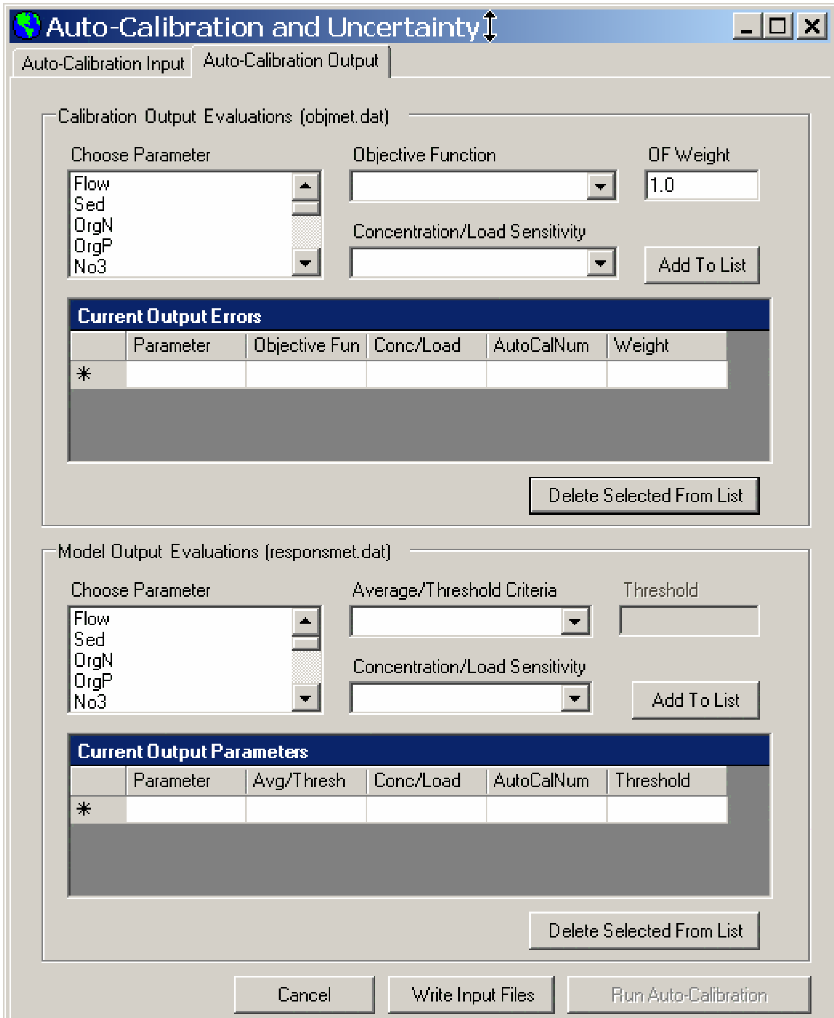


Figure 14.53

Calibration Output Evaluations

This section defines the SWAT output variables that will be used in the objective functions during auto-calibration.

1. Select an output parameter to evaluate from the **Choose Parameter** list box (Figure 14.54).

2. Select the **Objective Function** option.

3. Select the **OF Weight** setting. Choose a weight of 1.0 unless multiple objective functions are to be used for the same model output parameter.

4. Select the **Concentration/Load Sensitivity** option (only for parameters other than "Flow").

5. Click the **Add To List** button. The new parameter is added to **the Current Output Errors** table.

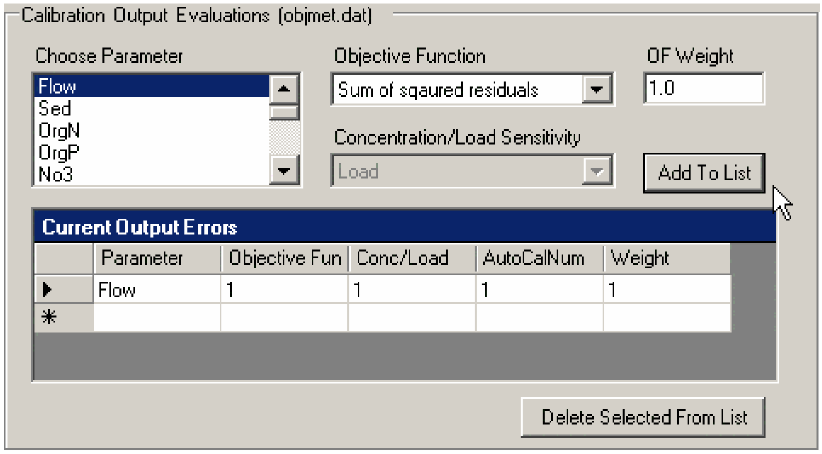


Figure 14.54

6. Repeat steps 1 through 5 for addition parameters to evaluate.

7. To delete a parameter from the **Current Output Parameters** table, select the parameter in the table and click the Delete Selected From List button (Figure 14.55)

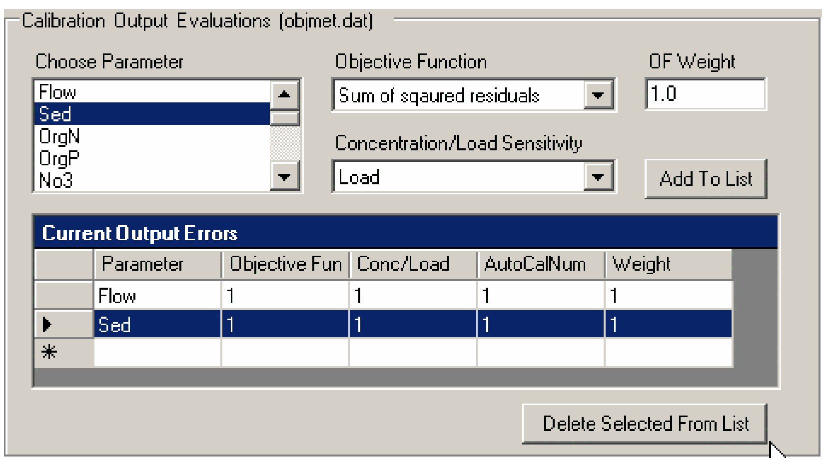


Figure 14.55

Model Output Evaluations

This section defines model outputs that will be evaluated for each calibration run. The inputs in this section are optional for both PARASOL and SUNGLASSES.

1. Select an output parameter to evaluate from the **Choose Parameter** list box (Figure 14.56).

2. Select the **Average/Threshold Criteria** option.

3. Select the **Threshold** setting (Only if "Threshold" is selected from the **Average/Threshold Criteria** combo box).

4. Select the **Concentration/Load Sensitivity** option (only for parameters other than "Flow").

5. Click the **Add To List** button. The new parameter is added to the **Current Output Parameters** table.

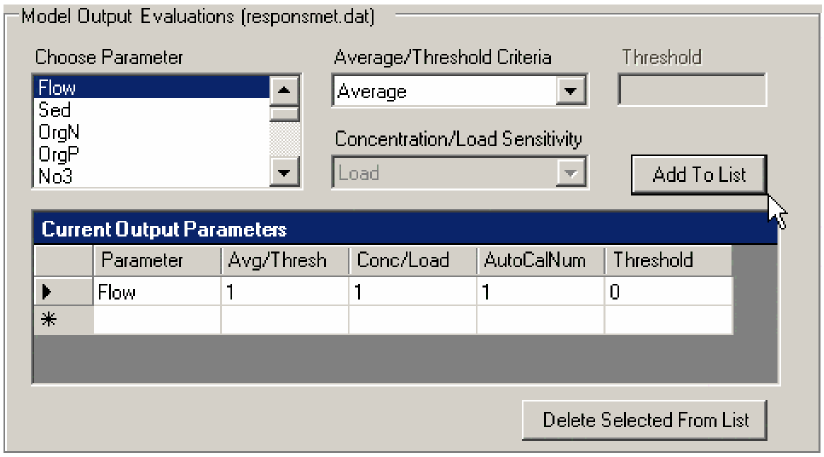


Figure 14.56

6. Repeat steps 1 through 5 for addition parameters to evaluate.

7. To delete a parameter from the **Current Output Parameters** table, select the parameter in the table and click the Delete Selected From List button (Figure 14.57)

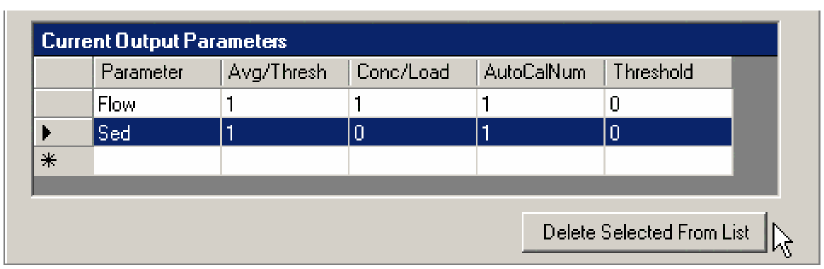


Figure 14.57

Run Auto-Calibration and Uncertainty

To run the sensitivity analysis

1. Click the **Write Input Files** button. This will write the additional auto-calibration input files that SWAT 2005 will read during execution.

2. Click the **Run Auto-Calibration** button. The model runs will begin. (Figure 14.58)

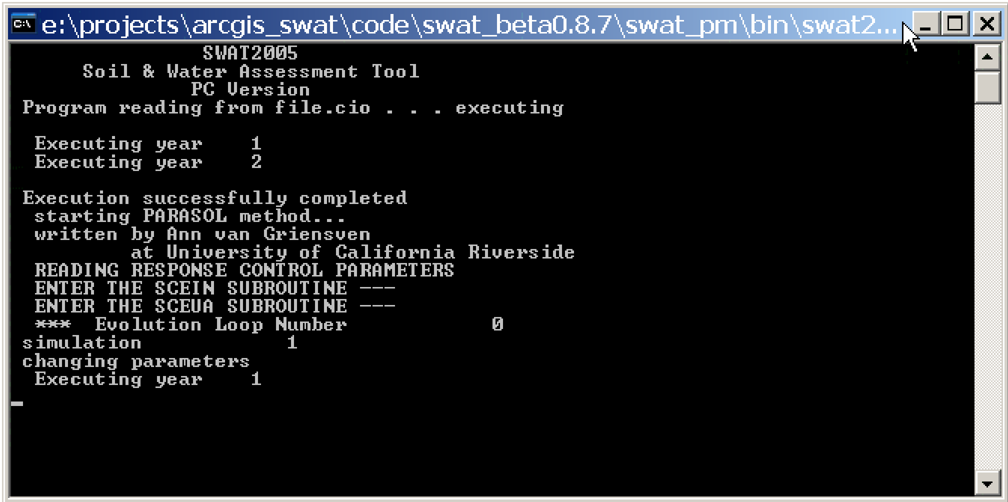


Figure 14.58

3. When completed, a message will appear indicating if the run was successful (Figure 14.59). You can now read the auto-calibration output reports (See section 14.5 of this document).

Figure 14.59

4. To exit the auto-calibration, click the **Cancel** button.

SECTION 14.4: RERUN CALIBRATED MODEL

The fourth command in the **SWAT Simulation** menu launches the **Re-Run Calibrated SWAT** dialog. This option will only be enabled if auto-calibration has been run for one of the saved SWAT simulations. For a full discussion of the auto-calibration and uncertainty analysis options for SWAT, refer to the *Sensitivity, Auto-calibration, uncertainty and model evaluation in SWAT 2005* manual.

1. Select **ReRun Calibrated Model** from the SWAT Simulation menu (Figure 14.60)

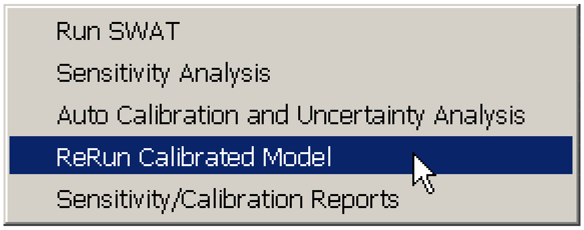


Figure 14.60

2. The **Re-Run Calibrated SWAT** dialog is displayed (Figure 14.61)

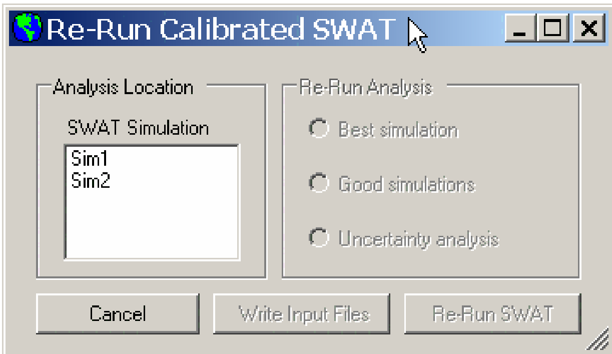


Figure 14.61

3. Choose a simulation to re-run the calibrated model for from the **SWAT Simulation** list box (Figure 14.62). The **Re-Run Analysis** section will become enabled.

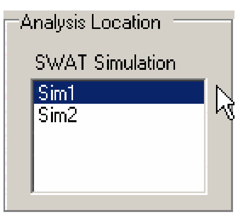


Figure 14.62

4. From **the Re-Run Analysis** section, choose a run option

   a. Best simulation: Will re-run SWAT for using the “best” parameter set

   b. Good simulations: Will re-run SWAT using all the “good” parameter sets

   c. Uncertainty analysis: Will re-run SWAT uncertainty analysis if auto-calibration was stopped manually

5. Click **Write Input Files**.

6. Click Re-Run SWAT. The model run(s) will begin (Figure 14.63).

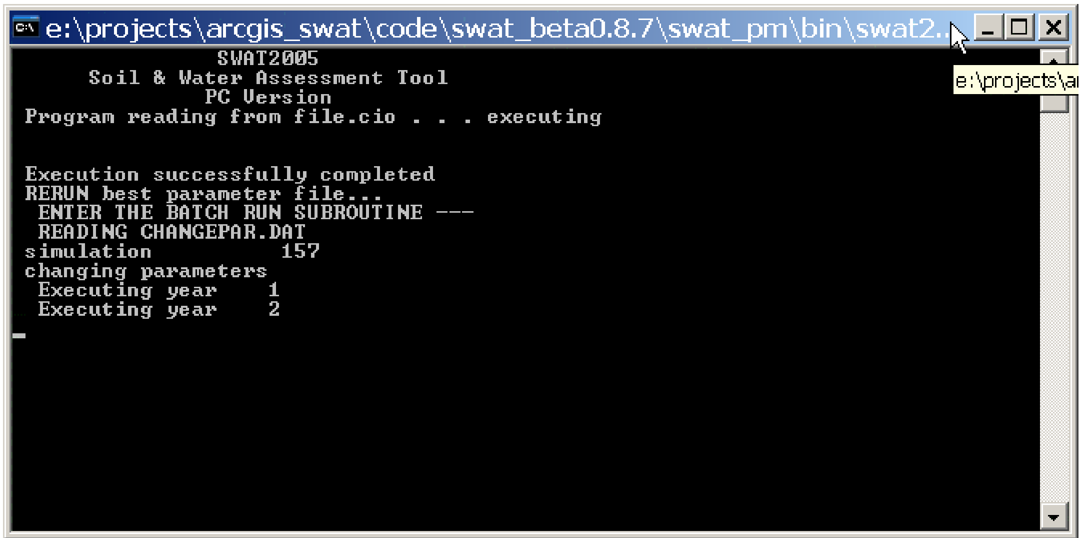


Figure 14.63

7. When completed, a message will appear indicating if the run was successful (Figure 14.64). You can now read the auto-calibration output reports (See section 14.5 of this document).

Figure 14.64

8. To exit, click the **Cancel** button.

SECTION 14.5: SENSITIVITY/CALIBRATION REPORTS

The fifth command in the **SWAT Simulation** menu launches the **SWAT Run Reports** dialog. This option will only be enabled if sensitivity analysis or auto-calibration has been run for one of the saved SWAT simulations. For a full discussion of the auto-calibration and uncertainty analysis output files for SWAT, refer to the *Sensitivity, Auto-calibration, uncertainty and model evaluation in SWAT 2005* manual.

1. Select **Sensitivity/Calibration Reports** from the SWAT Simulation menu (Figure 14.65)

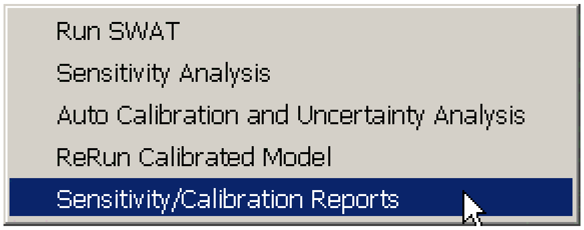


Figure 14.65

2. The **SWAT Run Reports** dialog is displayed (Figure 14.66)

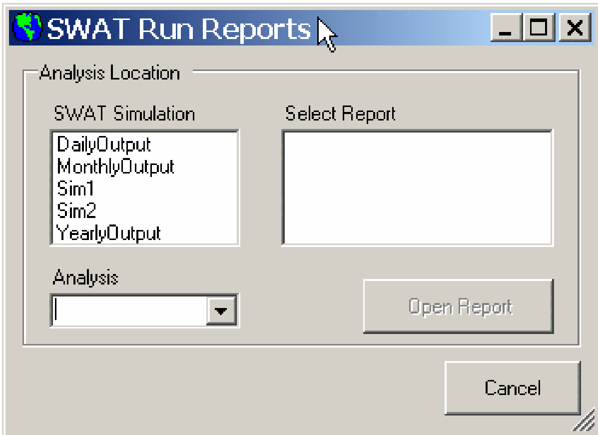


Figure 14.66

3. Choose a simulation to re-run the calibrated model for from the **SWAT Simulation** list box (Figure 14.67). The **Analysis** combo box will become populated with Auto-Calibration and/or Sensitivity Analysis if they have been run for the simulation selected.

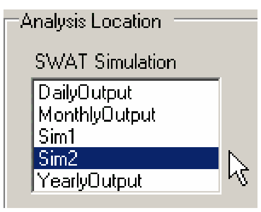


Figure 14.67

4. Choose an analysis type from the **Analysis** combo box. Choosing "Auto-calibration" will populate the **Select Report** list box with the calibration reports available and selecting "Sensitivity analysis" will populate the list box with the sensitivity analysis reports available (Figure 14.68).

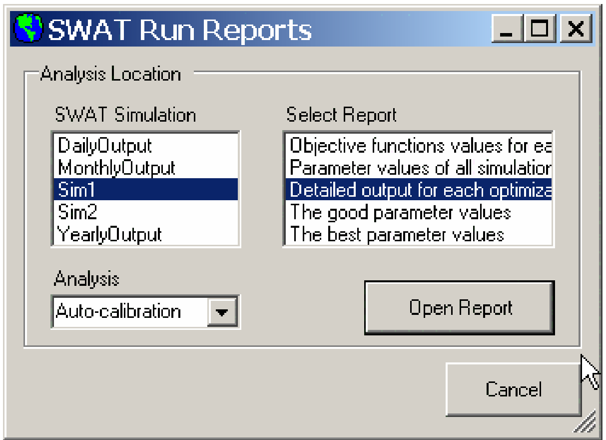
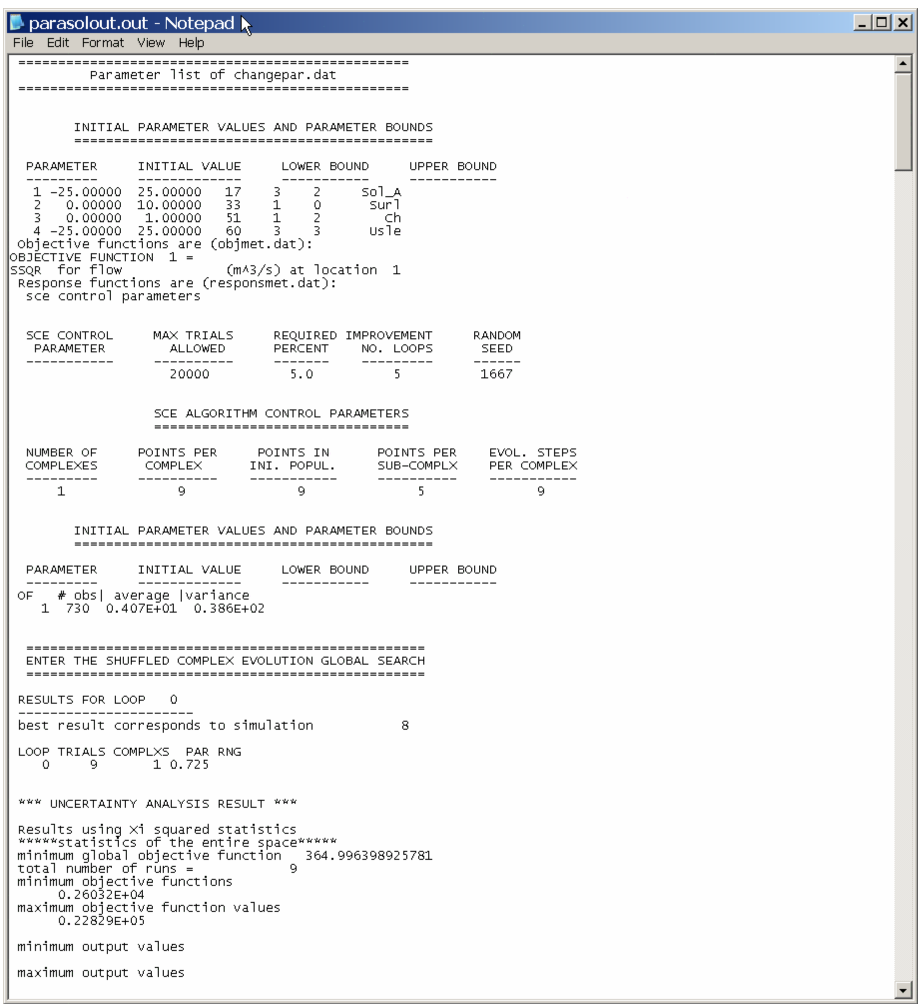


Figure 14.68

5. Choose a report from the **Select Report** list box and click the **Open Report** button. A text editor wil open displaying the report (Figure 14.69)




```
 ================================================
          Parameter list of changepar.dat
 ================================================


       INITIAL PARAMETER VALUES AND PARAMETER BOUNDS
       =============================================

  PARAMETER     INITIAL VALUE     LOWER BOUND     UPPER BOUND
  ---------     -------------     -----------     -----------
   1 -25.00000  25.00000   17    3    2      Sol_A
   2   0.00000  10.00000   33    1    0       Surl
   3   0.00000   1.00000   51    1    2         Ch
   4 -25.00000  25.00000   60    3    3       Usle
 objective functions are (objmet.dat):
OBJECTIVE FUNCTION  1 =
SSQR  for flow             (m^3/s) at location  1
 Response functions are (responsmet.dat):
  sce control parameters


  SCE CONTROL     MAX TRIALS     REQUIRED IMPROVEMENT     RANDOM
   PARAMETER        ALLOWED      PERCENT    NO. LOOPS      SEED
  -----------    ----------      -------    ---------     ------
                   20000           5.0          5          1667


                 SCE ALGORITHM CONTROL PARAMETERS
                 ================================

  NUMBER OF     POINTS PER     POINTS IN      POINTS PER    EVOL. STEPS
  COMPLEXES      COMPLEX      INI. POPUL.    SUB-COMPLX    PER COMPLEX
  ---------     ----------    -----------    ----------    -----------
      1              9             9              5              9


       INITIAL PARAMETER VALUES AND PARAMETER BOUNDS
       =============================================

  PARAMETER     INITIAL VALUE     LOWER BOUND     UPPER BOUND
  ---------     -------------     -----------     -----------
 OF   # obs| average |variance
    1  730  0.407E+01  0.386E+02


  ==================================================
  ENTER THE SHUFFLED COMPLEX EVOLUTION GLOBAL SEARCH
  ==================================================

 RESULTS FOR LOOP   0
 ----------------------
 best result corresponds to simulation          8

 LOOP TRIALS COMPLXS  PAR RNG
    0     9       1 0.725


 *** UNCERTAINTY ANALYSIS RESULT ***

 Results using Xi squared statistics
 *****statistics of the entire space*****
 minimum global objective function   364.996398925781
 total number of runs =            9
 minimum objective functions
      0.26032E+04
 maximum objective function values
      0.22829E+05

 minimum output values

 maximum output values
```

Figure 14.69

6. Click **Cancel** to exit the SWAT Run Report dialog.

SECTION 15: SWAT DATABASE EDITORS

The SWAT model uses five databases to store required information about plant growth and urban land uses, tillage, fertilizer components and pesticide properties (See *Soil and Water Assessment Tool User's Manual, Version 2005*). The interface provides dialog-based editors to access and edit these five databases as well as an additional database that stores custom soils parameters. The SWAT databases MUST be edited to their desired content prior to writing the SWAT Input tables in order to be reflected in the model input files. Editing the SWAT database will modify the content of the SWAT2005.mdb database being used for the project. The edits made to the SWAT2005.mdb tables will be available for other SWAT projects in addition to the current project. It is good practice to make a backup copy of the *SWAT2005.mdb* prior to working on a SWAT project.

The first item of the **Edit SWAT Input** menu allows the user to access the editing dialogs for the SWAT Database (Figure 15.1).

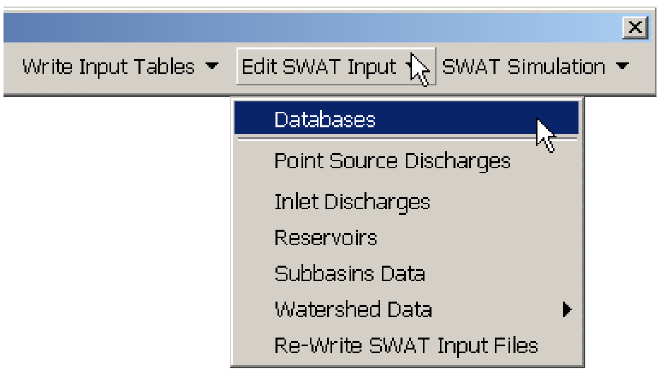


Figure 15.1

Selecting the **Database** command on the **Edit SWAT Input** menu will open the Edit SWAT Databases dialog (Figure 15.2)

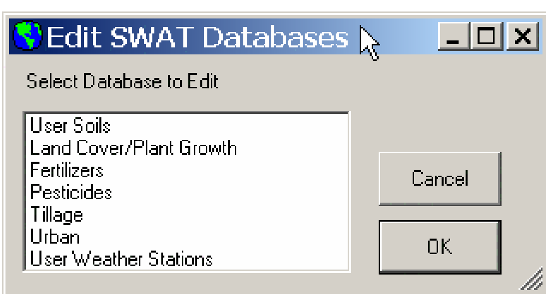


Figure 15.2

Six databases are available for editing:

1. User Soils: This database is used to store custom soil data. Data is entered into this database for soil maps that do not use the US STATSGO soil database included with the interface.

2. Land Cover/Plant Growth: This database contains SWAT plant growth parameters. While users are given the option of modifying existing land cover/plant parameters or adding additional plant species to the database, we would like to emphasize that changes to the plant database should be based on experimental data. The typical user will not need to make changes to this database. Information about the plant growth parameters provided with the interface is provided in *Soil and Water Assessment Tool User's Manual, Version 2005*, Appendix A.

3. Fertilizer: This database contains SWAT fertilizer/manure parameters. Both inorganic and organic (manure) fertilizer data is stored in this database. Information about the fertilizer parameters provided with the interface is provided in *Soil and Water Assessment Tool User's Manual, Version 2005*, Appendix A.

4. Pesticide: This database contains SWAT pesticide parameters. Information about the pesticide parameters provided with the interface is provided in *Soil and Water Assessment Tool User's Manual, Version 2000*, Appendix A.

5. Tillage: This database contains SWAT tillage parameters. Information about the tillage parameters provided with the interface is provided in *Soil and Water Assessment Tool User's Manual, Version 2005* Appendix A.

6. Urban: This database contains SWAT urban land type parameters. Information about the urban land type parameters provided with the interface is provided in *Soil and Water Assessment Tool User's Manual, Version 200*5, Appendix A.

7. User Weather Stations: This database is used to store custom weather station parameters used by the SWAT weather generator. Stations that are not already part of the US database are stored here.

SECTION 15.1: USER SOILS DATABASE

The ArcSWAT SWAT Parameters Database (SWAT2005.mdb) distributed with the ArcSWAT install package contains a User Soils Database table (*usersoil*) with the proper set of fields for the database and a number of sample records. Users may either manually edit the *usersoil* table through the ArcSWAT interface or import an entire table of user soil records using the ArcToolbox Append tool.

To append an entire table of user soil records to the usersoil table:

1. Select the **ArcToolbox Append** tool (Figure 5.3)

Figure 5.3

2. Launch the tool and select the table of user soil records you wish to *append as the* ***Input Features*** *and select the* /SWAT2005.mdb/usersoil table as **the Output Features** (Figure 5.4). Click **OK**.

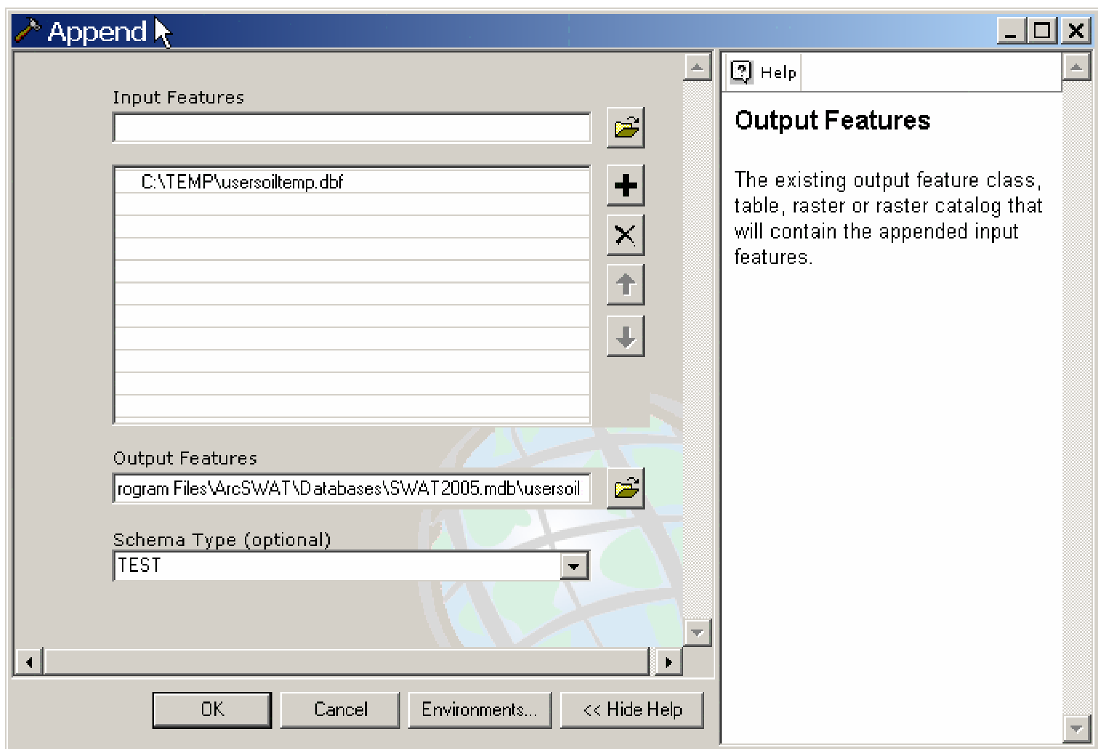


Figure 5.4

3. The new records will be added to the *usersoil* table.

Note:	The table of new user soil records must conform to the same field structure as the usersoil table in the SWAT2005.mdb database. If the table structure is not the same, then the new

records may not append correctly and/or result in errors in the ArcToolbox append operation.

To edit the User Soils Database through the ArcSWAT interface:

1. Select **the User Soils** on the list of databases (Figure 15.5) and click **OK**.

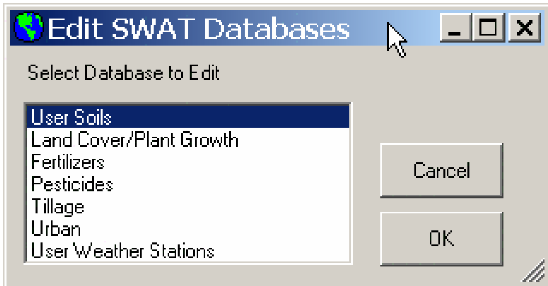


Figure 15.5

2. The **User Soils Edit** dialog box will be displayed (Figure 15.6)

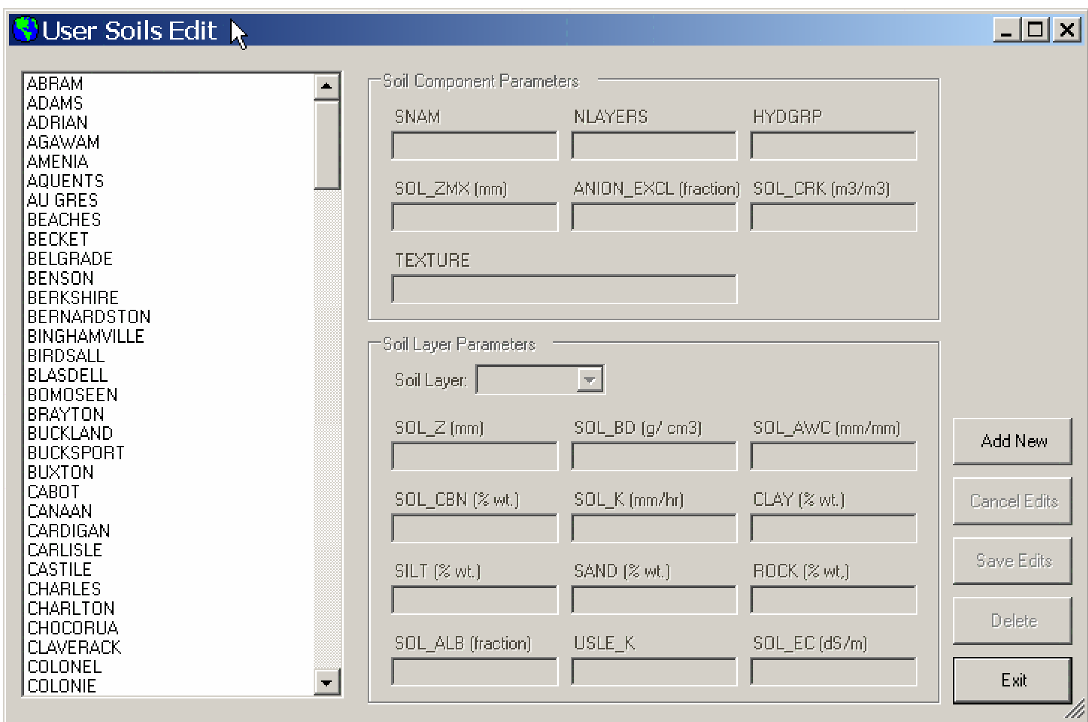


Figure 15.6

A list of soils in the custom database is displayed on the left side of the dialog box.

3. The user has four options: edit an existing soil record, add a new soil record, delete an existing soil record, or exit the database.

To edit an existing soil record:

a. Click the name of the soil to be edited.

b. The data for the soil will be displayed (Figure 15.7). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 22.

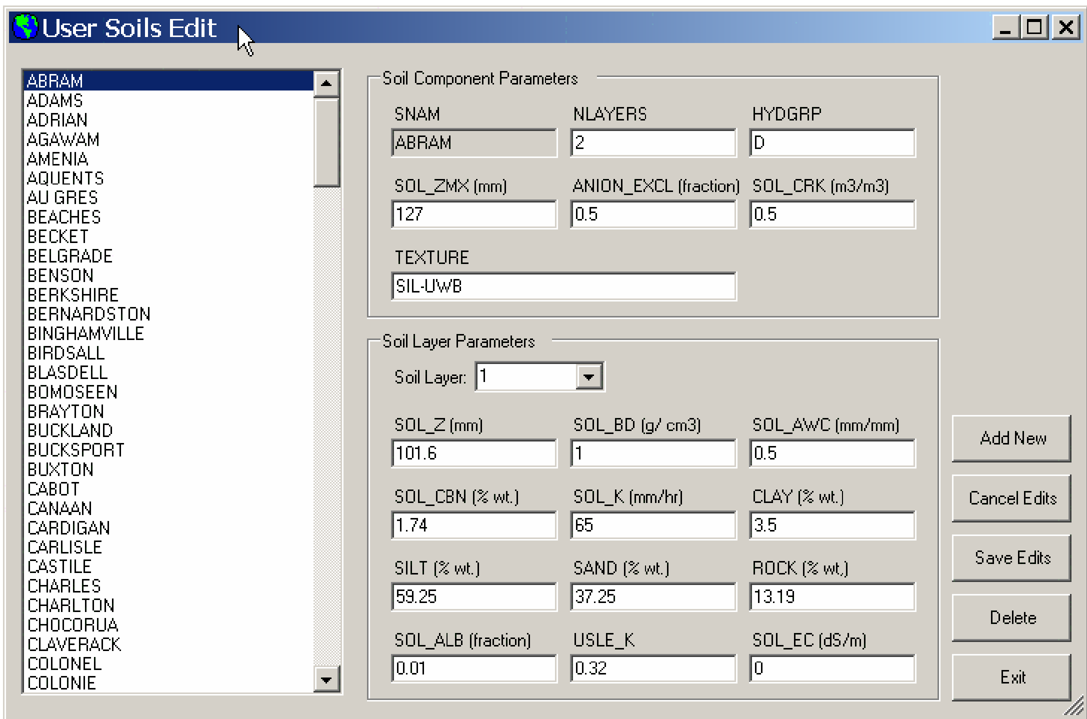


Figure 15.7

Note:	If the cursor is placed on top of any text box or button, a short help description (yellow label) appears and the range of variation is shown.

c. The soil parameters are separated into two groups. The parameters that are applicable to the **entire soil profile are displayed in the section titled Soil** Component Parameters and the parameters that pertain to a particular soil layer are displayed in the section titled **Soil Layers Parameters**. The layer number is displayed in the **Soil Layer** combo box. The different layers in the soil profile can be accessed by selecting a layer value from the combo box. .

d. To edit a parameter type the new value in the text box. If the value of the parameter is out of range a message box like the one in Figure 15.8 will be displayed.

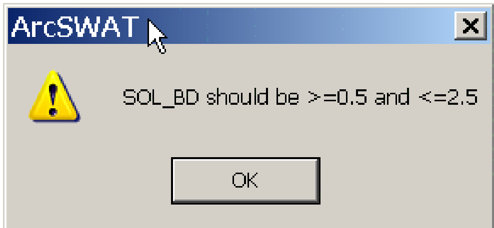


Figure 15.8

Click **OK**. The parameter will be reset to the previous value.

e. If you decide not save the changes you have made to the soils parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

f. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.9).

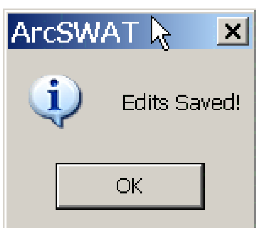


Figure 15.9

To add a new soil record:

A new soil may be added to the database by setting parameters based on a default soil or by copying data from an existing soil record to the new record.

a. Click the button labeled **Add New** on the **User Soils Edit** dialog box.

b. If no soil record is currently selected before clicking **Add New**, then the dialog box will appear with the parameters populated to those of a default soil. If there is a soil record selected before clicking **Add New**, then the parameter values of the selected soil will be applied to the new soil record (Figure 15.10). The "SNAM" of the soil will be set to "New Soil".

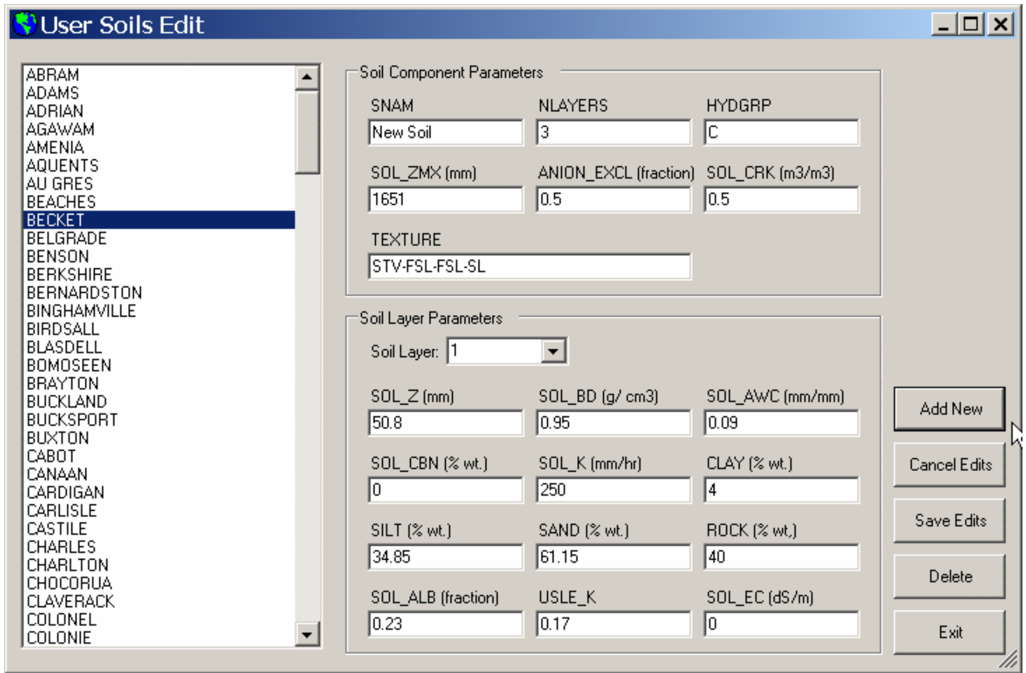


Figure 15.10

c. At this point, the user may type the necessary data into the different fields. A unique name ("SNAM") must be given to the soil (the name can include numbers, but the name must begin with a letter). Note: The "SNAM" value may NOT include "_" characters.

d. If you decide not to save the changes you have made to the soils parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.9).

f. After clicking **Save Edits**, the soil whose edits were just saved will remain active in the dialog.

To delete a soil record:

a. From the User Soils dialog box, click the name of the soil to be deleted.

b. The dialog box will be modified to display the soil data. Click the **Delete** button to delete the soil (Figure 15.11).

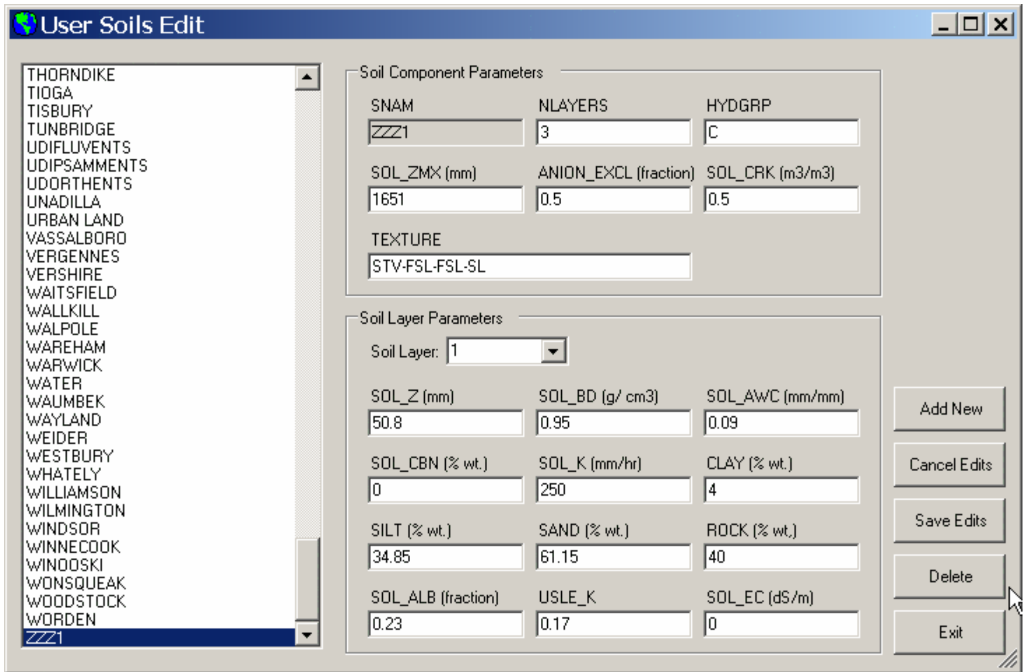


Figure 15.11

c. The soil will be removed from the "usersoil" table in the "SWAT2005.mdb" database, and the User Soils Edit dialog will be cleared.

To exit the User Soils database:

a. From the User Soils Edit dialog box, click Exit.

SECTION 15.2: LAND COVER / PLANT COVER / PLANT GROWTH DATABASE

To edit the Land Cover/Plant Growth Database:

1. Select **Land Cover/Plant Growth** on the list of databases (Figure 15.12) and click **OK**.

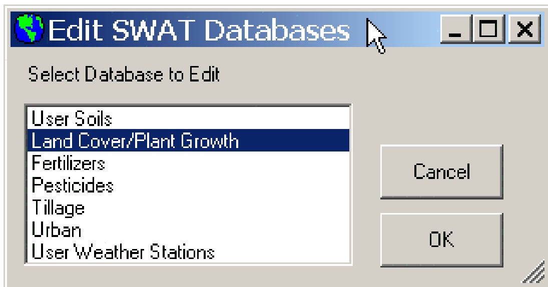


Figure 15.12

2. The Land **Cover/Plant Growth Edit** dialog box will be displayed (Figure 15.13)

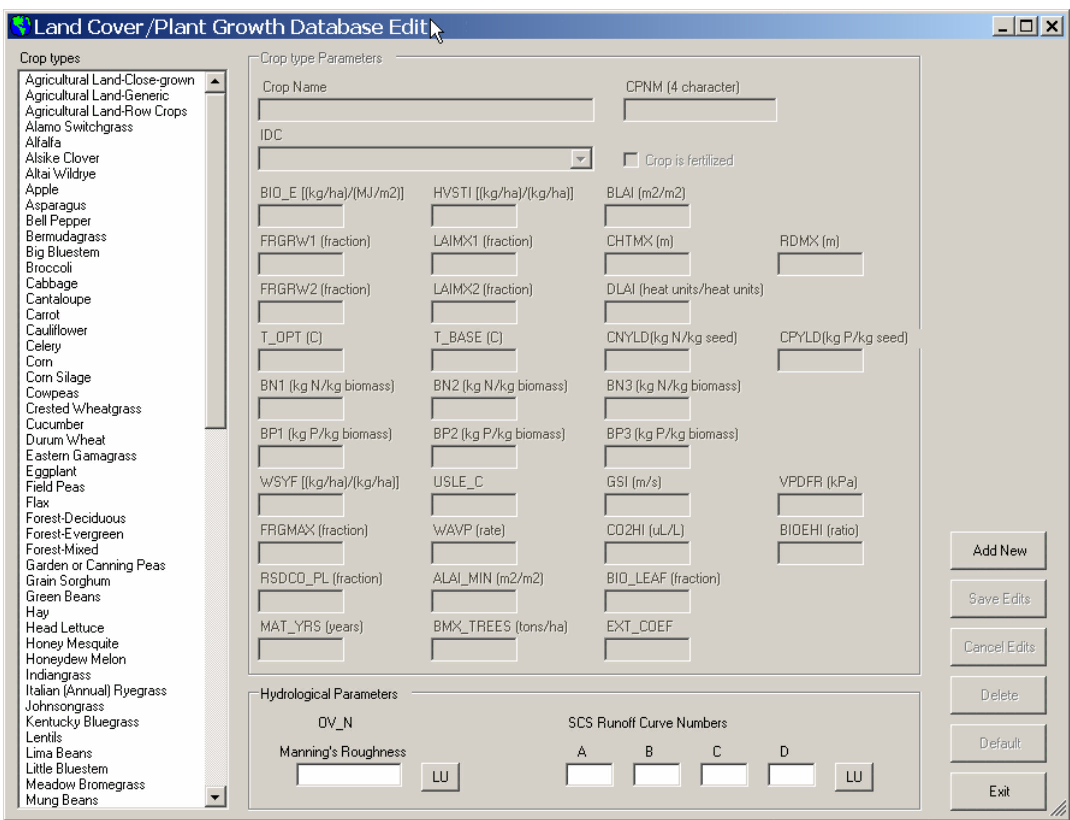


Figure 15.13

A list of land covers in the “crop” database is displayed on the left side of the dialog box.

3. The user has four options: edit an existing land cover record, add a new land cover record, delete an existing land cover record, or exit the database.

To edit an existing land cover record:

a. Click the name of the land cover to be edited.

b. The data for the land cover will be displayed (Figure 15.14). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 14

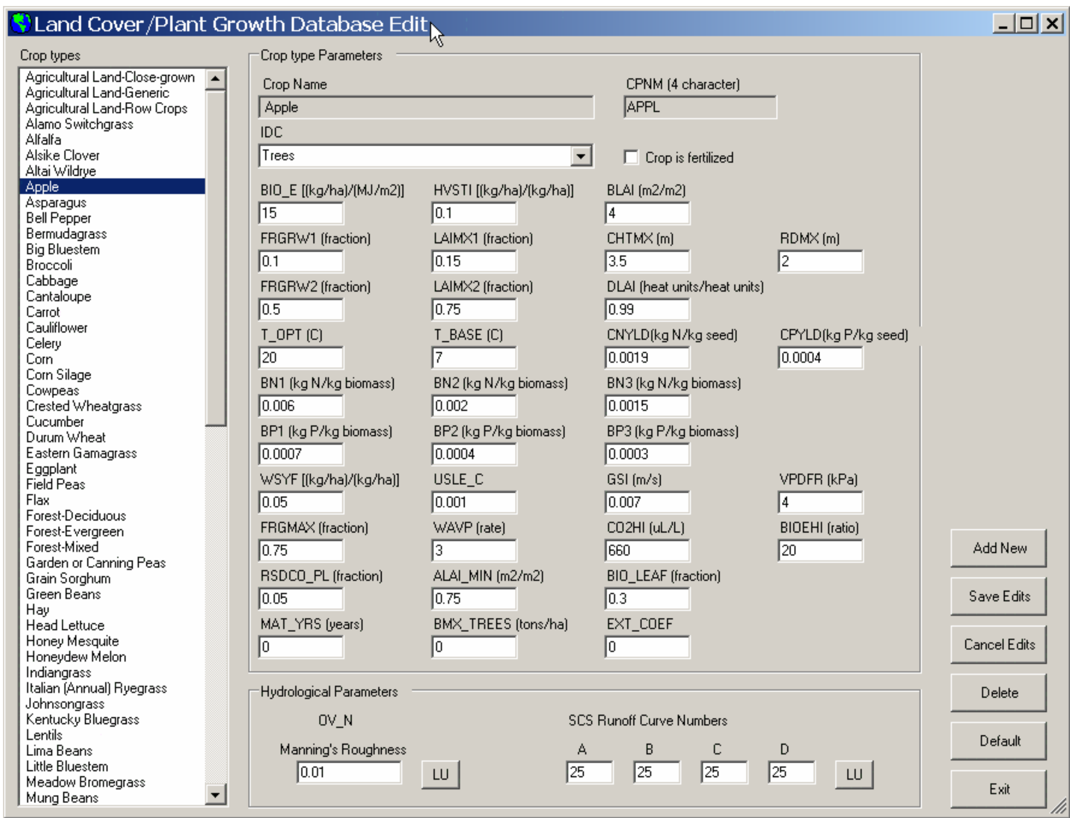


Figure 15.14

Note:	If the cursor is placed on top of any text box or button, a short help description (yellow label) appears and the range of variation is shown.

c. To edit a parameter type the new value in the text box. If the value of the parameter is out of range a message box like the one in Figure 15.15 will be displayed.

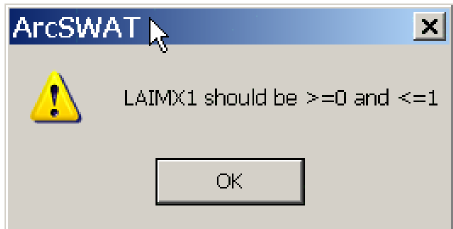


Figure 15.15

Click **OK**. The parameter will be reset to the previous value.

d. To edit the manning's n value, either type the desired value in the text box, or click on the LU button to the right on the **Manning's Roughness** text box (Figure 15.16) to launch a lookup table of values.

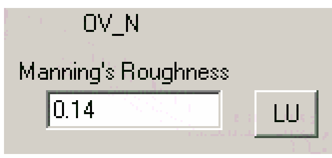


Figure 15.16

e. The Manning's "n" Lookup Table dialog will open allowing you to choose an appropriate value for your land cover (Figure 15.17). Choose the type of Manning's value by selecting from the **Type** combo box. Click in the grid cell corresponding to the value desired, then click **OK**. The value will appear in the Manning's Roughness text box (Figure 15.18).

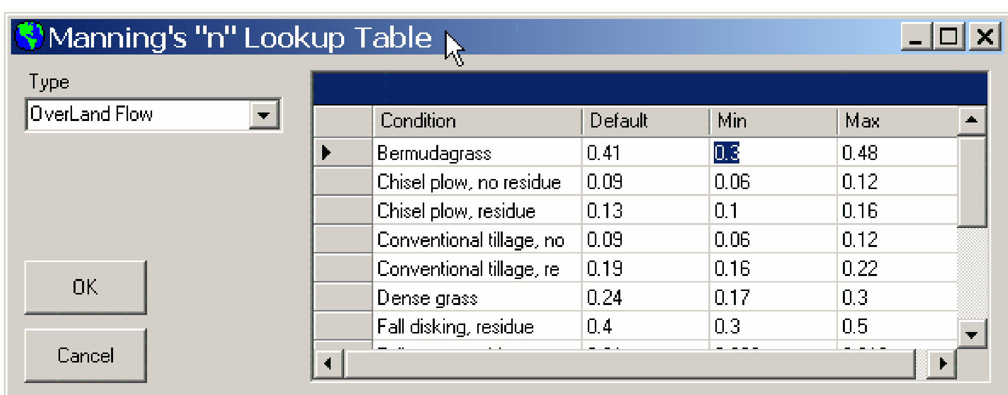


Figure 15.17

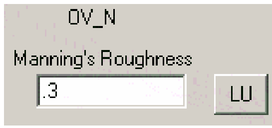


Figure 15.18

f. To edit the SCS curve number values, either type the desired values in the text boxes, or click on the **LU** button to the right on the **SCS Runoff Curve Number** text boxes (Figure 15.20) to launch a lookup table of values.

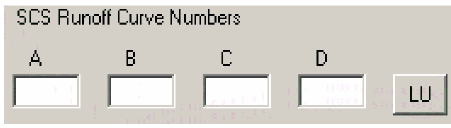


Figure 15.20

g. The **SCS Curve Number Lookup Table** dialog will open allowing you to choose a set of curve numbers appropriate for your land cover (Figure 15.21). Choose the type of land cover condition by selecting from the **Condition** combo box. Click on the table row corresponding to the value desired, then click **OK**. The selected curve number values will appear in the **SCS Curve Numbers** text boxes (Figure 15.22).

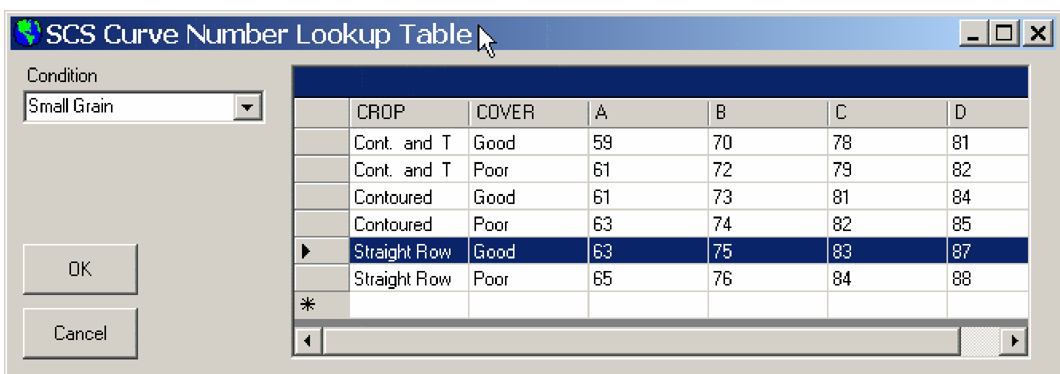


Figure 15.21

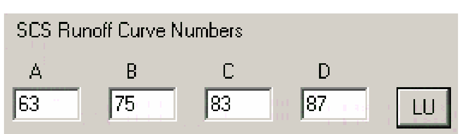


Figure 15.22

h. If you decide not save the changes you have made to the land cover parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

i. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.23).

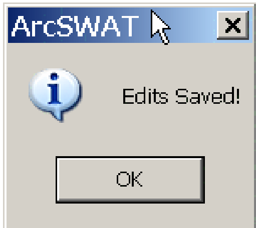


Figure 15.23

To reset land cover parameters to default values:

The default growth parameters for the land cover types provided with the interface are stored and can be recovered at any time. This operation may only be performed for land covers provided with the interface. This operation will eliminate all changes made to the growth parameters by the user.

a. While editing a land cover (Figure 15.14), click the Default button.

b. The values in the **Land Cover/Plant Growth Database** Edit dialog will revert back to the default values

c. Click **Save Edits** to save the default values back to the database.

To add a new land cover record:

A new land cover may be added to the database by setting parameters based on a default land cover or by copying data from an existing land cover record to the new record.

a. Click the button labeled **Add New** on the **Land Cover/Plant Growth Database Edit** dialog box.

b. If no land cover record is currently selected before clicking **Add New**, then the dialog box will appear with the parameters populated to those of a default land cover. If there is a land cover record selected before clicking **Add New**, then the parameter values of the selected land cover will be applied to the new land cover record (Figure 15.24). The “Crop Name” will be set to “New Crop” and the “CPNM” value will be “NEWC”.

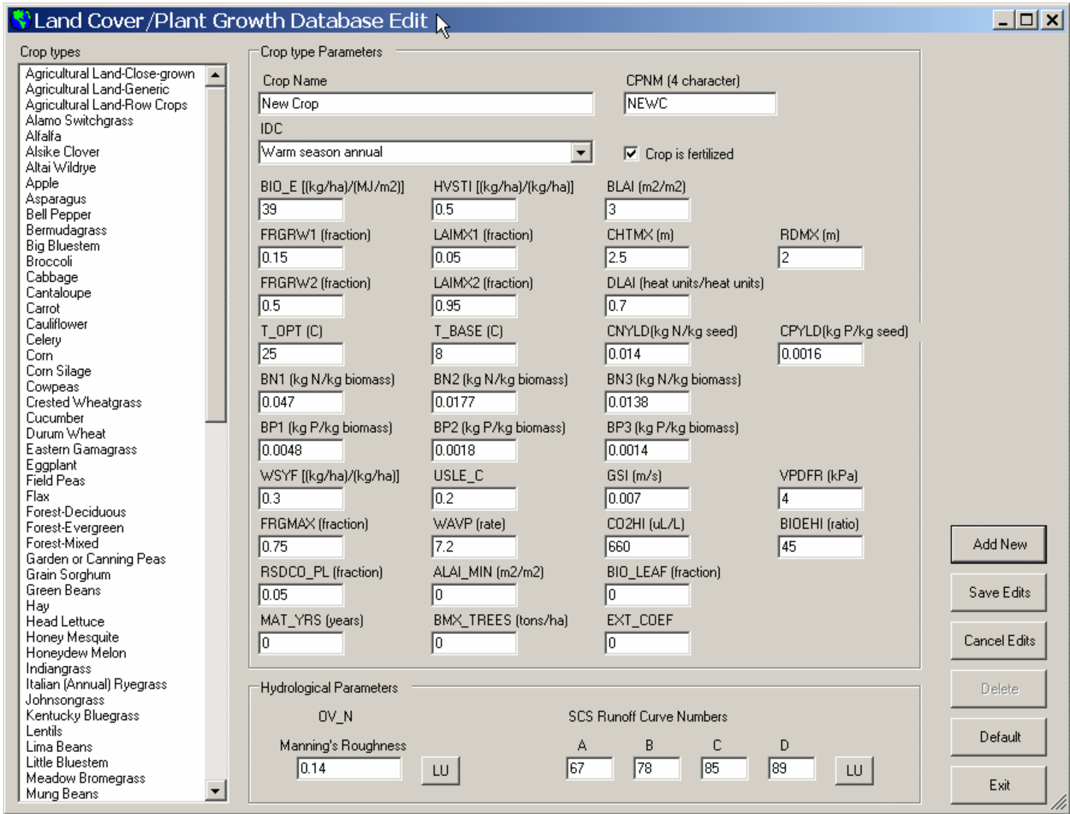


Figure 15.24

c. At this point, the user may type the necessary data into the different fields. A unique name ("CPNM") must be given to the land cover (the name can only be 4 characters).

d. If you decide not to save the changes you have made to the land cover parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.23).

f. After clicking **Save Edits**, the land cover whose edits were just saved will remain active in the dialog.

To delete a land cover record:

a. From the **Land Cover/Plant Growth** dialog box, click the name of the land cover to be deleted.

b. The dialog box will be modified to display the land cover data. Click the **Delete** button to delete the land cover (Figure 15.25).

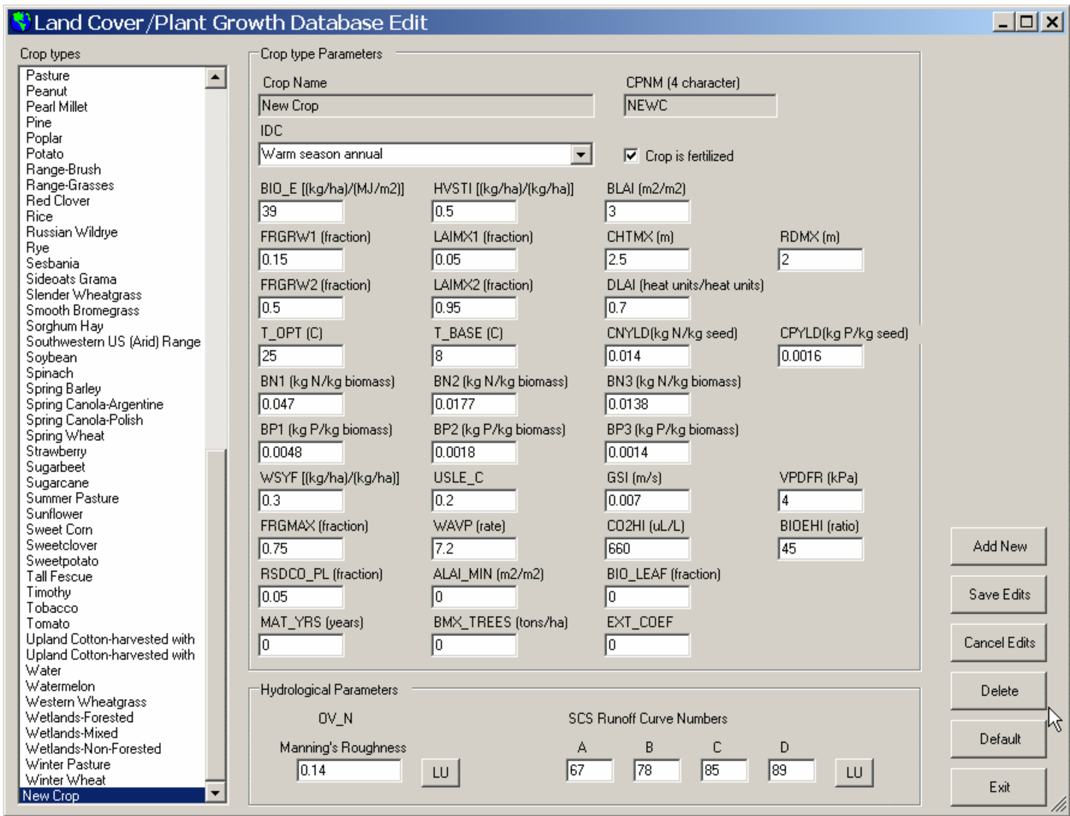


Figure 15.25

c. The land cover will be removed from the "crop" table in the "SWAT2005.mdb" database, and the **Land Cover/Plant Growth Database Edit** dialog will be cleared.

To exit the Land Cover/Plant Growth database:

a. From the Land Cover/Plant Growth Database Edit dialog box, click Exit.

SECTION 15.3: FERTILIZER DATABASE

To edit the Fertilizer Database:

1. Select **Fertilizers** on the list of databases (Figure 15.26) and click **OK**.

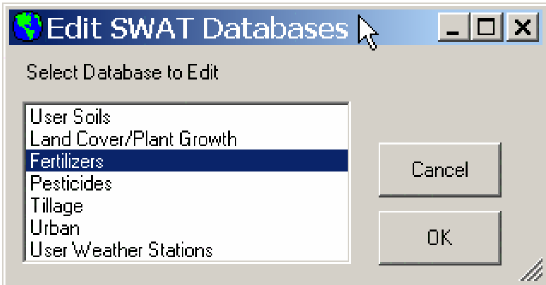


Figure 15.26

2. The **Fertilizer Database Edit** dialog box will be displayed (Figure 15.27)

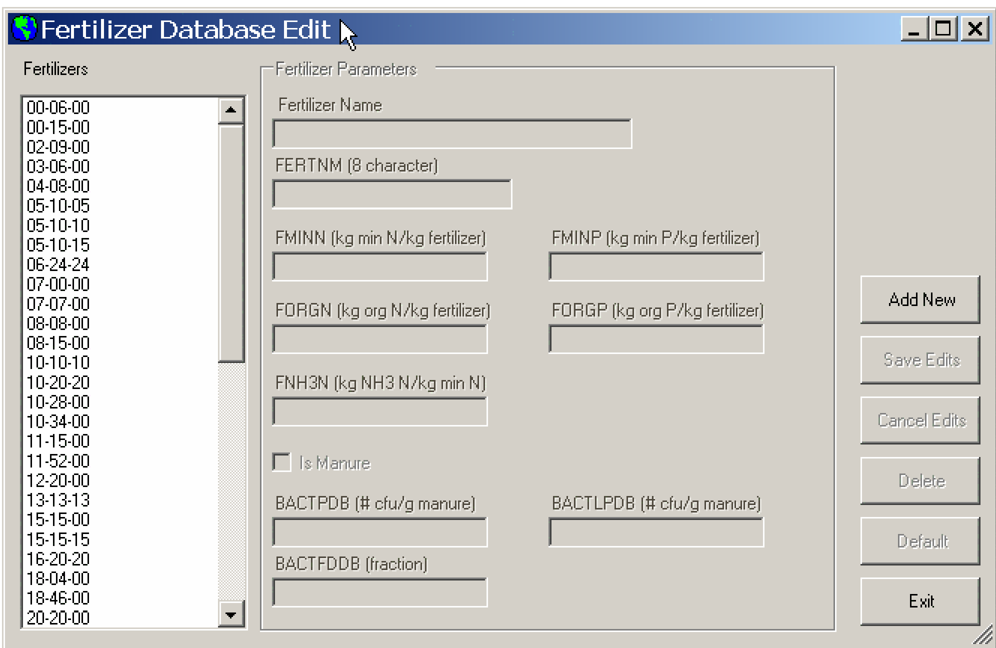


Figure 15.27

A list of fertilizers in the "fert" database is displayed on the left side of the dialog box.

3. The user has four options: edit an existing fertilizer cover record, add a new fertilizer record, delete an existing fertilizer record, or exit the database.

To edit an existing fertilizer record:

a. Click the name of the fertilizer to be edited.

b. The data for the fertilizer will be displayed (Figure 15.28). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 17.

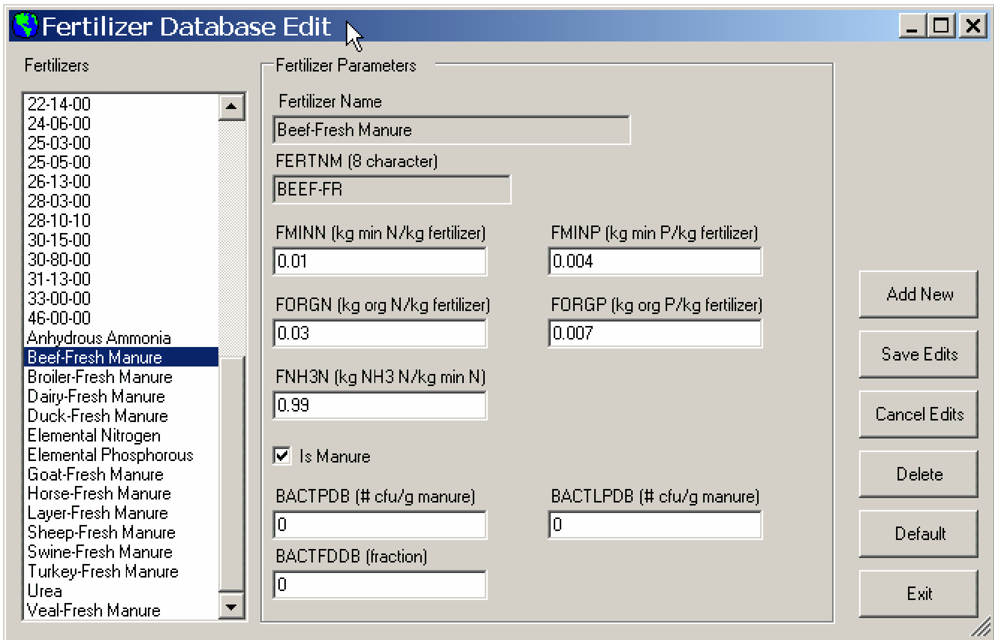


Figure 15.28

Note:	If the cursor is placed on top of any text box or button, a short help description (yellow label) appears and the range of variation is shown.

c. To edit a parameter type the new value in the text box. If the value of the parameter is out of range a message box like the one in Figure 15.29 will be displayed.

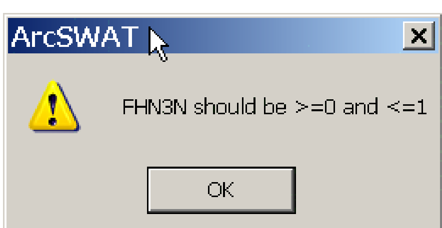


Figure 15.29

Click **OK**. The parameter will be reset to the previous value.

d. If you decide not to save the changes you have made to the fertilizer parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.30).

Figure 15.30

To reset fertilizer parameters to default values:

The default parameters for the fertilizer types provided with the interface are stored and can be recovered at any time. This operation may only be performed for fertilizers provided with the interface. This operation will eliminate all changes made to the parameters by the user.

a. While editing a fertilizer (Figure 15.28), click the **Default** button.

b. The values in the **Fertilizer Database Edit** dialog will revert back to the default values

c. Click **Save Edits** to save the default values back to the database.

To add a new fertilizer record:

A new fertilizer may be added to the database by setting parameters based on a default fertilizer or by copying data from an existing fertilizer record to the new record.

a. Click the button labeled **Add New** on the **Fertilizer Database Edit** dialog box.

b. If no fertilizer record is currently selected before clicking **Add New**, then the dialog box will appear with the parameters populated to those of a default fertilizer. If there is a fertilizer record selected before clicking

Add New, then the parameter values of the selected fertilizer will be applied to the new fertilizer record (Figure 15.31). The "Fertilizer Name" will be set to "New Fertilizer" and the "FERTNM" value will be "New Fert".

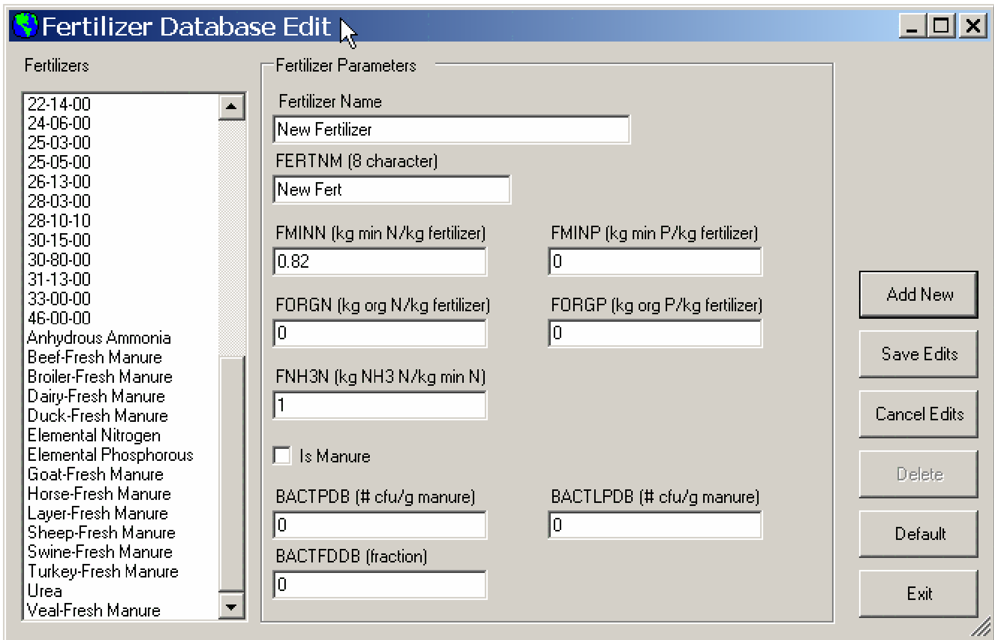


Figure 15.31

c. At this point, the user may type the necessary data into the different fields. A unique name ("FERTNM") must be given to the fertilizer (the name can only be 8 characters).

d. If you decide not to save the changes you have made to the fertilizer parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.30).

f. After clicking **Save Edits**, the land cover whose edits were just saved will remain active in the dialog.

To delete a fertilizer record:

a. From the **Fertilizer Database Edit** dialog box, click the name of the fertilizer to be deleted.

b. The dialog box will be modified to display the fertilizer data. Click the **Delete** button to delete the fertilizer (Figure 15.32).

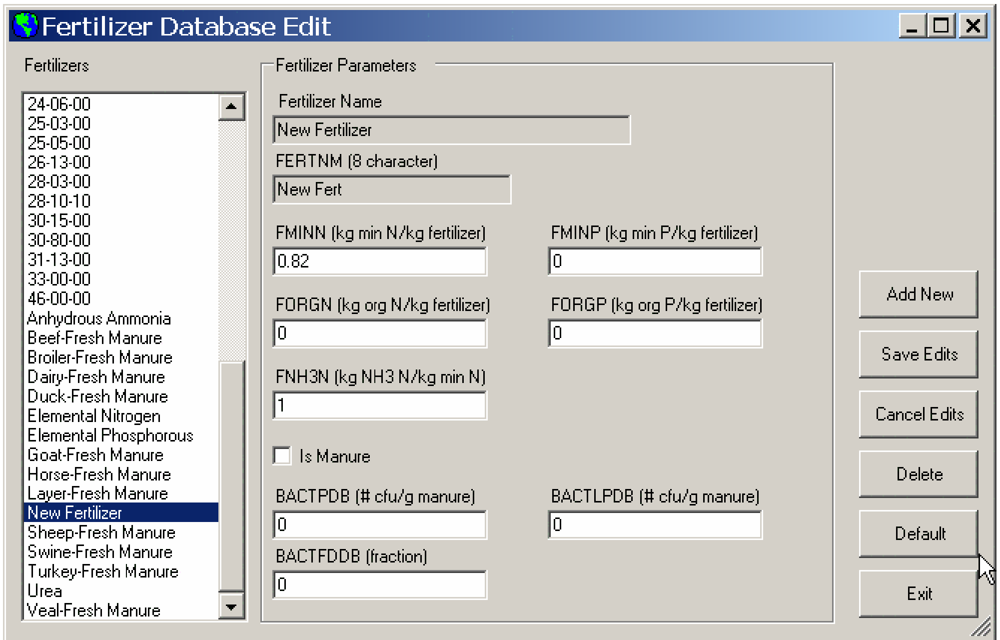


Figure 15.32

c. The fertilizer will be removed from the “fert” table in the “SWAT2005.mdb” database, and the **Fertilizer Database Edit** dialog will be cleared.

To exit the Fertilizer database:

a. From the **Fertilizer Database Edit** dialog box, click **Exit**.

SECTION 15.4: PESTICIDE DATABASE

To edit the Pesticide Database:

1. Select **Pesticides** on the list of databases (Figure 15.33) and click **OK**.

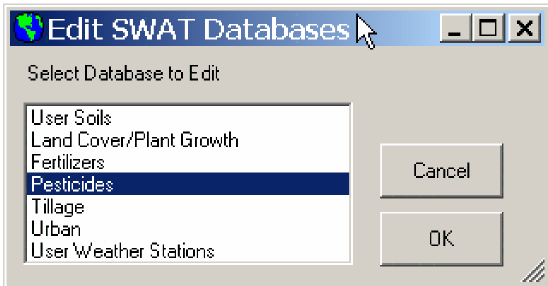


Figure 15.33

2. The **Pesticide Database Edit** dialog box will be displayed (Figure 15.33)

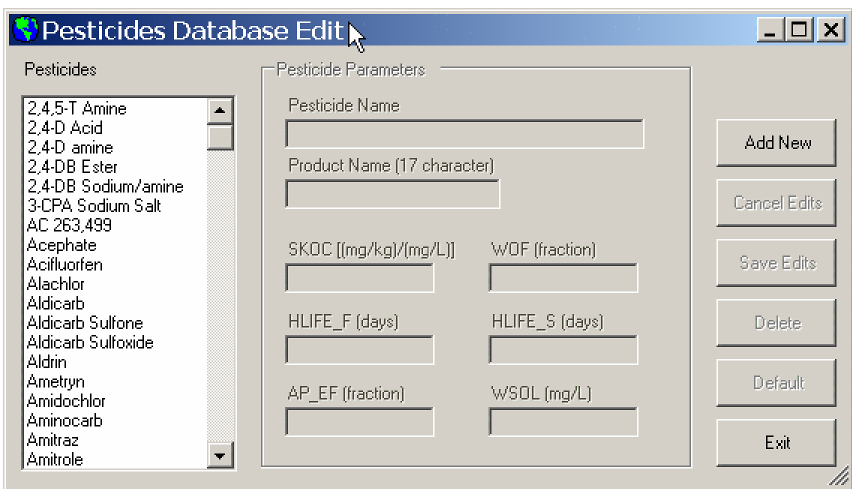


Figure 15.33

A list of pesticides in the “pest” database is displayed on the left side of the dialog box.

3. The user has four options: edit an existing pesticide record, add a new pesticide record, delete an existing pesticide record, or exit the database.

To edit an existing pesticide record:

a. Click the name of the pesticide to be edited.

b. The data for the pesticide will be displayed (Figure 15.33). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 16.

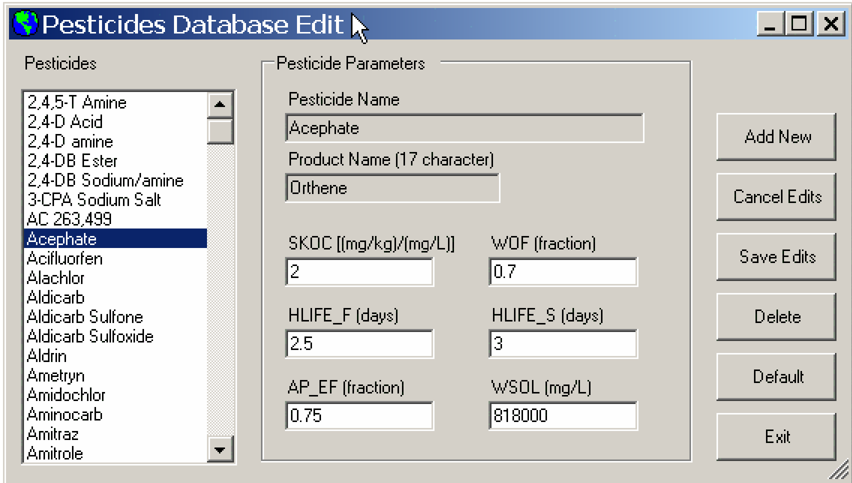


Figure 15.33

Note:	If the cursor is placed on top of any text box or button, a short help description (yellow label) appears and the range of variation is shown.

c. To edit a parameter type the new value in the text box. If the value of the parameter is out of range a message box like the one in Figure 15.34 will be displayed.

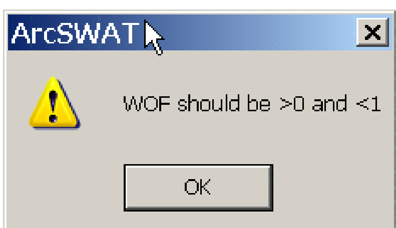


Figure 15.34

Click **OK**. The parameter will be reset to the previous value.

d. If you decide not to save the changes you have made to the pesticide parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.35).

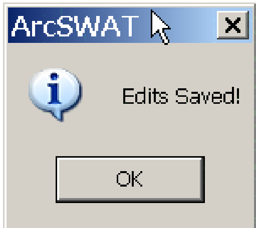


Figure 15.35

To reset pesticide parameters to default values:

The default parameters for the pesticide types provided with the interface are stored and can be recovered at any time. This operation may only be performed for pesticides provided with the interface. This operation will eliminate all changes made to the parameters by the user.

a. While editing a pesticide (Figure 15.33), click the **Default** button.

b. The values in **the Pesticide Database Edit** dialog will revert back to the default values

c. Click **Save Edits** to save the default values back to the database.

To add a new pesticide record:

A new pesticide may be added to the database by setting parameters based on a default pesticide or by copying data from an existing pesticide record to the new record.

a. Click the button labeled **Add New** on the **Pesticide Database Edit** dialog box.

b. If no pesticide record is currently selected before clicking **Add New**, then the dialog box will appear with the parameters populated to those of a default pesticide. If there is a pesticide record selected before clicking **Add New**, then the parameter values of the selected pesticide will be applied to the new pesticide record (Figure 15.36). The “Pesticide Name” will be set to “New Pesticide” and the “Product Name” value will be “New Product”.

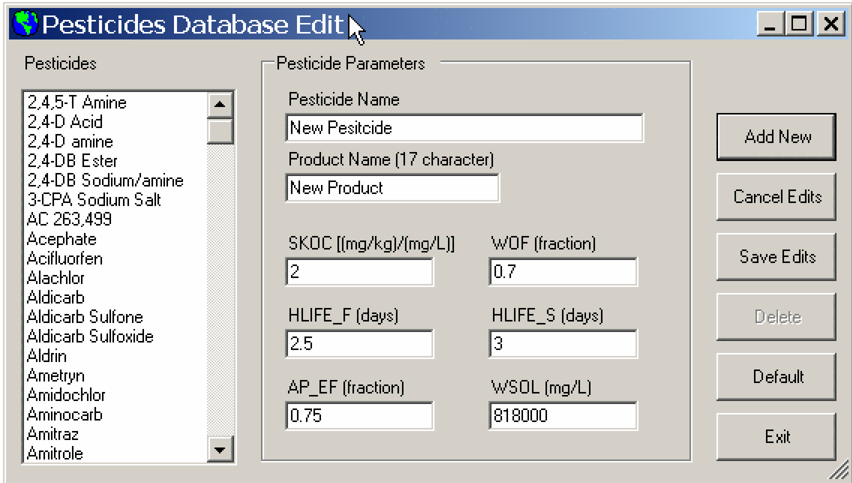


Figure 15.36

c. At this point, the user may type the necessary data into the different fields. A unique product name ("Product Name") must be given to the pesticide (the name can only be 17 characters).

d. If you decide not to save the changes you have made to the pesticide parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.35).

f. After clicking **Save Edits**, the land cover whose edits were just saved will remain active in the dialog.

To delete a pesticide record:

a. From the **Pesticide Database Edit** dialog box, click the name of the pesticide to be deleted.

b. The dialog box will be modified to display the pesticide data. Click the **Delete** button to delete the pesticide (Figure 15.37).

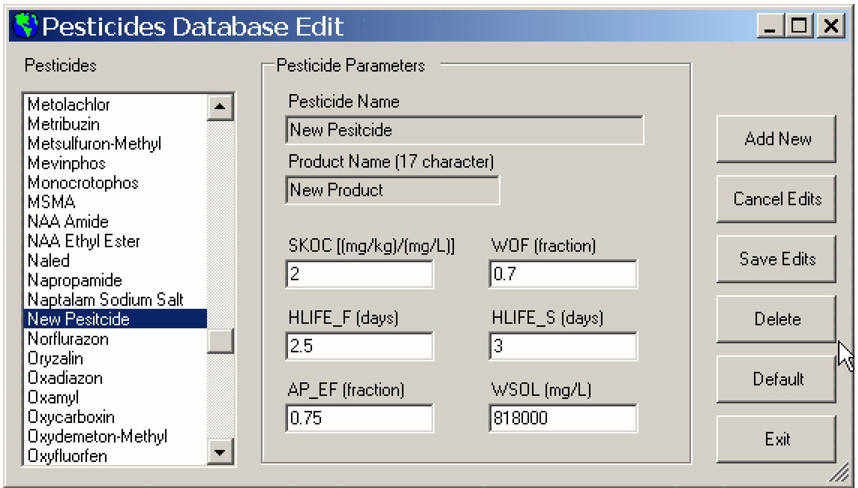


Figure 15.37

c. The pesticide will be removed from the “pest” table in the “SWAT2005.mdb” database, and **the Pesticide Database Edit** dialog will be cleared.

To exit the Pesticide database:

a. From the **Pesticide Database Edit** dialog box, click **Exit**.

To edit the Tillage Database:

1. Select **Tillages** on the list of databases (Figure 15.38) and click OK.

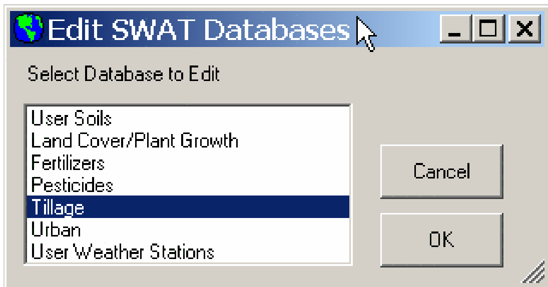


Figure 15.38

2. The **Tillage Database Edit** dialog box will be displayed (Figure 15.39)

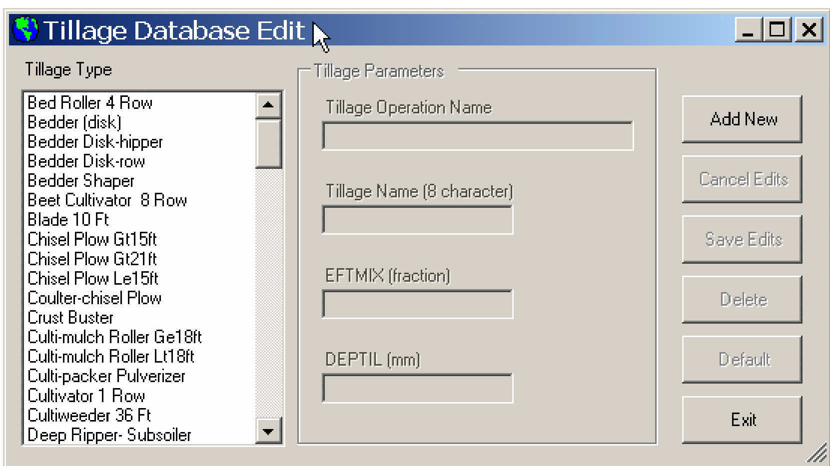


Figure 15.39

A list of tillage operations in the “till” database is displayed on the left side of the dialog box.

3. The user has four options: edit an existing tillage record, add a new tillage record, delete an existing tillage record, or exit the database.

To edit an existing tillage record:

a. Click the name of the tillage to be edited.

b. The data for the tillage will be displayed (Figure 15.40). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 15.

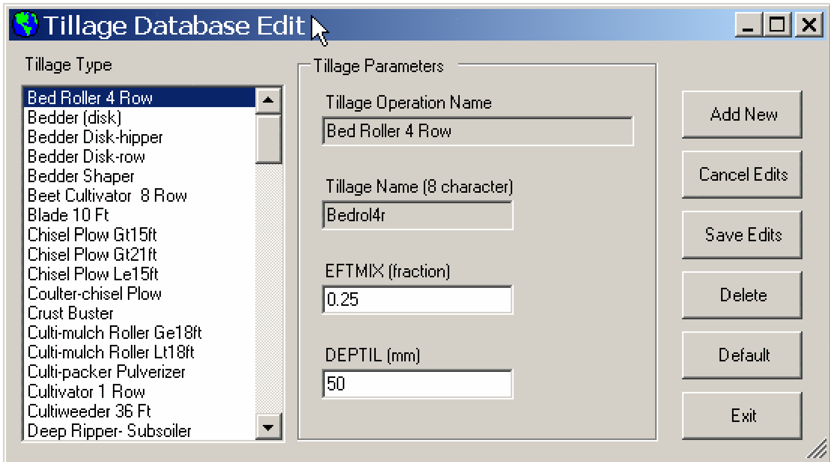


Figure 15.40

Note:	If the cursor is placed on top of any text box or button, a short help description (yellow label) appears and the range of variation is shown.

c. To edit a parameter type the new value in the text box. If the value of the parameter is out of range a message box like the one in Figure 15.41 will be displayed.

Figure 15.41

Click **OK**. The parameter will be reset to the previous value.

d. If you decide not save the changes you have made to the tillage parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.42).

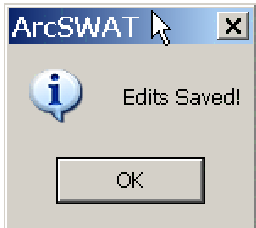


Figure 15.42

To reset tillage parameters to default values:

The default parameters for the tillage types provided with the interface are stored and can be recovered at any time. This operation may only be performed for tillage operations provided with the interface. This operation will eliminate all changes made to the parameters by the user.

a. While editing a tillage operation (Figure 15.40), click the **Default** button.

b. The values in the **Tillage Database Edit** dialog will revert back to the default values

c. Click **Save Edits** to save the default values back to the database.

To add a new tillage record:

A new tillage may be added to the database by setting parameters based on default tillage or by copying data from an existing tillage record to the new record.

a. Click the button labeled **Add New** on the **Tillage Database Edit** dialog box.

b. If no tillage record is currently selected before clicking **Add New**, then the dialog box will appear with the parameters populated to those of a default tillage operation. If there is a tillage record selected before clicking **Add New**, then the parameter values of the selected tillage will be applied to the new tillage record (Figure 15.43). The “Tillage Operation Name” will be set to “New Till Op” and the “Tillage Name” value will be “New Till”.

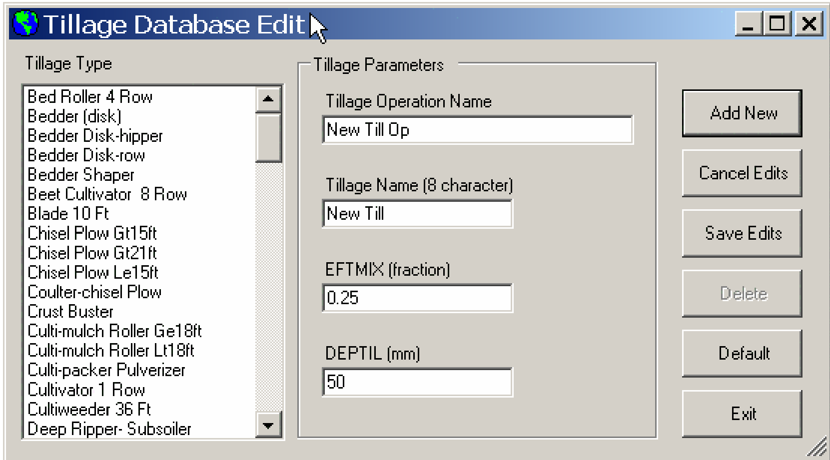


Figure 15.43

c. At this point, the user may type the necessary data into the different fields. A unique tillage name ("Tillage Name") must be given to the tillage (the name can only be 8 characters).

d. If you decide not to save the changes you have made to the tillage parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.43).

f. After clicking **Save Edits**, the land cover whose edits were just saved will remain active in the dialog.

To delete a tillage record:

a. From the **Tillage Database Edit** dialog box, click the name of the tillage to be deleted.

b. The dialog box will be modified to display the tillage data. Click the **Delete** button to delete the tillage (Figure 15.44).

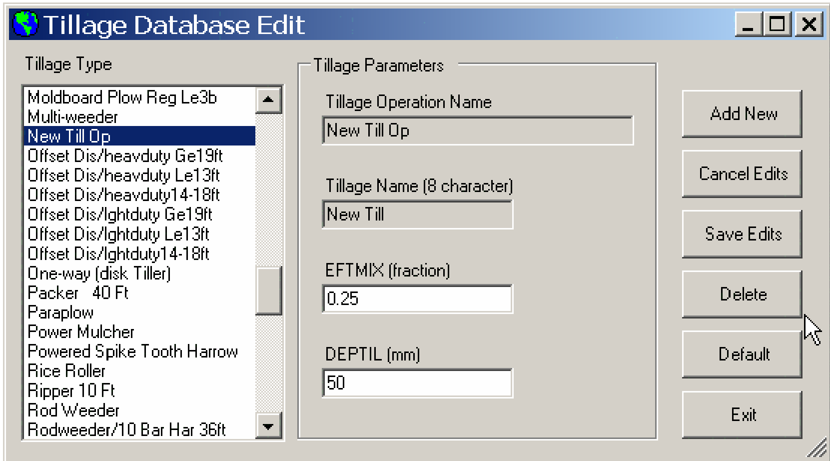


Figure 15.44

c. The tillage operation will be removed from the “till” table in the “SWAT2005.mdb” database and the **Tillage Database Edit** dialog will be cleared.

To exit the Tillage database:

a. From the **Tillage Database Edit** dialog box, click **Exit**.

SECTION 15.6: URBAN DATABASE

To edit the Urban Database:

1. Select **Urban** on the list of databases (Figure 15.45) and click **OK**.

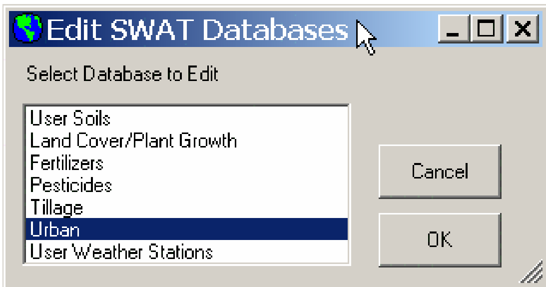


Figure 15.45

2. The **Urban Area Database Edit** dialog box will be displayed (Figure 15.46)

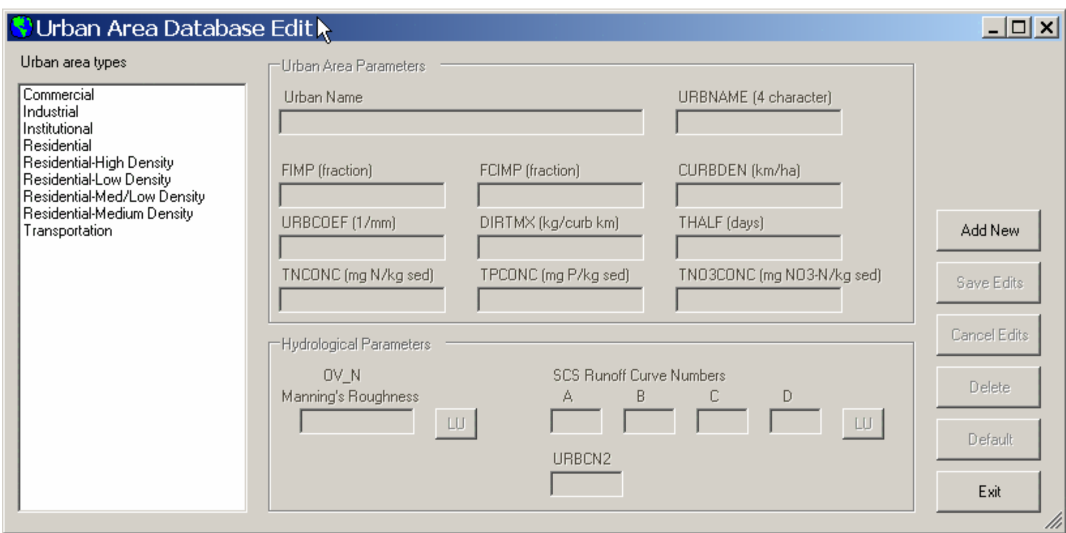


Figure 15.46

A list of urban area types in the “urban” database is displayed on the left side of the dialog box.

3. The user has four options: edit an existing urban record, add a new urban record, delete an existing urban record, or exit the database.

To edit an existing urban record:

a. Click the name of the urban area to be edited.

b. The data for the urban area will be displayed (Figure 15.47). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 18

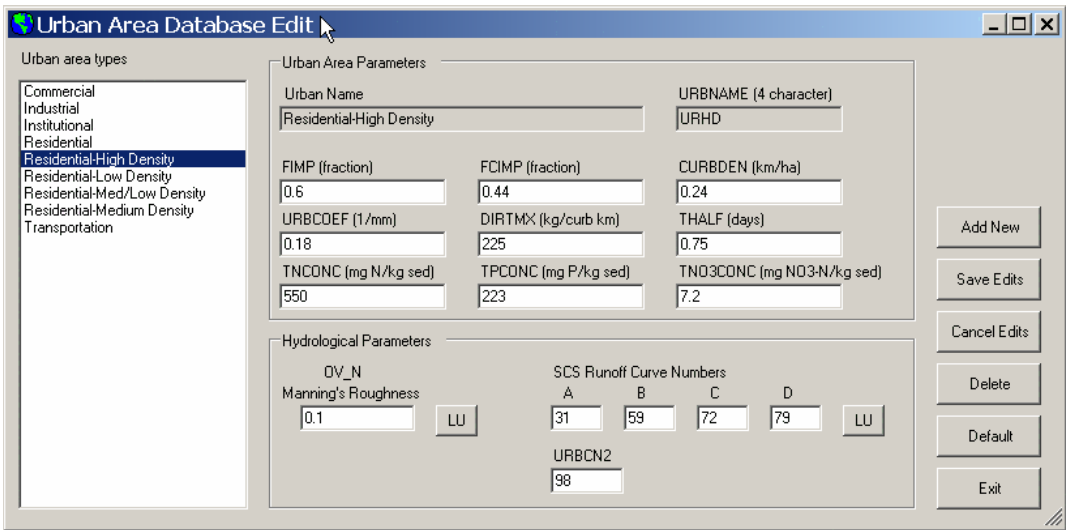


Figure 15.47

Note: If the cursor is placed on top of any text box or button, a short help description (yellow label) appears and the range of variation is shown.

c. To edit a parameter type the new value in the text box. If the value of the parameter is out of range a message box like the one in Figure 15.48 will be displayed.

Figure 15.48

Click **OK**. The parameter will be reset to the previous value.

d. To edit the manning's n value, either type the desired value in the text box, or click on the LU button to the right on the **Manning's Roughness** text box (Figure 15.49) to launch a lookup table of values.

Figure 15.49

e. The Manning's "n" Lookup Table dialog will open allowing you to choose an appropriate value for your urban area (Figure 15.50). Choose the type of Manning's value by selecting from the **Type** combo box. Click in the grid cell corresponding to the value desired, the click OK. The value will appear in the **Manning's Roughness** text box (Figure 15.51).

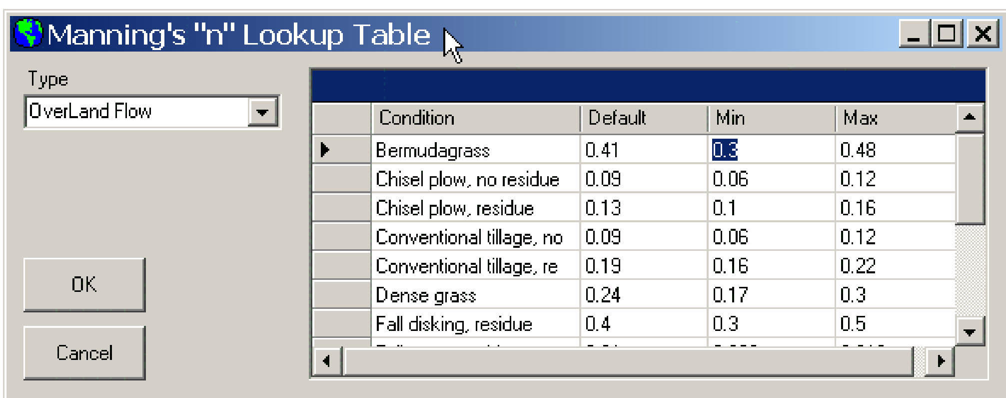


Figure 15.50

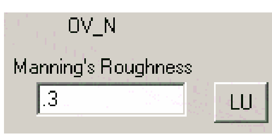


Figure 15.51

f. To edit the SCS curve number values for pervious areas, either type the desired values in the text boxes, or click on the LU button to the right on the **SCS Runoff Curve Number** text boxes (Figure 15.50) to launch a lookup table of values.

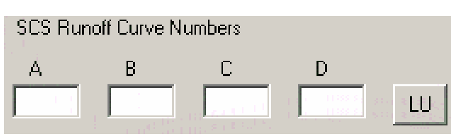


Figure 15.52

g. The **SCS Curve Number Lookup Table** dialog will open allowing you to choose a set of curve numbers appropriate for your pervious urban areas (Figure 15.53).Choose the pervious land cover type of condition by selecting from the **Condition** combo box. Click on the table row corresponding to the value desired, then click **OK**. The selected curve number values will appear in the **SCS Curve Numbers** text boxes (Figure 15.54).

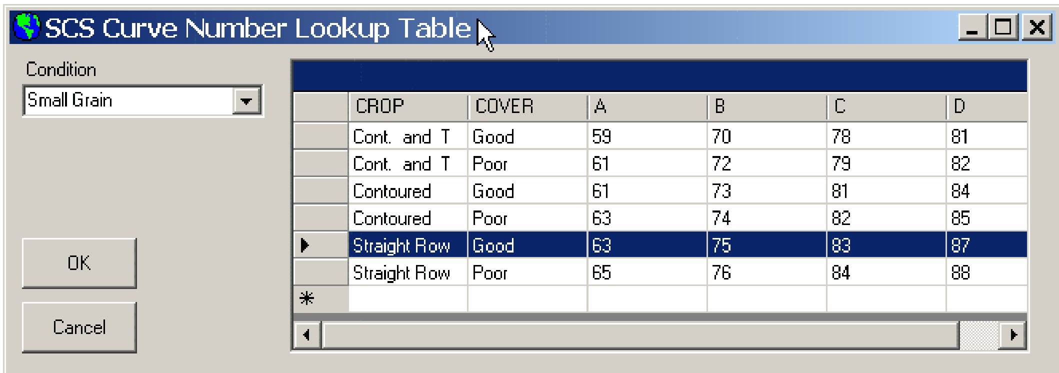


Figure 15.53

Figure 15.54

h. If you decide not to save the changes you have made to the urban parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

i. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.55).

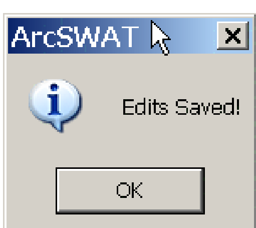


Figure 15.55

To reset urban parameters to default values:

The default parameters for the urban types provided with the interface are stored and can be recovered at any time. This operation may only be performed for urban land covers provided with the interface. This operation will eliminate all changes made to the parameters by the user.

a. While editing an urban area (Figure 15.47), click the **Default** button.

b. The values in the **Urban Area Database Edit** dialog will revert back to the default values

c. Click **Save Edits** to save the default values back to the database.

To add a new urban record:

A new urban area may be added to the database by setting parameters based on a default urban area or by copying data from an existing urban record to the new record.

a. Click the button labeled **Add New** on the **Urban Area Database Edit** dialog box.

b. If no urban record is currently selected before clicking **Add New**, then the dialog box will appear with the parameters populated to those of a default urban area. If there is an urban record selected before clicking **Add New**, then the parameter values of the selected urban area will be applied to the new urban record (Figure 15.56). The “Urban Name” will be set to “New Urban” and the “URBNAME” value will be “NEWU”.

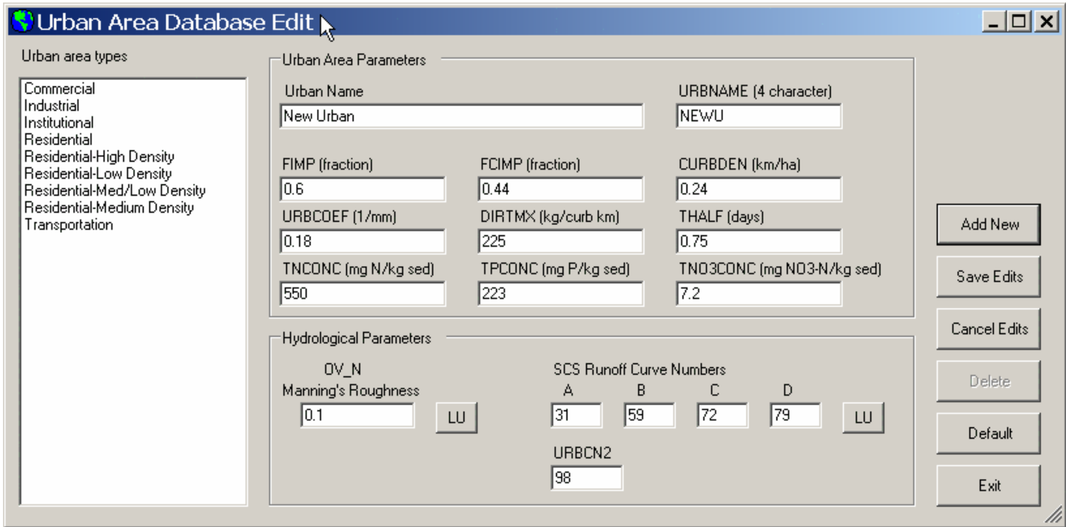


Figure 15.56

c. At this point, the user may type the necessary data into the different fields. A unique name ("URBNAME") must be given to the urban area (the name can only be 4 characters).

d. If you decide not to save the changes you have made to the urban parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.55).

f. After clicking **Save Edits**, the urban areas whose edits were just saved will remain active in the dialog.

To delete an urban record:

a. From the **Urban area types** dialog box, click the name of the urban to be deleted.

b. The dialog box will be modified to display the urban data. Click the **Delete** button to delete the urban (Figure 15.56).

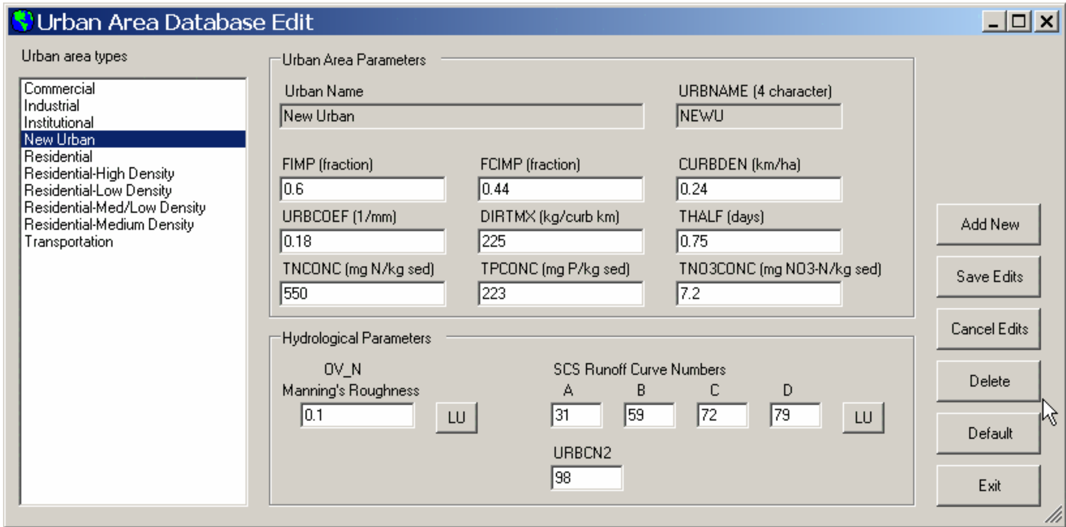


Figure 15.56

c. The urban area will be removed from the "urbane" table in the "SWAT2005.mdb" database, and the **Urban Area Database Edit** dialog will be cleared.

To exit the Urban database:

a. From the **Urban Area Database Edit** dialog box, click **Exit**.

SECTION 15.7: USER WEATHER STATIONS DATABASE

The ArcSWAT SWAT Parameters Database (SWAT2005.mdb) distributed with the ArcSWAT install package contains a User Weather Stations Database table (userwgn) with the proper set of fields for the database and several sample records. Users may either manually edit the userwgn table through the ArcSWAT interface or import an entire table of user weather station records using the ArcToolbox Append tool.

To append an entire table of user soil records to the userwgn table:

1. Select the **ArcToolbox Append** tool (Figure 5.57)

Figure 5.57

2. Launch the tool and select the table of user weather station records you wish to append as the **Input Features** and select the */SWAT2005.mdb/userwgn* table as the Output Features (Figure 5.58). Click **OK**.

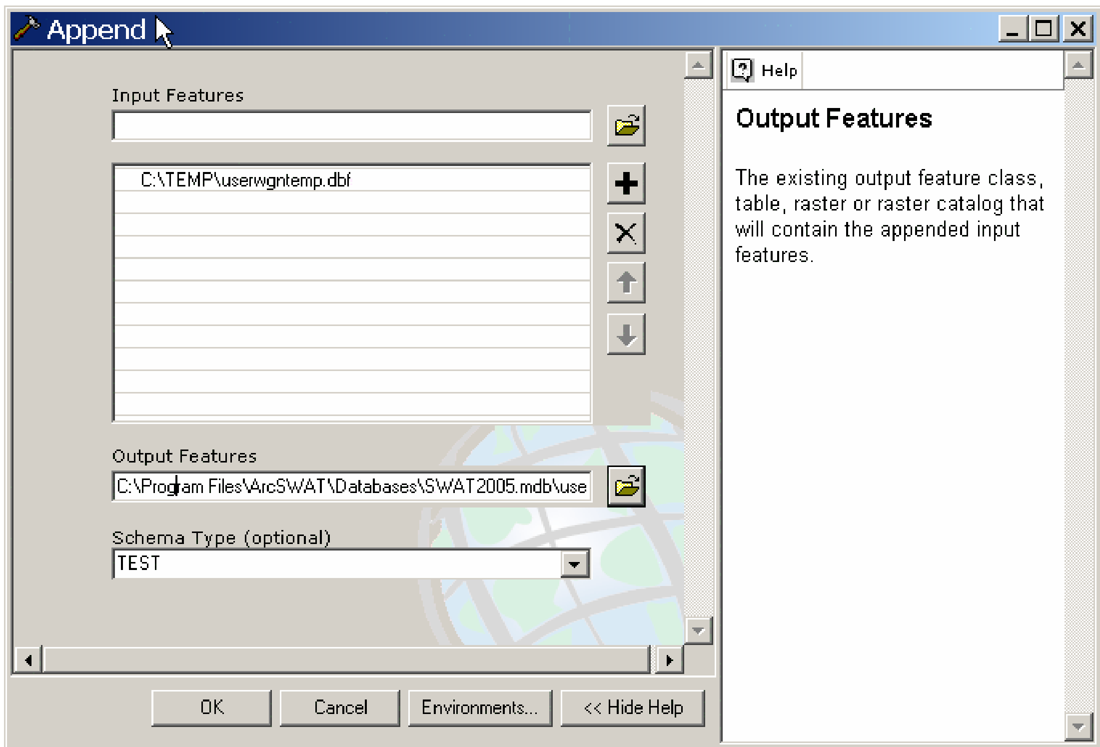


Figure 5.58

3. The new records will be added to the *userwgn* table.

Note:	The table of new user weather station records must conform to the same field structure as the userwgn table in the SWAT2005.mdb database. If the table structure is not the same, then the new records may not append correctly and/or result in errors in the ArcToolbox append operation.

To edit the User Weather Stations Database through the ArcSWAT interface:

1. Select the **User Weather Stations** on the list of databases (Figure 15.59) and click **OK**.

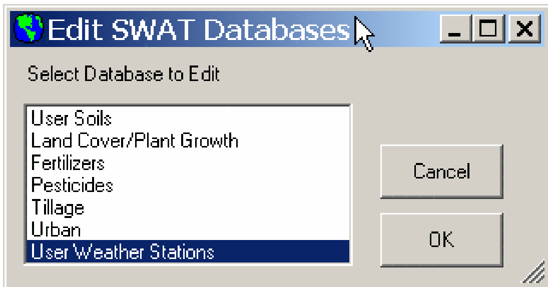


Figure 15.59

2. The **User Soils Edit** dialog box will be displayed (Figure 15.60)

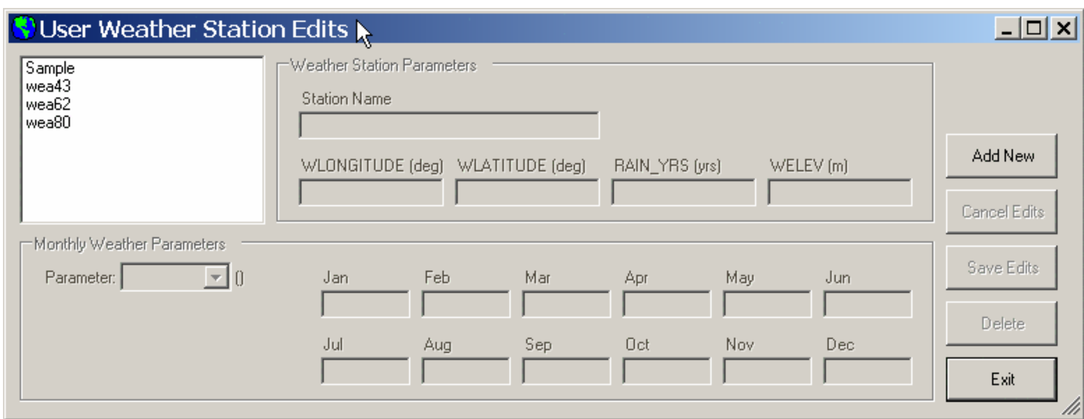


Figure 15.60

A list of weather stations in the custom database is displayed on the left side of the dialog box.

3. The user has four options: edit an existing weather station record, add a new weather station record, delete an existing weather station record, or exit the database.

To edit an existing weather station record:

a. Click the name of the weather station to be edited.

b. The data for the weather station will be displayed (Figure 15.61). A complete description of the variables is provided in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 12.

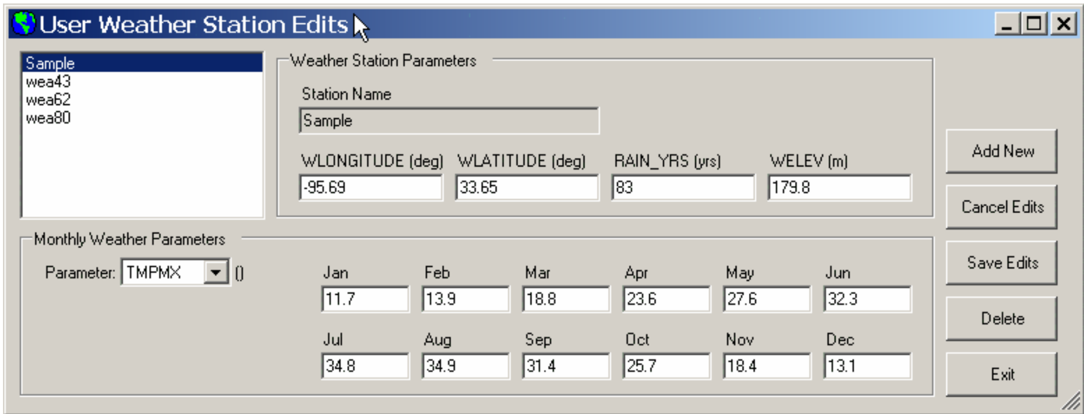


Figure 15.61

Note:	If the cursor is placed on top of any text box or button, a short help description (yellow label) appears and the range of variation is shown.

c. The weather station parameters are separated into two groups. The parameters that are applicable to the weather station location and record are displayed in the section titled **Weather Station Parameters** and the parameters that pertain to a particular meteorological parameter are displayed in the section titled **Monthly Weather Parameters**. The meteorological parameter is displayed in the **Parameter** combo box. The different parameters can be accessed by selecting a value from the combo box.

d. To edit a parameter type the new value in the text box. If the value of the parameter is out of range a message box like the one in Figure 15.62 will be displayed.

Figure 15.62

Click **OK**. The parameter will be reset to the previous value.

e. If you decide not save the changes you have made to the weather station parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

f. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.63).

Figure 15.63

To add a new weather station record:

A new weather station may be added to the database by setting parameters based on a default weather station or by copying data from an existing weather station record to the new record.

a. Click the button labeled **Add New** on the **User Weather Stations Edit** dialog box.

b. If no weather station record is currently selected before clicking **Add New**, then the dialog box will appear with the parameters populated to those of a default weather station. If there is a weather station record selected before clicking **Add New**, then the parameter values of the selected weather station will be applied to the new weather station record (Figure 15.64). The "Station Name" of the weather station will be set to "New Weather".

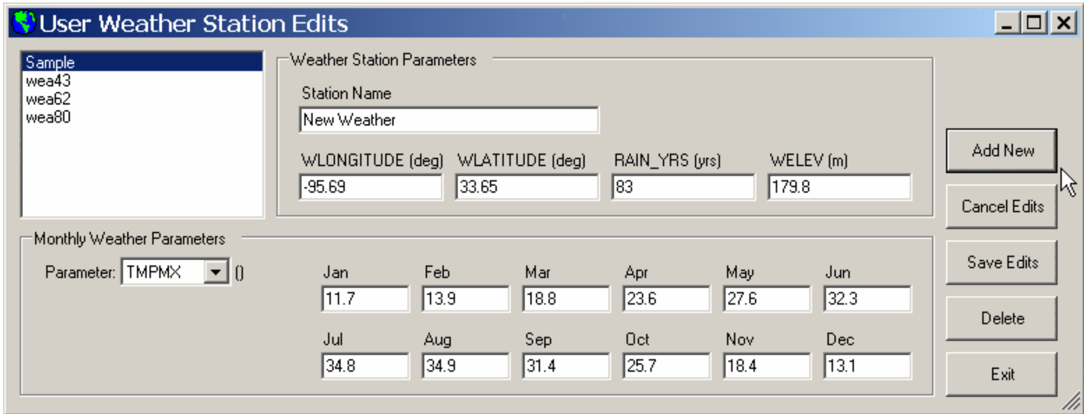


Figure 15.64

c. At this point, the user may type the necessary data into the different fields. A unique name ("Station Name") must be given to the weather station (the name can include numbers, but the name must begin with a letter).

d. If you decide not to save the changes you have made to the weather stations parameters, click the **Cancel Edits** button and the parameters will revert back to their original values.

e. Once all editing changes have been made, click **Save Edits**. A message will appear indicating that edits have been saved (Figure 15.63).

f. After clicking **Save Edits**, the weather station whose edits were just saved will remain active in the dialog.

To delete a weather station record:

a. From the User Weather stations dialog box, click the name of the weather station to be deleted.

b. The dialog box will be modified to display the weather station data. Click the **Delete** button to delete the weather station (Figure 15.65).

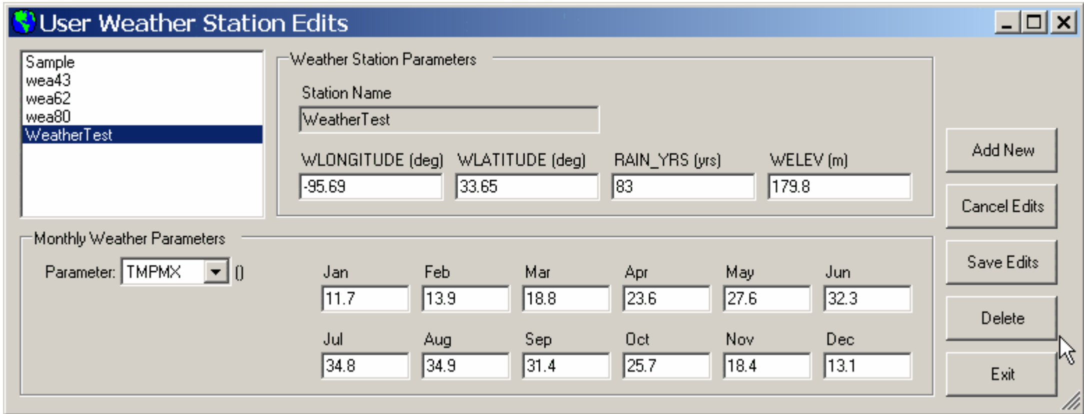


Figure 15.65

c. The weather station will be removed from the “userwgn” table in the “SWAT2005.mdb” database, and the **User Weather Stations Edit** dialog will be cleared.

To exit the User Weather stations database:

a. From the **User Weather Stations Edit** dialog box, click **Exit**.

SECTION 16: THE EXAMPLE DATA SET

Data for the Lake Fork Watershed in Northeast Texas has been included in the installation package as a demonstration data set. The example data set is stored in the directory*: \Installation dir\ Databases\Example1* which can be found on the drive that the ArcSWAT interface is installed (Figure 16.1).

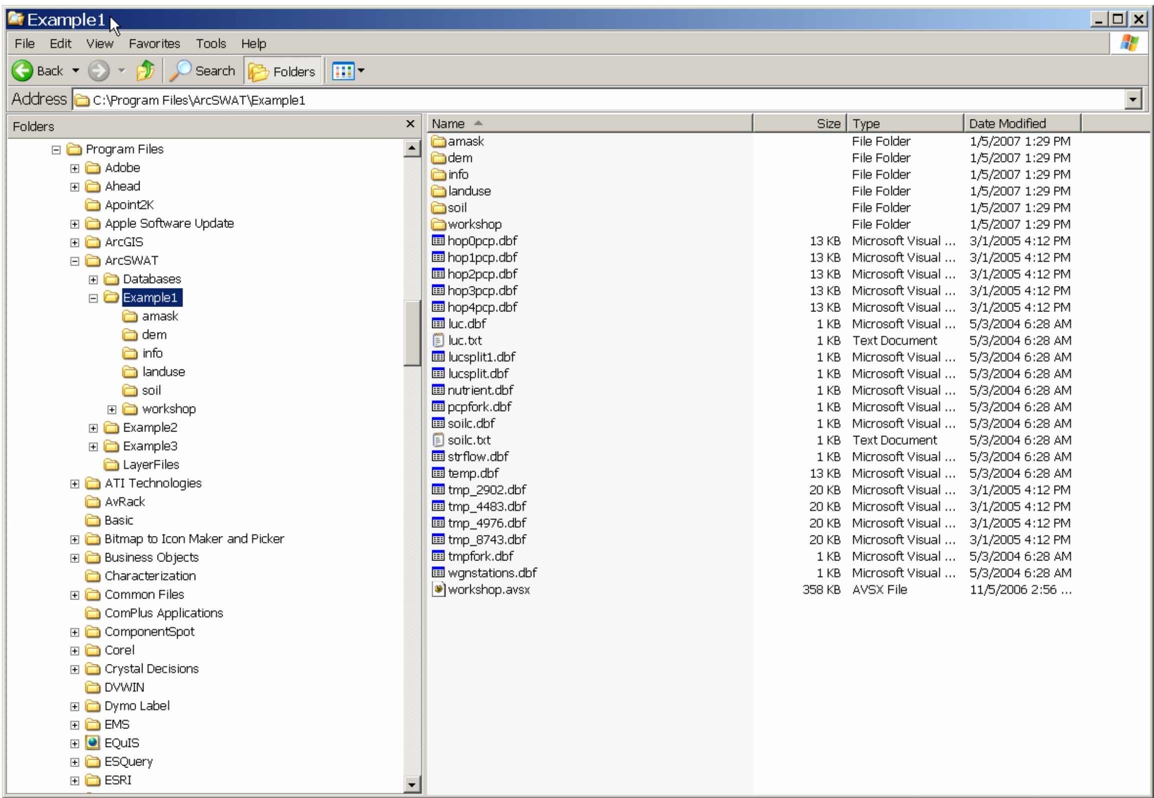


Figure 16.1

The example data set includes 4 raster datasets, 16 DBF tables, and two text files. The 4 raster datasets are:

- **dem**: A Digital Elevation Model (DEM) raster dataset for the Lake Fork Watershed. The map was created in the Albers Equal Area projection with the resolution in meters and the elevation in meters.
- **amask**: A DEM Mask raster dataset. The map was created in the Albers Equal Area projection with the resolution in meters.
- **landuse**: A Land Cover/Land Use raster dataset for the Lake Fork Watershed. The map was created in the Albers Equal Area projection with the resolution in meters.

- **soil**: A Soil raster dataset for the Lake Fork Watershed. The map was created in the Albers Equal Area projection with the resolution in meters. The Soil grid is a STATSGO soil map.
- The DBF tables and text files are:
- Location table for USGS stream flow gages: **strflow.dbf**
- Location table for in-stream nutrient monitoring points: **nutrient.dbf**
- Location table for rain gages: **pcpfork.dbf**
- Precipitation data tables: hop0pcp.dbf, hop1pcp.dbf, hop2pcp.dbf, hop3pcp.dbf, hop4pcp.dbf
- Location table for temperature gages**: tmpfork.dbf**
- Temperature data tables**: tmp_2902.dbf, tmp_4483.dbf, tmp_4976.dbf, tmp_8743.dbf**
- Location table for weather stations whose data was used to create custom weather generator data sets**: wgnstations.dbf**
- Land Use look up table**: luc.dbf**
- Land Use look up file: **luc.txt**
- Soil look up table, STMUID option: **soilc.dbf**
- Soil look up file, STMUID option: **soilc.txt**

For more information on the different types of tables and maps required to run the interface, please see Section 3.

SECTION 16.1: CREATE SWAT RUN WITH EXAMPLE DATASET

1. Open ArcMap and choose “A new empty map”.
2. On the **Tools** menu, click **Extensions**. Make sure that the “SWAT Project Manager”, “SWAT Watershed Delineator”, and “Spatial Analyst” extensions are checked.
3. From the **View->Toolbars** menu, make sure that the **ArcSWAT** toolbar is checked.
4. From the **SWAT Project Setup** menu, click the **New SWAT Project** command.
5. In the **Project Set Up** dialog, set the **Project Directory** to a location on your local drive or network in a folder called “lakefork” (Figure 16.2). The

SWAT Project Geodatabase will be automatically set to "lakefork.mdb" and the raster geodatabase will be set as "RasterStore.mdb". The SWAT Parameter Geodatabase will be set to the SWAT2005.mdb database located in your ArcSWAT install folder (Figure 16.2). Click **OK**.

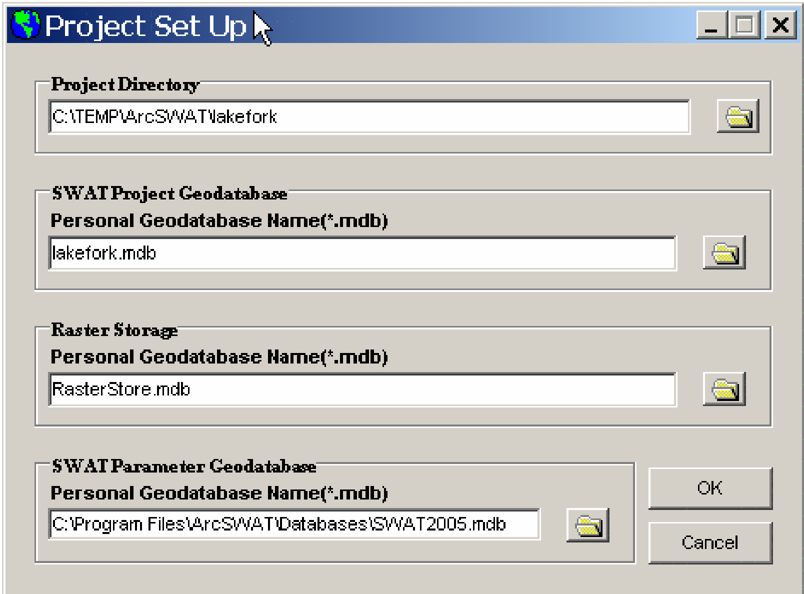


Figure 16.2

6. A new ArcSWAT project is created.

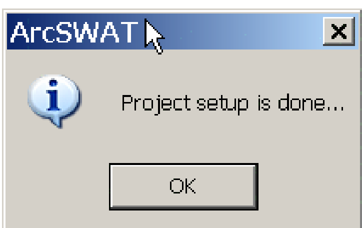


Figure 16.3

SECTION 16.1.1: PROCESSING THE ELEVATION DATASET

1. Choose the **Automatic Watershed Delineation** item from the **Watershed Delineation** menu. The Watershed Delineation dialog opens (Figure 16.4).

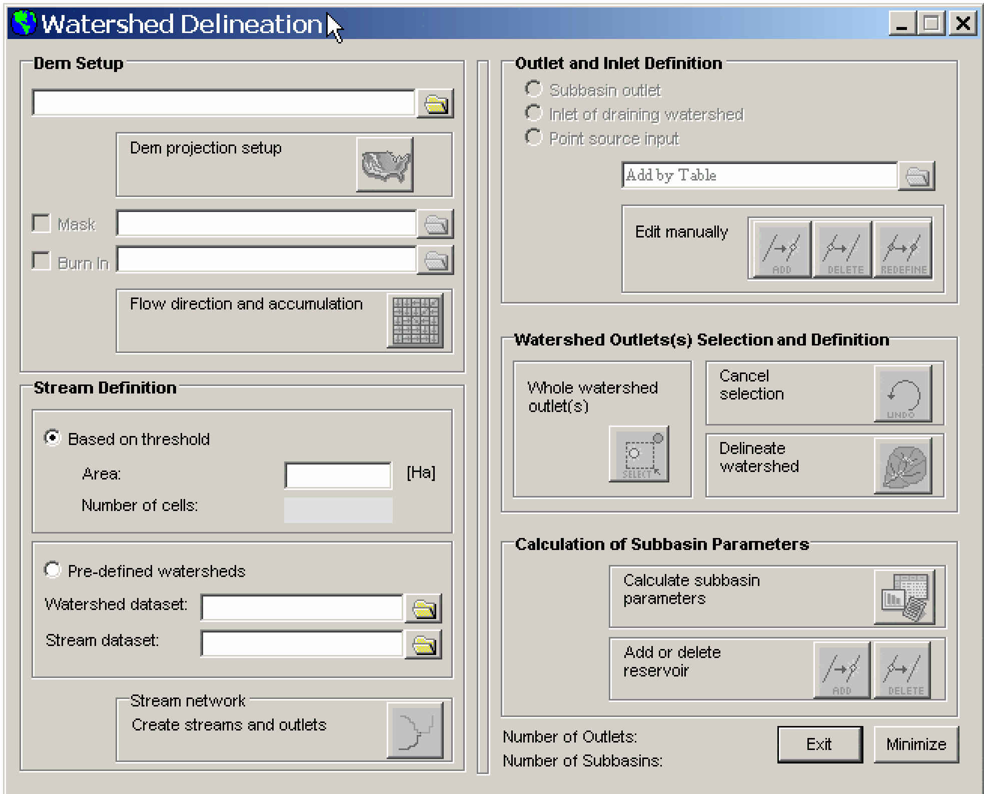


Figure 16.4

2. Load the dem called “dem” from the **Example 1** data folder by clicking on the browse button next to the DEM Setup text box.

3. The elevation grid will be imported to the “RasterSTore.mdb” geodatabase associated with the current ArcSWAT project. The name of the elevation grid (from within the “RasterStore.mdb” database) will be displayed in the **DEM Setup** text box on the **Watershed Delineation** dialog box and the elevation map will be displayed (Figure 16.4).

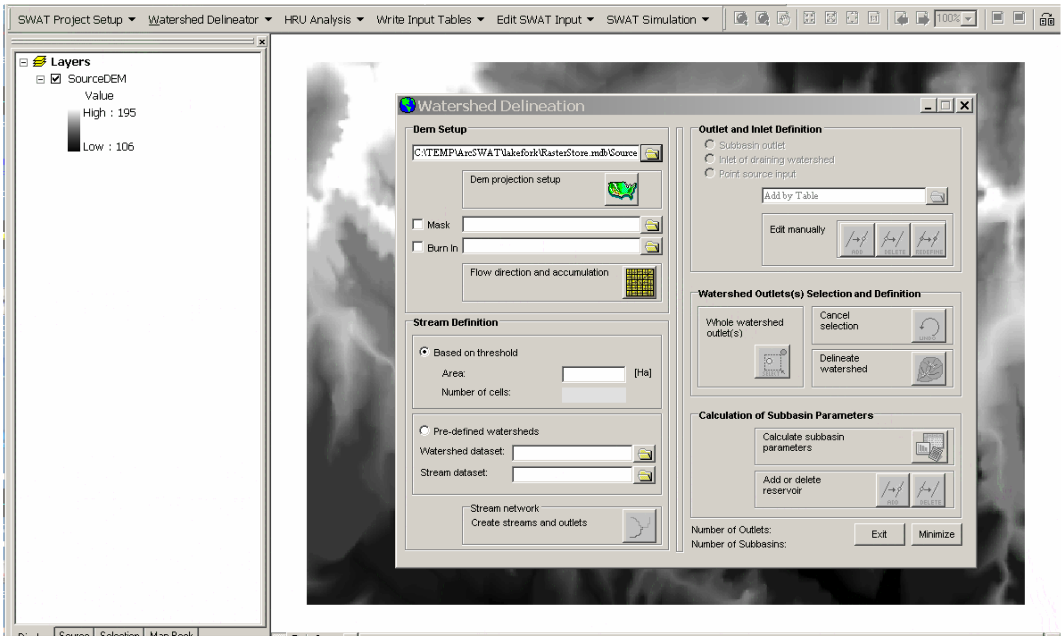


Figure 16.4

4. **Click the Dem** projection setup button to open the DEM properties dialog. Set the Z-units to "meter" (Figure 16.5).

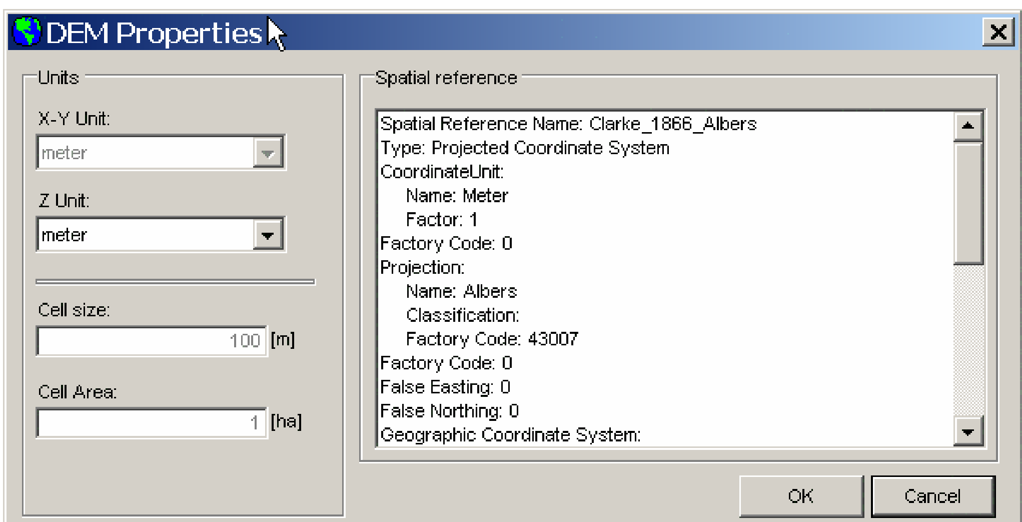


Figure 16.5

5. Check the checkbox next to **Mask**, and then click the adjacent file browse button to browse to the location of the "amask" grid in the **Example 1** folder. Choose the "Load from Disk" option when prompted.

6. The mask grid will be imported to the "RasterSTore.mdb" geodatabase associated with the current ArcSWAT project. The name of the mask grid (from within the "RasterStore.mdb" database) will be displayed in the

Mask text box on the **Watershed Delineation** dialog box and the mask will be displayed (Figure 16.6).

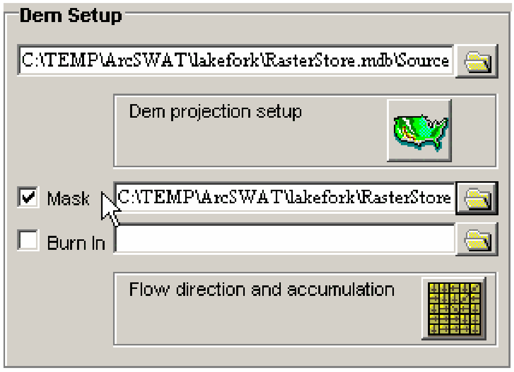


Figure 16.6

When a mask grid is used, the stream network will be delineated only for the area of the DEM covered by the mask grid.

7. Click the Flow direction and accumulation button. This action will fill all the sinks in the DEM, then calculate the flow direction and flow accumulation grids that will be used in the stream definition and watersheds boundary calculations. For large DEMs, this process wil take along time (many hours some cases). For the example dataset the process only takes a few minutes. When completed, the following message will appear (Figure 16.7)

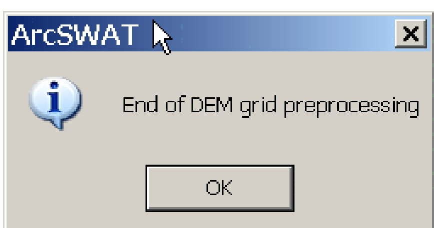


Figure 16.7

8. Once the elevation grid has been preprocessed, the threshold area used to define the origin of a stream needs to be specified. The smaller the number, the more detailed the stream network generated by the interface. Figure 16.8 shows the stream network generated with the threshold set to 100 ha while Figure 16.9 shows the stream network generated with the threshold set to 1000 ha.

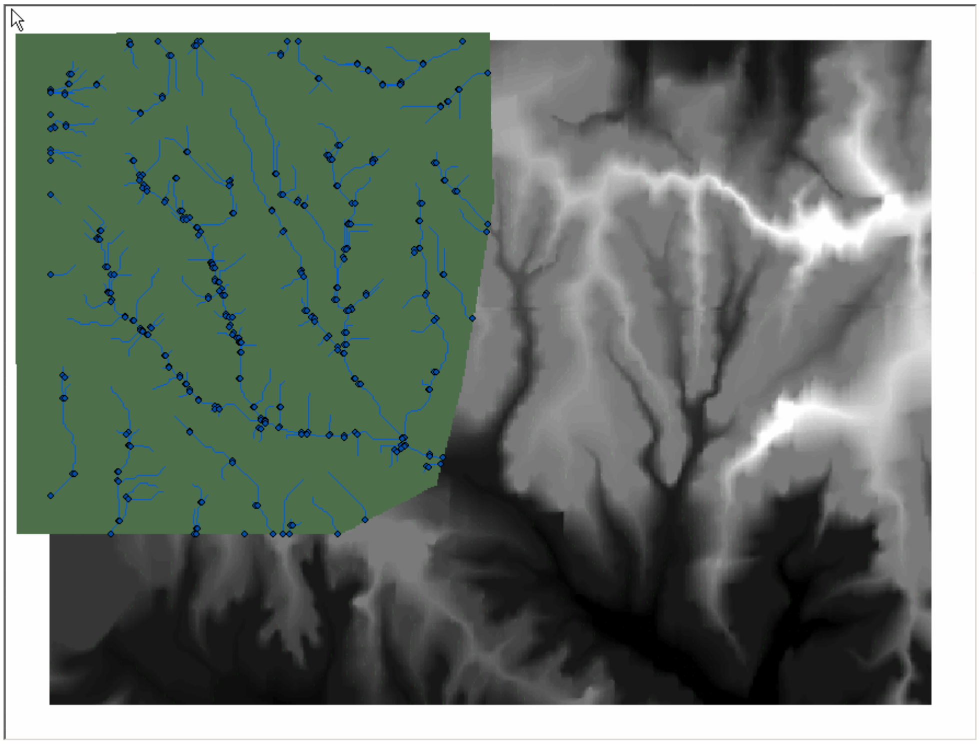


Figure 16.8

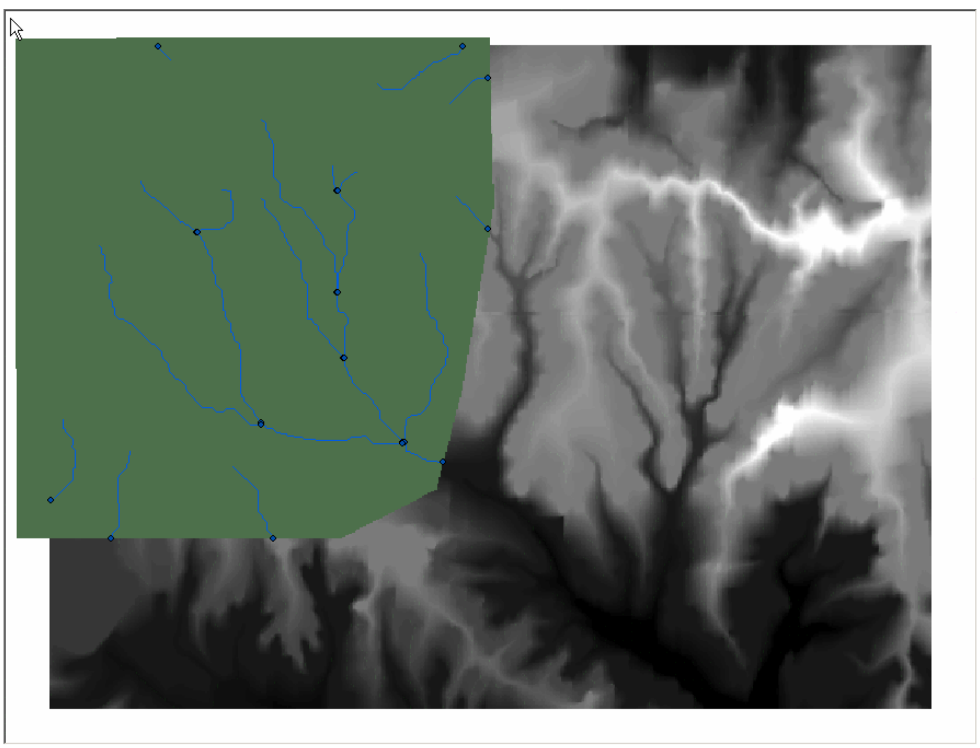


Figure 16.9

For the example project, set the threshold area to 1000. Choose the **Based on threshold** option under Stream Definition and enter “1000” into **the Threshold Area checkbox. Click the Create** streams and outlets button to apply the threshold and create a stream network and outlets (Figure 16.10)

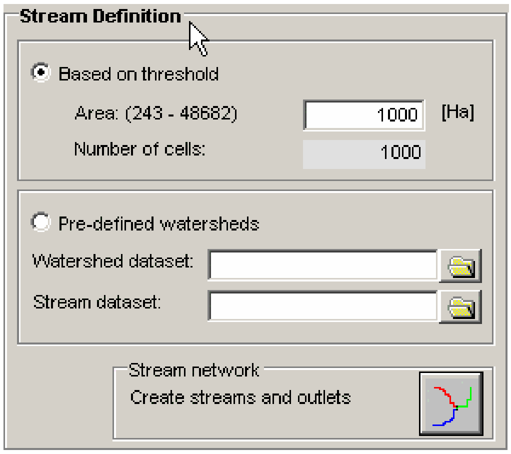


Figure 16.10

9. The stream network will be displayed upon completion of the calculations (Figure 16.9). Subbasin outlets defined by the junction of two streams are denoted on the network by blue dots.

> Note: The user may modify the number of subbasin outlets manually or by importing a database (.dbf) table containing outlet location coordinates. Points added via the table or manually will be snapped to the closest point on the delineated stream channels.

10. A table of locations where nutrient data was collected has been included in the example 1 data set. To load the table, first verify that the **Subbasin Outlet** radio button is selected in the **Outlet and Inlet Definition** section of the **Watershed Delineation** form. Then click file browse button next to the text box labeled **Add by Table** on the **Watershed Delineation** dialog box (Figure 16.11).

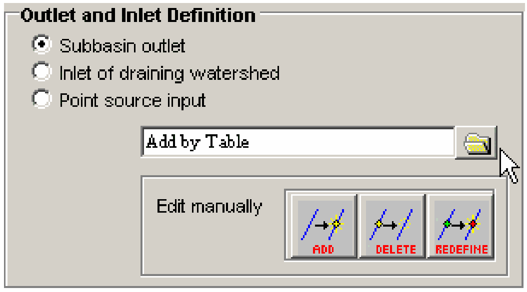


Figure16.11

11. A browser will be displayed (Figure 16.12).

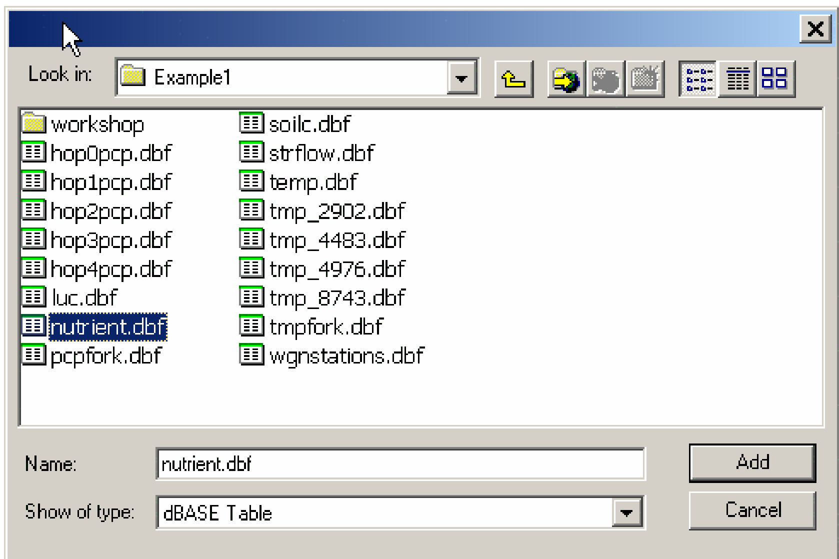


Figure 16.12

Select nutrient.dbf from the list of tables and click **OK**. The subbasin outlet locations loaded from the table are displayed as white dots (Figure 16.13).

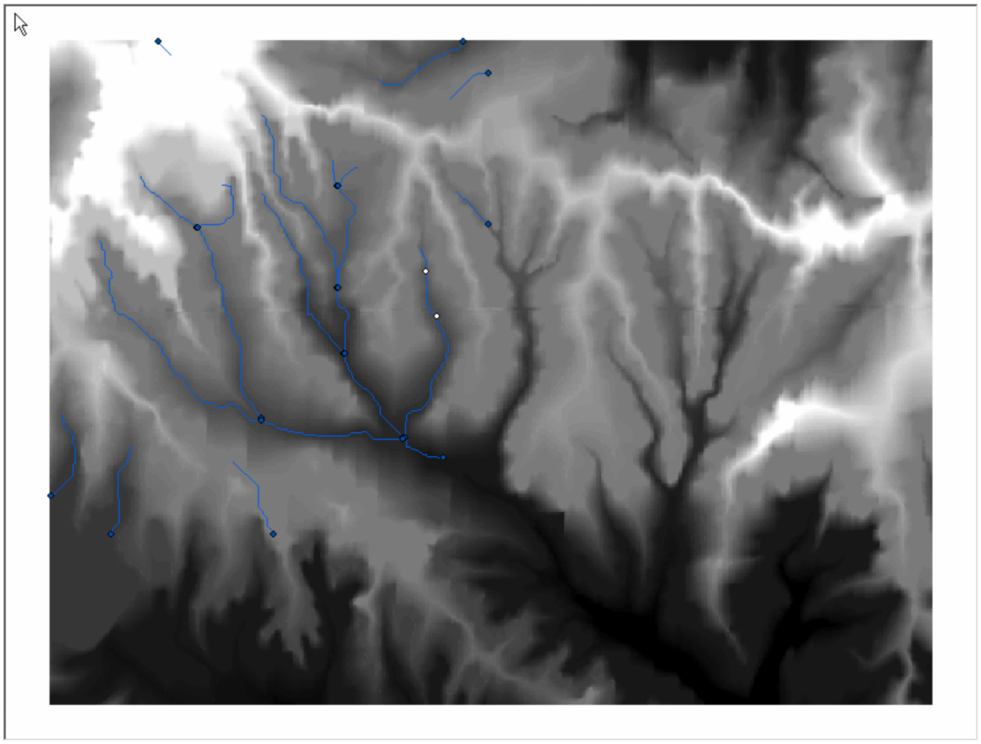


Figure 16.13

12. To manually add subbasin outlets, first verify that the Subbasin Outlet radio button is selected. Then click the button labeled Add (Figure 16.14)

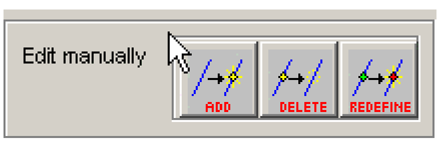


Figure 16.14

13. The dialog box will be minimized. Use the mouse to move around the map and click with the left mouse button to place a subbasin outlet where the mouse is positioned. Subbasin outlets added manually will be displayed as red dots. Add four outlets so that the map looks similar to Figure 16.15

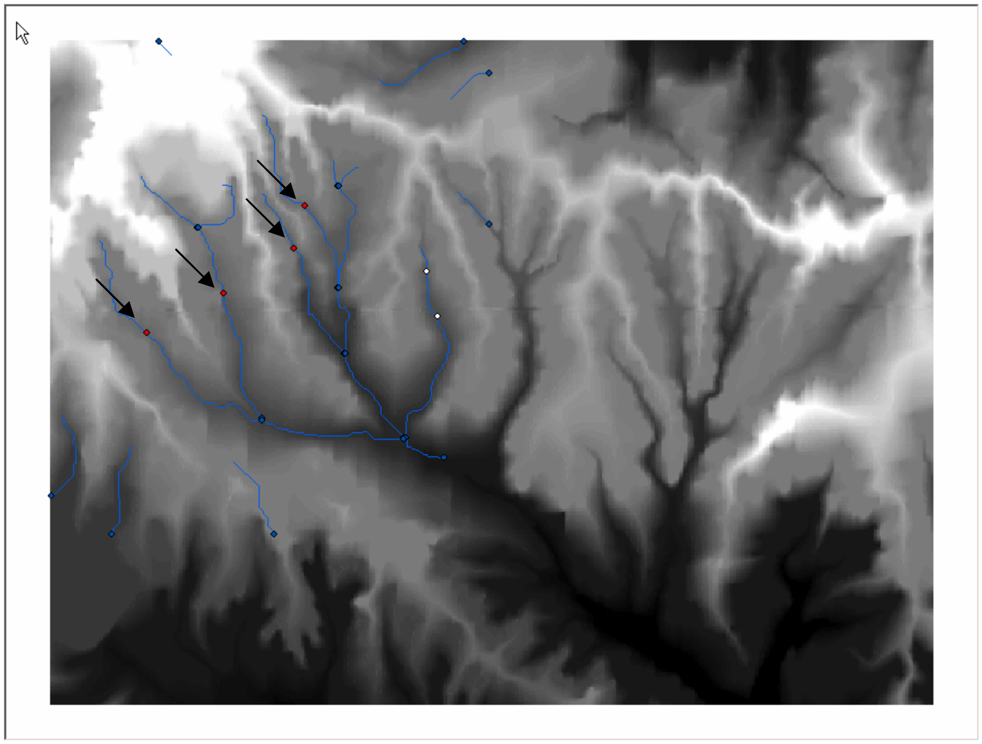


Figure 16.15

14. Once the display of subbasin outlets is satisfactory, the watershed outlet must be selected. Click the Whole watershed outlet(s) button (Figure 16.16).

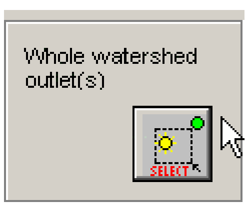


Figure 16.16

15. The dialog box will be minimized. Select the subbasin outlet located on the lower right (Figure 16.17) to be the subbasin outlet by holding down the left mouse button and moving the mouse to form a box around the outlet dot. The outlet dot will turn blue when it is selected and a prompt box will appear indicating that outlets were selected (Figure 16.18).

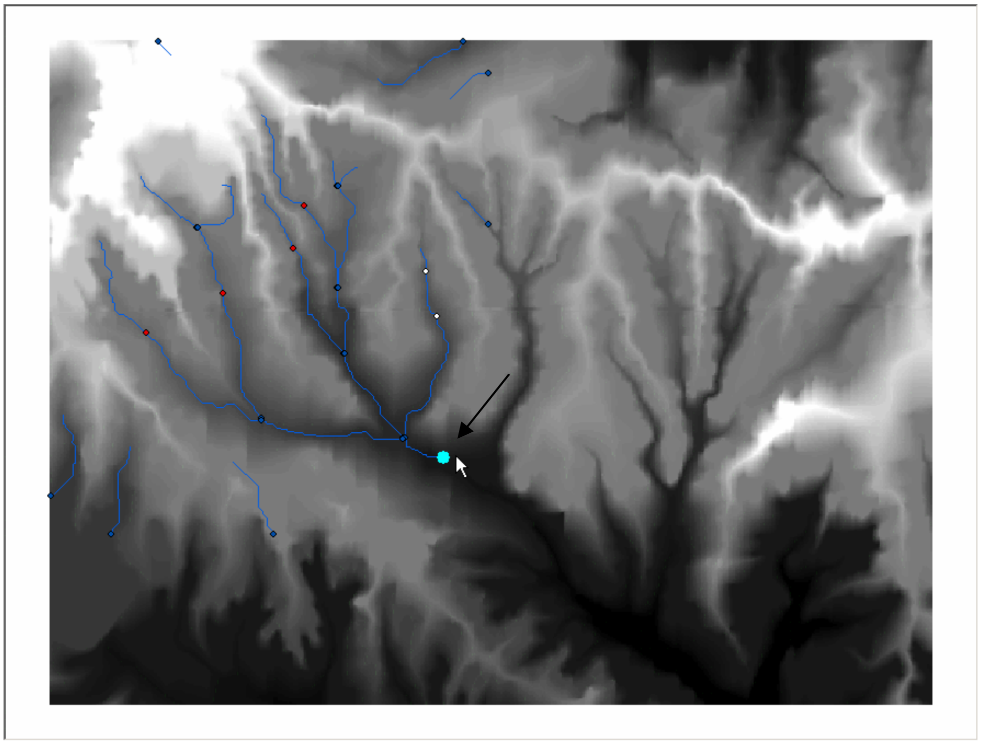


Figure 16.17

Figure 16.18

16. Click the Delineate watershed button if the outlet selected was correct (Figure 16.19). The watershed delineation process will proceed.

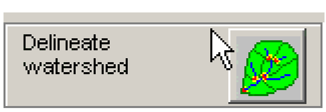


Figure 16.19

17. The subbasin delineation for the watershed will be displayed when processing has completed (Figure 16.20).

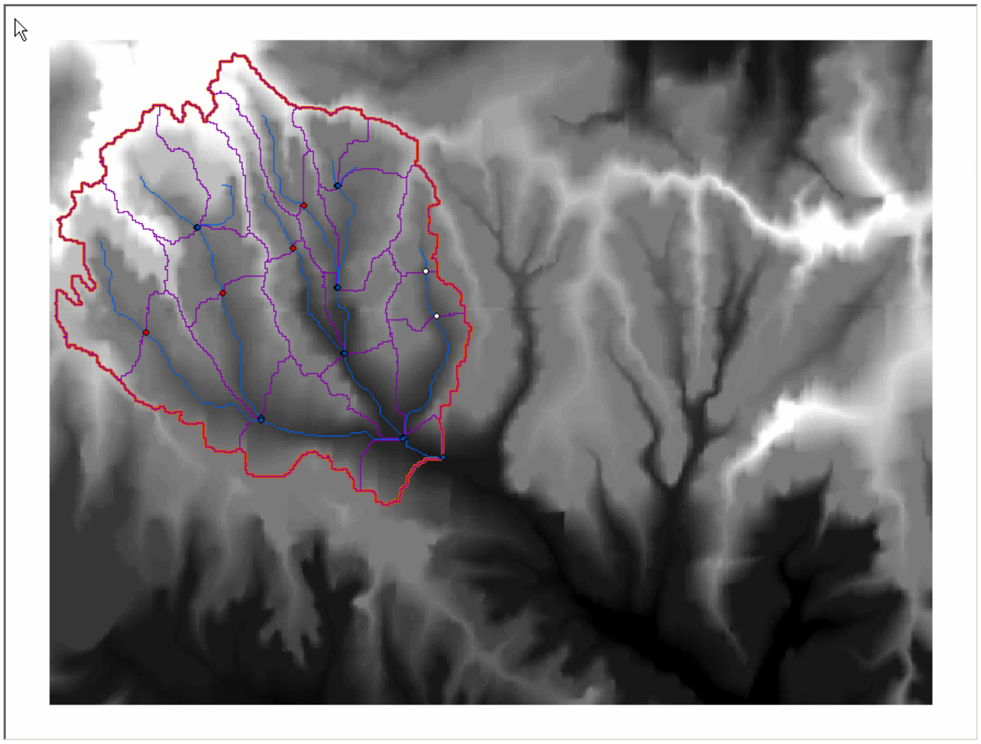


Figure 16.20

18. Click the **Calculate subbasin parameters** button to calculate the subbasin and reach parameters.

19. Once the calculation of subbasin parameters is complete, a prompt box will appear. Click OK. Watershed delineation is completed.

SECTION 16.1.2: HRU ANALYSIS

1. Select **Land Use/Soils/Slope Definition** in the **HRU Analysis** menu.

2. The **Land Use/Soils/Slope** Definition dialog box will open (Figure 16.21)

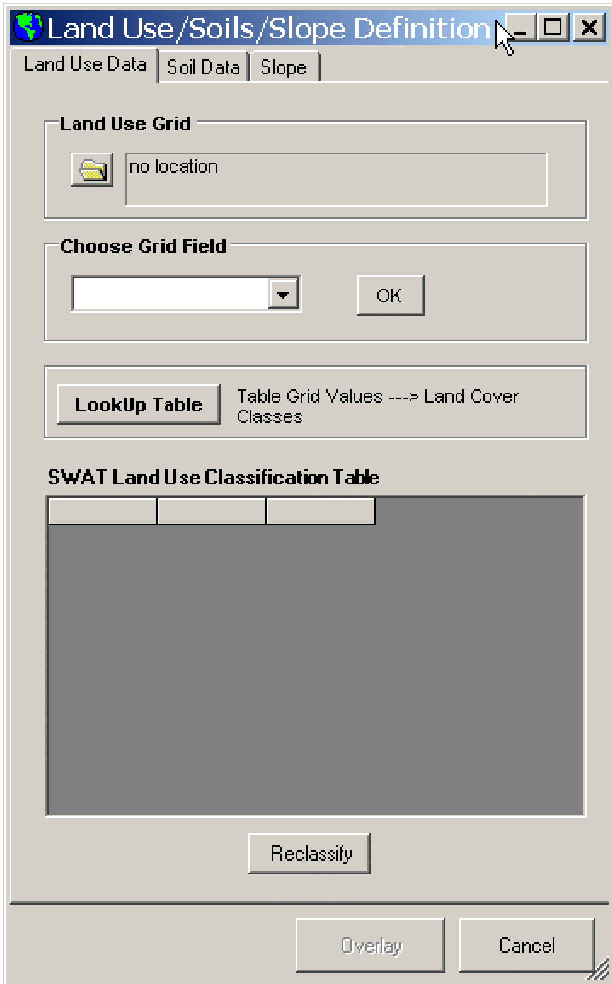


Figure 16.21

3. To load the example land use grid, click the file browse button in the **Land Use Grid** section .

4. A prompt box will appear (Figure 16.22).

Figure 16.22

Select **Load Land Use dataset (s) from disk** and click **Open**.

5. A message box will appear reminding the user that the data must be projected. Click **Yes**.

6. A browser will appear with the User Data directory active. Click the name of the land use map grid “landuse”. Click **Select** to confirm the choice. Several information messages will appear indicating the overlap area of the land use dataset.

7. The raw land use grid will be displayed and clipped to the watershed area (Figure 16.23).

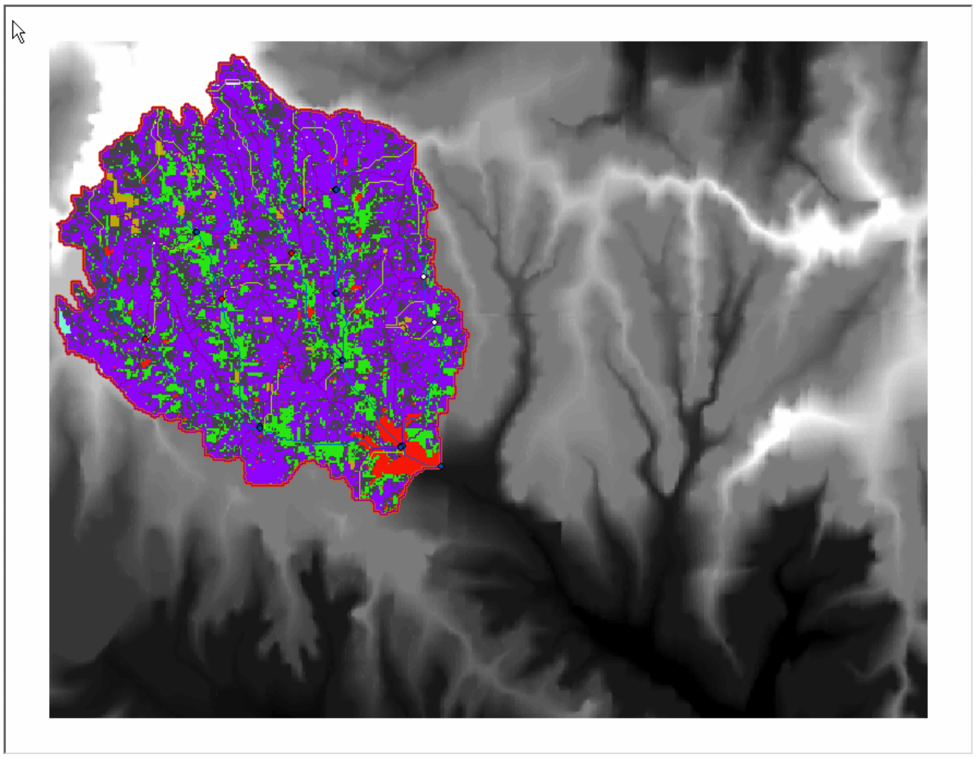


Figure 16.23

8. When the land use map grid is loaded, the interface does not know which SWAT land use code to assign to the different categories. Three options for loading this information are described in Section 6.

9. Under the **Choose Grid Field** combo box, choose “value”, and then click **OK**.

10. Click the **Lookup Table** button to load a land use lookup table. The example data set includes a custom look up table to define the SWAT land uses to be modeled for each category. A prompt box will be displayed for the user to select the type of table to be loaded. Highlight **User table** and click **OK** (Figure 16.24).

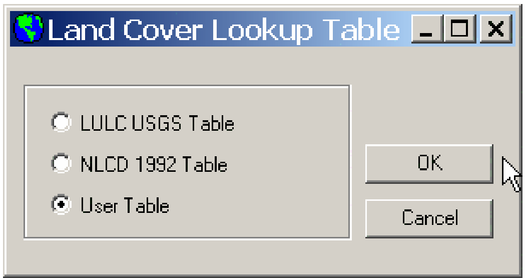


Figure 16.24

11. A browser will be displayed. Click the name of the look up table (luc.dbf). Once the correct table is selected, click **Select**.

12. The SWAT land use categories will be displayed in the **SWAT Land Use Classification Table**. Once a *LandUseSwat* code has been assigned to all map categories, the **Reclassify** button will be enabled. Click the **Reclassify** button.

13. The category display for the map will show the SWAT land use codes (Figure 16.25).

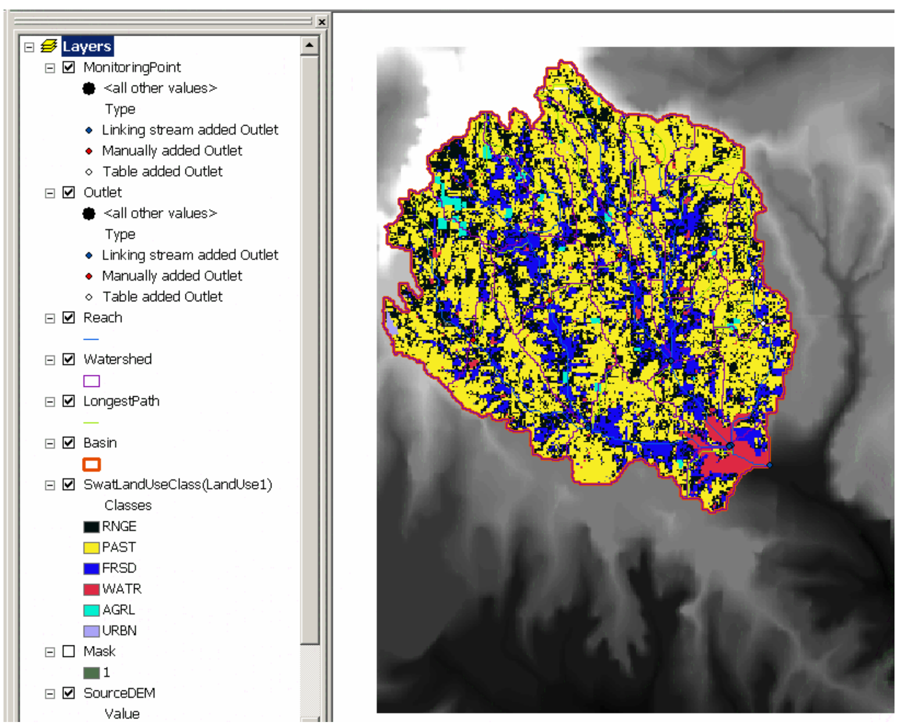


Figure 16.25

14. To load the example soil grid, move to the **Soil Data** tab on the **Land Use/Soils/Slope Definition** form and click the file browse button in the **Soils Grid** section.

15. A prompt box will appear (Figure 16.26).

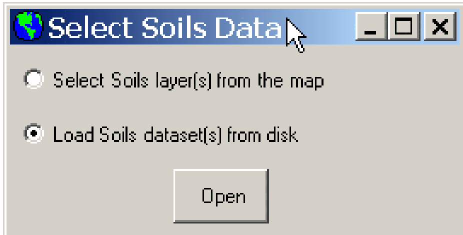


Figure 16.26

Select **Load Soils dataset (s) from disk** and click **Open**.

16. A message box will appear reminding the user that the data must be projected. Click **Yes**.

17. A browser will appear with the User Data directory active. Click the name of the soils grid "soil". Click **Select** to confirm the choice. Several information messages will appear indicating the overlap area of the soils dataset.

18. The raw soil grid will be displayed and clipped to the watershed area (Figure 16.27).

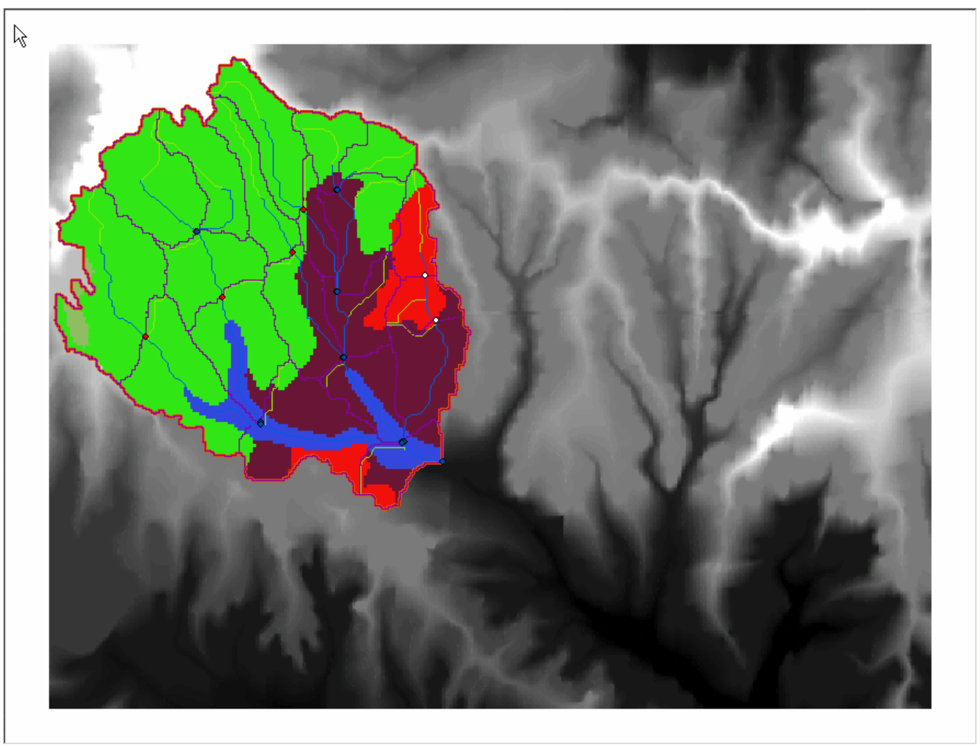


Figure 16.27

19. Under the Choose Grid Field combo box, choose "value", and then click **OK**.

20. Five options for linking the soil map grid to the soil database are described in Section 6. The example data set is set up to link via STATSGO polygon numbers. On the **Land Use/Soil/Slope Definition** dialog box, select the **Stmuid** option for linking the soil grid to the soil database. Then click the **Lookup Table** button.

21. A browser will be displayed. Click the name of the look up table (soilc.dbf). Once the correct table is selected, click **Select**.

22. The soil linkage information will be displayed in the **SWAT Soil Classification Table** Once a *Stmuid* code has been assigned to all map categories, the **Reclassify** button will be enabled. Click the **Reclassify** button.

23. The category display for the map will show the soil codes (Figure 16.28).

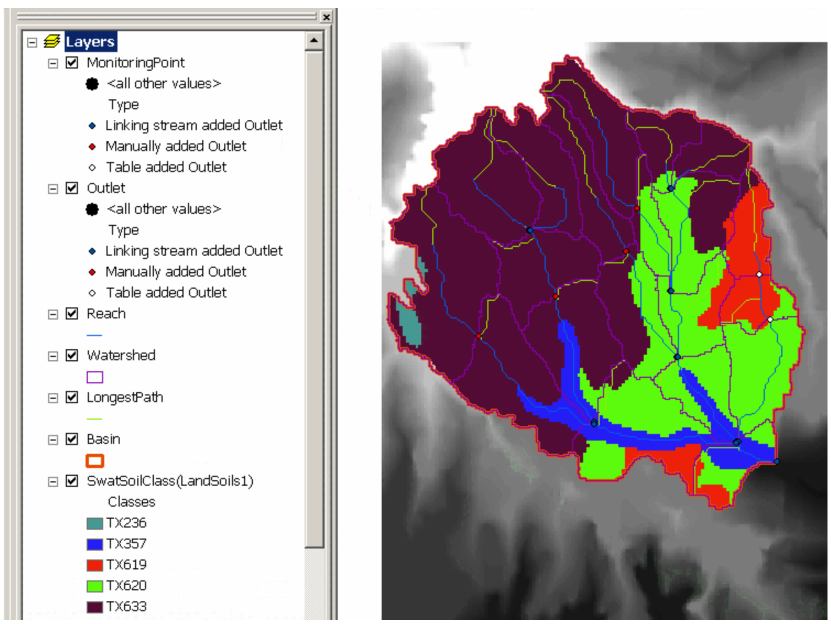


Figure 16.28

24. To load theslope grid, move to the **Slope** tab on the **Land Use/Soils/Slope Definition** form.

25. Click the **Multiple Slope** option to reclassify the slope grid into multiple slope classifications.

26. Choose 2 slope classes under **the Number of Slope Classes** combo box.

27. Set the upper limit of “slope class 1” to be 1%. By default, the upper limit of the “slope class 2” will be 9999% (Figure 16.29).

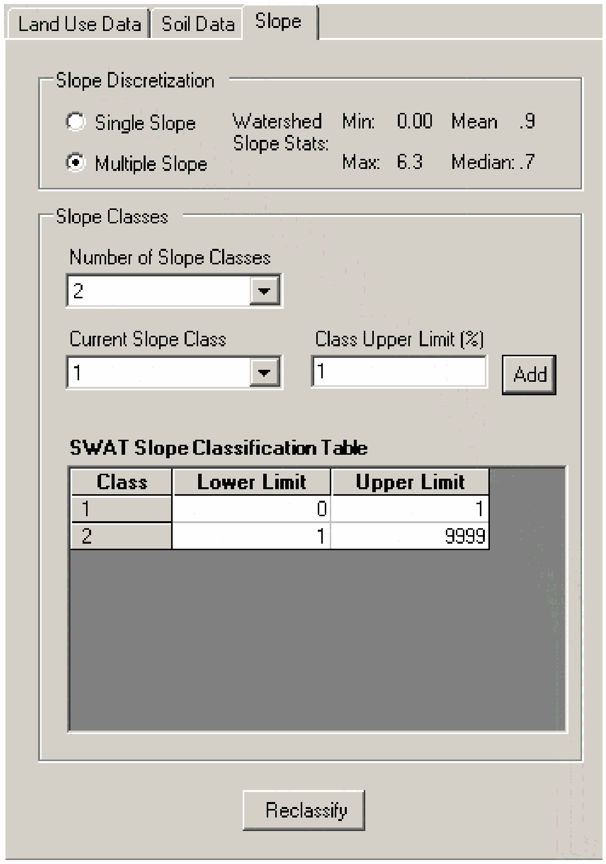


Figure 16.29

28. Click the **Reclassify** button.

29. The slope map for the watershed with the slope classifications will be displayed (Figure 16.30).

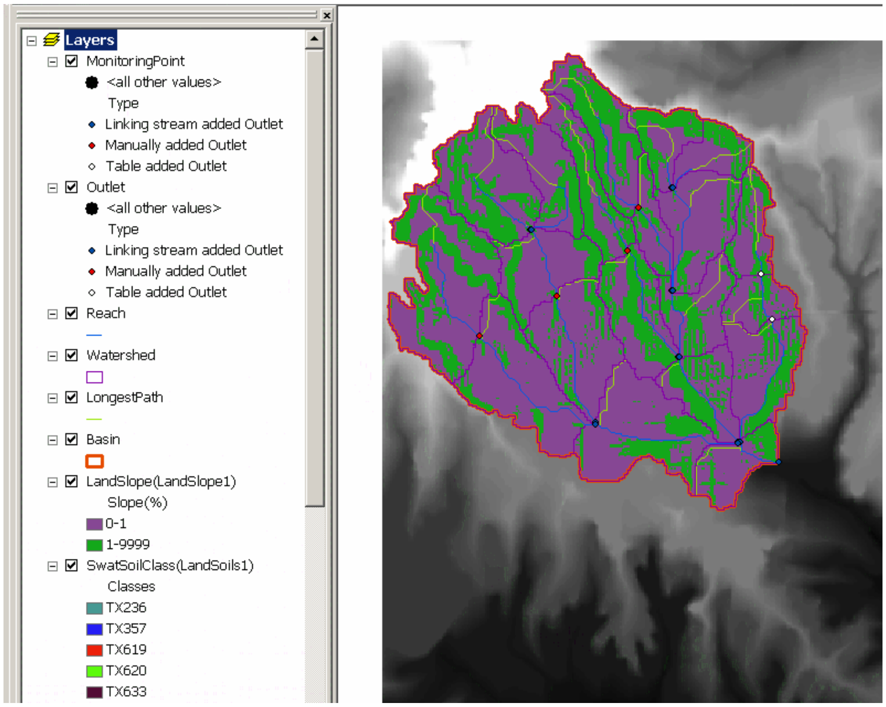


Figure 16.30

30. Once the land use, soil, and slope datasets have been loaded and reclassified, click the button labeled Overlay at the bottom of the **Land Use/Soil/Slope Definition** dialog box.

31. When the overlay of the land use, soil, and slope grids is complete, a prompt box will notifying the user that the overlay process is complete. Click **OK**.

32. A report is generated during the overlay process. To access the report, select **HRU Analysis Reports** under the **HRU Analysis** menu. From the list of reports, select *LandUse, Soils, Slope Distribution* and click **OK**.

33. Close the report after viewing.

SECTION 16.1.3: HRU DEFINITION

1. Select **HRU Definition** from the **HRU Analysis** menu.

2. The **HRU Definition** dialog box will be displayed (Figure 16.31).

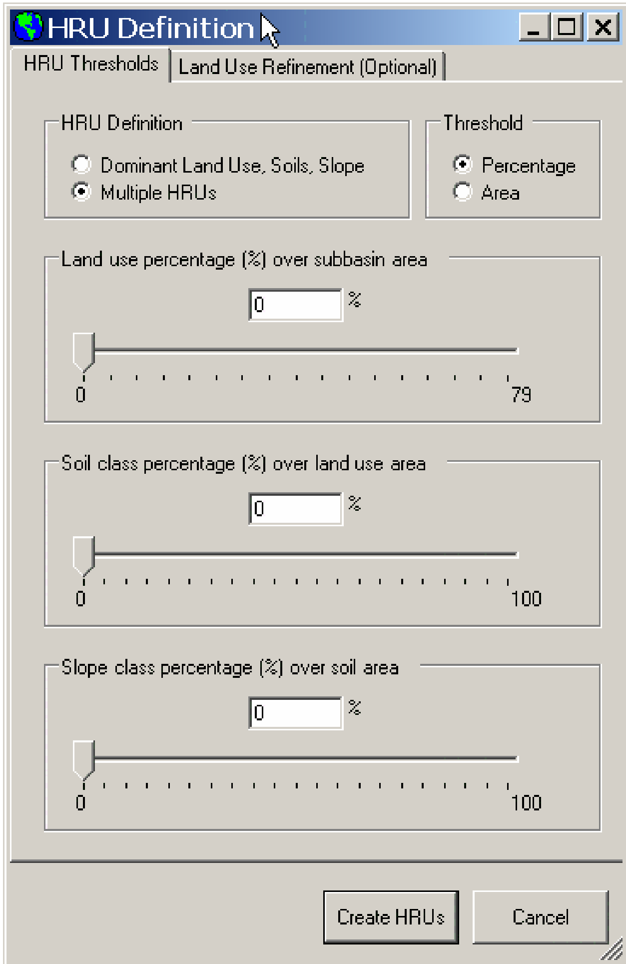


Figure 16.31

Select **Multiple HRUs**.

3. Set the **Land use percentage(%) over subbasin area** at 5%
4. Set the **Soil class percentage(%) over subbasin area** at 20%
5. Set the Slope **class percentage(%) over subbasin area** at 20%
6. Click **Create HRUs**.
7. A message box will be displayed notifying the user when setup of HRUs is completed. Click **OK**.
8. A report is generated during the HRU creation process. To access the report, select **HRU Analysis Reports** under the **HRU Analysis** menu. From the list of reports, select *Final HRU Distributioon* and click **OK**. The total number of HRUs created in the watershed is listed in the top section of the report in bold letters. The remainder of the report lists the land use,

subbasins.

9. Close the report after viewing.

SECTION 16.1.4: WEATHER STATIONS

1. To load the example weather data, click **Weather Stations** under the **Write Input Table** menu.

2. The **Weather Data Definition** dialog box will be displayed (Figure 16.31).

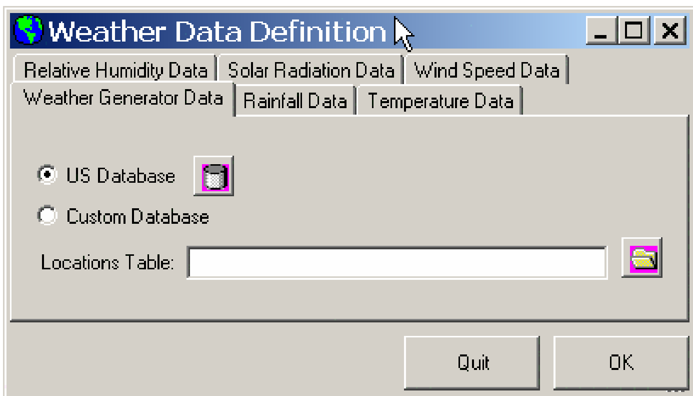


Figure 16.31

The example data set contains data files with measured precipitation and temperature for weather stations around the watershed.

3. For a SWAT simulation using measured weather data, weather simulation information is needed to fill in missing data and to generate relative humidity, solar radiation and wind speed. The example data set uses weather generator data loaded into the custom database. Click the radio button next to **Custom data base**. Next, click the file browse button next to the **Locations Table** text box. Select the name of the weather generator stations location table (*wgnstations.dbf*) from the *Example 1* data folder, and click **Add**.

4. To load the table containing the locations of the rain gage stations, click **Rainfall Data** tab of the **Weather Data Definition** dialog. Click the radio button next to **Raingages** and choose a **Precip Timestep** of “Daily”. Next, click the file browse button next to the **Locations Table** text box. Select the name of the weather generator stations location table (*pcpfprk.dbf*) from the *Example 1* data folder, and click **Add**. The path to the rain gage station file appears in the text box (Figure 16.32).

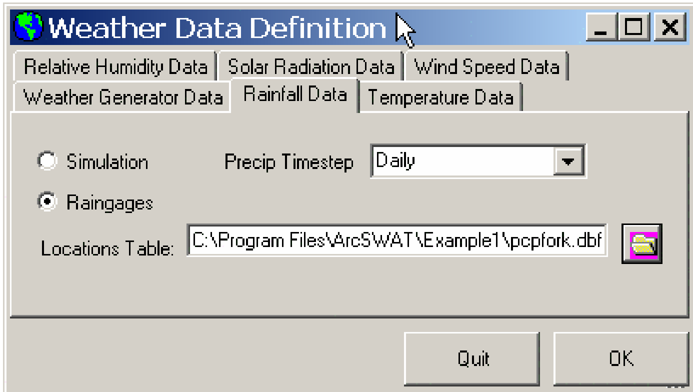


Figure 16.32

5. To load the table containing the locations of the rain gage stations, click **Temperature Data** tab of the **Weather Data Definition** dialog. Click the radio button next to **Climate Stations**. Next, click the file browse button next to the **Locations Table** text box. Select the name of the weather generator stations location table *(tmpfprk.dbf*) from the *Example 1* data folder, and click **Add**. The path to the climate station file appears in the text box (Figure 16.33).

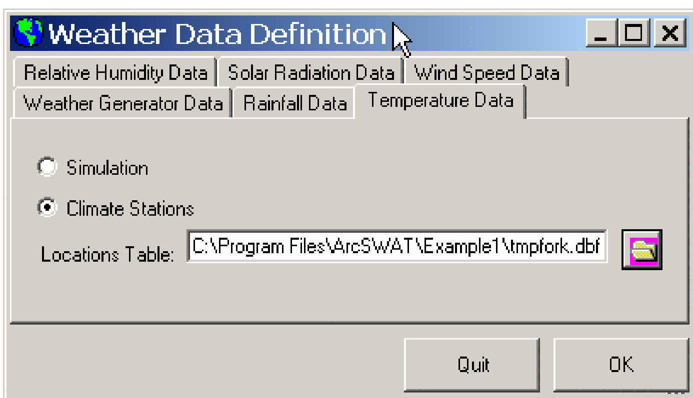


Figure 16.33

6. The weather data time series for relative humidity, solar radiation, and wind speed will be simulated by the weather generator, so defining station files for these4 parameters will not be necessary in this example

7. To generate spatial layers of the weather stations, and load the observed weather data into SWAT weather files, click the **OK** button at the bottom of the **Weather Data Definition** dialog. The interface will also assign the different weather station data sets to the subbasins in the watershed.

8. A prompt box will appear when processing of the weather data is complete. Click **OK**.

SECTION 16.1.5: CREATE ARCVIEW DATABASES AND SWAT INPUT FILES

1. On the **Write Input Tables** menu, click **Write All**. This creates the ArcSWAT databases and SWAT input files containing default settings for SWAT input.

2. When the interface reaches the point where general subbasin data is compiled, a prompt box will appear asking the user of the default Manning's n value of 0.014 for overland flow should be changed. Click **No**.

3. When the interface reaches the point where main channel data is compiled, a prompt box will appear asking the user of the default Manning's n value of 0.014 for channel flow should be changed. Click **No**.

4. When the interface reaches the point where management data is compiled, a prompt box will appear asking if plant heat units should be estimated or set to a default value. Click **Yes** to estimate.

5. A message box will be displayed upon completion of the SWAT input database initialization. Click **OK**.

SECTION 16.1.6: RUN SWAT

1. On the **SWAT Simulation** menu, click **Run SWAT.**

2. A dialog box will be brought up (Figure 15.42).

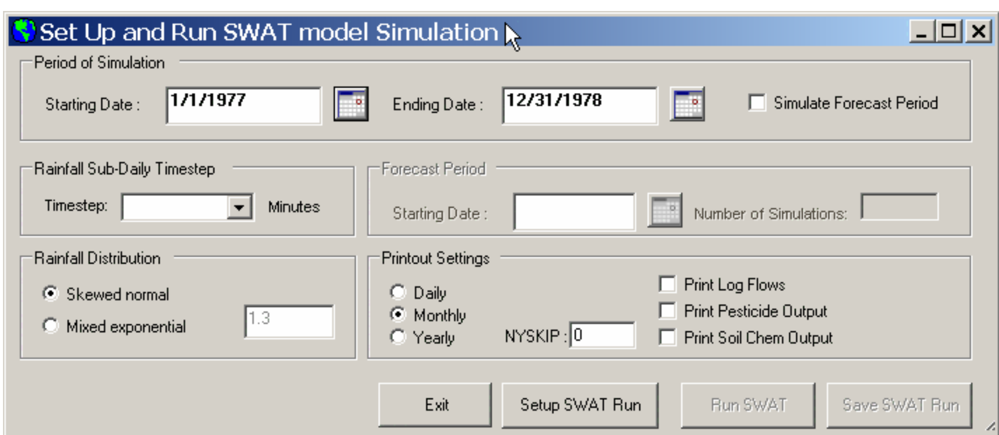


Figure 15.34

3. The initial and final day of simulation are set to the first and last days of measured weather data. Leave those values set to 1/1/1977 and 12/31/1978. Set the **Printout Settings** to **Monthly** frequency. Leave all other settings as is.

4. Click the button labeled **Setup SWAT Run** to build master watershed control file and write point source, inlet and reservoir files. A prompt will indicate when setup is complete.

5. Click the **Run SWAT** button.

6. When the SWAT run is finished, a message box will be displayed noting that the simulation was successfully completed. Click **OK**.

7. To save the simulation you just ran, click the **Save SWAT Run** button. You will prompted to enter a name for your simulation. Name your simulation *First_SWAT_Run* and click **OK**. You will receive a prompt if the simulation is saved properly. The simulation will now be saved in a folder called *First_SWAT_Run* under the *lakefork\Scenarios\ folder*.

SECTION 16.1.7: VIEW RESULTS

All SWAT output files will be written to the *lakefork\Scenarios\First_SWAT_RUN\TxtInOut* folder. The output files are described in the *Soil and Water Assessment Tool User's Manual, Version 2005*, Chapter 32. These ascii files maybe be loaded into spreadsheet or database files (e.g., Excel or Access) for analysis, or may be viewed and analyzed using the **VIZSWAT** SWAT output analysis toolset. For more information on VIZWAT, please visit the SWAT web site at, http://www.brc.tamus.edu/swat/.

APPENDIX 1: ARCSWAT PROJECT DATABASE SPATIAL DATABASE AND TABLES

This appendix describes the spatial data and tables found in the SWAT Project geodatabase ("ProjectName.mdb") created by the ArcSWAT interface. The datasets and table described are those that remain as permanent datasets when a SWAT project is completed. There are several temporary datasets created during the project development process that are not described in this section. Spatial dataset attributes are described for those datasets with attributes other than the obligatory unique object ID, shape field, shape area and shape length. The datasets and tables are listed alphabetically, beginning with the spatial datasets.

Spatial Data

ArcHydro\Basin: This feature class contains a single polygon that represents the entire basin being modeled. It is a composition of all the subbasins in the model.

Field Name	Field Type	Definition
N/A	N/A	N/A

ArcHydro\LongestPath: This feature class contains polylines representing the longest flow path within each subbasin.

Field Name	Field Type	Definition
ARCID	integer	Unique longest path feature ID
GRID_CODE	Integer	The grid code of a longest path polyline refers to the GRID_CODE of the subbasin that the longest oath refers to
FROM_NODE	Integer	The from node of the polyline
TO_NODE	integer	The to node of the polyline

ArcHydro\MonitoringPoint: This feature class contains points representing all monitoring points within the watershed. Monitoring points include ALL point features: outlets, inlets, point sources, reservoirs, and weather gages.

Field Name	Field Type	Definition
POINTID	integer	Unique longest path feature ID
GRID_CODE	Integer	The grid code of the monitoring point and refers to the GRID_CODE of the subbasin that the monitoring point relates to
XPR	Integer	Latitude in projected units
YPR	integer	Longitude in projected units
Lat	Double	Latitude in geographic units
Long_	Double	Longitude in geographic units
Elev	Double	Elevation of point (required for precip and temp gages)
Name	Text	Name of monitoring point (required only for weather stations)
Type	Text	Type of monitoring point: L = linking stream outlet T = Manually added outlet O = Table added outlet W = Manually added inlet I = Table added inlet P = Manually added point source D = Table added point source R = Reservoir RNG = Precipitation gage TMPG = Temperature gage SLRG = Solar gage WNDG = Wind gage RLHG = Humidity gage
Subbasin	Integer	Subbasin the monitoring point refers to (required for outlets, inlets, point sources and reservoirs)
HydroID	Integer	The hydo ID of the monitoring point (a unique ID required for all points)
OutletID	Integer	The outlet Id of the monitoring point (a unique ID required for all outlets, inlets, point sources and reservoirs)

ArcHydro\Inland: This feature class contains polygons representing draining inland areas.

Field Name	Field Type	Definition
GRID_CODE	Integer	The grid code of the inland area

ArcHydro\Outlet: This feature class contains points representing the outlets and inlets from the monitoring points feature class.

Field Name	Field	Definition

	Type	
POINTID	integer	Unique longest path feature ID
GRID_CODE	Integer	The grid code of the outlet point and refers to the GRID_CODE of the subbasin that the outlet point relates to
XPR	Integer	Latitude in projected units
YPR	integer	Longitude in projected units
Lat	Double	Latitude in geographic units
Long_	Double	Longitude in geographic units
Elev	Double	Elevation of point
Name	Text	Name of monitoring point (required only for weather stations)
Type	Text	Type of outlet point: L = linking stream outlet T = Manually added outlet O = Table added outlet W = Manually added inlet I = Table added inlet
HydroID	Integer	The hydo ID of the outlet point

ArcHydro\Reach: This feature class contains polylines representing the reaches associated with each subbasin.

Field Name	Field Type	Definition
ARCID	integer	Unique reach feature ID
GRID_CODE	Integer	The grid code of a reach polyline refers to the GRID_CODE of the subbasin that the reach belongs to
FROM_NODE	Integer	The from node of the polyline
TO_NODE	integer	The to node of the polyline
Subbasin	Integer	The subbasin grid code that the reach begins in
SubbasinR	integer	The subbasin grid code that the reach drains to
AreaC	Double	Cumulated drainage area [hectares]
Len2	Double	Stream reach length [meters]
Slo2	Double	Stream reach slope [%]
Wid2	Double	Stream reach width [meters]
Dep2	Double	Stream reach depth [meters]
MinEl	Double	Minimum elevation of the stream reach [meters]
MaxEl	Double	Maximum elevation of the stream reach [meters]

ArcHydro\Watershed: This feature class contains polygons representing all the subbasins within the watershed.

Field Name	Field Type	Definition

GRID_CODE	Integer	The grid code of the subbasin
Subbasin	Integer	The grid code of the subbasin
Area	Double	Subbasin area [hectares]
Slo1	Double	Subbasin slope [%]
Len1	Double	Longest path within the subbasin [meters]
Sll	Double	Field slope length [meters]
Csl	Double	Subbasin tributary reach slope [%]
Wid1	Double	Subbasin tributary reach width [meters]
Dep1	Double	Subbasin tributary reach depth [meters]
Lat	Double	Latitude of the subbasin centroid
Long_	Double	Longitude of the subbasin centroid
Elev	Double	Elevation of the subbasin centroid [meters]
ElevMin	Double	Min elevation in the subbasin
ElevMax	Double	Max elevation in the subbasin
BName	Text	String available for labeling the theme

FullHRU: This feature class contains polygons representing all the HRUs within the watershed. These are the HRU polygons created immediately after the overlay process, prior to applying any thrsholds.

Field Name	Field Type	Definition
GRID_CODE	Integer	The grid code of the HRU
Subbasin	Integer	The grid code of the subbasin
LU_NUM	Double	ArcSWAT internal land use ID
LU_CODE	Text	The SWAT land use lookup code
SOIL_NUM	Double	ArcSWAT internal soil ID
SOIL_CODE	Text	The soil lookup code
SLOPE_NUM	Double	ArcSWAT internal slope ID
SLOPE_CODE	Text	The slope range code
MEAN_SLOPE	Double	Subbasin tributary reach depth [meters]
AREA	Double	Area of the HRU [meters2]
UNIQUECOMB	Text	Unique string for the HRU composed of a concatenation of the land use, soil, and slope text codes

Tabular Data

Bsn: Contains SWAT general watershed attribute (.bsn) input data

Field Name	Field Type	Definition
SFTMP	float	Snowfall temperature (ºC)
SMTMP	float	Snow melt base temperature (ºC)
SMFMX	float	Maximum melt rate for snow during year (mm H2O/ºC/day)
SMFMN	float	Minimum melt rate for snow during year (mm H2O/ºC/day)
TIMP	float	Snow pack temperature lag factor
SNOCOVMX	float	Minimum snow water content that corresponds to 100% snow cover (mm H2O)

SNO50COV	float	Snow water content that corresponds to 50% snow cover (mm H2O)
IPET	Integer	PET method code
ESCO	Double	Soil evaporation compensation factor.
EPCO	double	Plant uptake compensation factor.
EVLAI		Leaf area index at which no evaporation occurs from water surface.
FFCB	float	Initial soil water storage expressed as a fraction of field capacity water content
IEVENT	integer	Rainfall/runoff/routing option:
ICRK	integer	Crack flow code.
SURLAG	float	Surface runoff lag time (days)
ADJ_PKR	float	Peak rate adjustment factor for sediment routing in the subbasin
PRF	float	Peak rate adjustment factor for sediment routing in the channel
SPCON	float	Linear parameter for calculating the maximum amount of sediment that can be reentrained during channel sediment routing
SPEXP	float	Exponent parameter for calculating sediment reentrained in channel sediment routing
RCN	float	Concentration of nitrogen in rainfall (mg N/L)
CMN		Rate factor for humus mineralization of active organic nutrients
N_UPDIS	double	Nitrogen uptake distribution parameter.
P_UPDIS	double	Phosphorus uptake distribution parameter.
NPERCO	float	Nitrogen percolation coefficient
PPERCO	float	Phosphorus percolation coefficient
PHOSKD	float	Phosphorus soil partitioning coefficient
PSP		Phosphorus availability index
RSDCO	float	Residue decomposition coefficient
PERCOP		Pesticide percolation coefficient
ISUBWQ	integer	Subbasin water quality code.
WDPQ	float	Die-off factor for persistent bacteria in soil solution (day-1)
WGPQ	float	Growth factor for persistent bacteria in soil solution (day-1)
WDLPQ	float	Die-off factor for less persistent bacteria in soil solution (day-1)
WGLPQ	float	Growth factor for less persistent bacteria in soil solution (day-1)
WDPS	float	Die-off factor for persistent bacteria adsorbed to soil particles (day-1)
WGPS	float	Growth factor for persistent bacteria adsorbed to soil particles (day-1)
WDLPS	float	Die-off factor for less persistent bacteria adsorbed to soil particles (day-1)
WGLPS	float	Growth factor for less persistent bacteria adsorbed to soil particles (day-1)
BACTKDQ	float	Bacteria partition coefficient
THBACT	float	Temperature adjustment factor for bacteria die-off/growth
WOF_P	Float	Wash-off fraction for persistent bacteria.

WOF_LP	Float	Wash-off fraction for less persistent bacteria.
WDPF	Float	Die-off factor for persistent bacteria on foliage at 20°C.
WGPF	Float	Growth factor for persistent bacteria on foliage at 20°C.
WDLPF	Float	Die-off factor for less persistent bacteria on foliage at 20°C.
WGLPD	Float	Growth factor for less persistent bacteria on foliage at 20°C.
IRTE	integer	Channel water routing method:
MSK_CO1	Float	Calibration coefficient used to control impact of the storage time constant for normal flow upon Km value for reach.
MSK_CO2	Float	Calibration coefficient used to control impact of the storage time constant for low flow upon Km value for reach.
MSK_X	Float	Weighting factor that controls the relative importance of inflow and outflow in determining the storage in a reach when using the Muskingum routing method.
IDEG	Integer	Channel degradation code.
IWQ	Integer	In-stream water quality code.
TRANSRCH	Float	Fraction of transmission losses from main channel that enter deep aquifer. The remainder if the transmission losses enter bank storage.
EVRCH	Float	Reach evaporation adjustment factor
IRTPEST	Integer	Number of pesticide to be routed through the watershed
ICN	integer	Daily curve number calculation method
CNCOEFF	float	Plant ET curve number coefficient.
CDN	float	Denitrification exponential rate coefficient
SDNCO	Float	Denitrification threshold water content
BACT_SWF	Float	Fraction of manure applied to land areas that has active colony forming units
BACTMX	Float	Bacteria percolation coefficient
BACTMINLP	Float	Minimum daily bacteria loss for less persistent bacteria
BACTMINP	Float	Minimum daily bacteria loss for persistent bacteria
WDLPRCH	Float	Die-off factor for less persistent bacteria in streams (moving water) at 20°C.
WDPRCH	Float	Die-off factor for persistent bacteria in streams (moving water) at 20°C.
WDLPRES	Float	Die-off factor for less persistent bacteria in water bodies (still water) at 20°C.
WDPRES	Float	Die-off factor for persistent bacteria in water bodies (still water) at 20°C.
TB_ADJ	Float	Adjustment factor for subdaily unit

		hydrograph basetime
DEPIMP_BSN	Float	Depth to impervious layer for modeling perched water tables
DDRAIN_BSN	Float	Depth to subsurface drain
TDRAIN_BSN	Float	Time to drain soil to field capacity
GDRAIN_BSN	Float	Drain tile lag time
CN_FROZ	integer	Frozen curve number active
ISED_DET	integer	Code governing calculation of daily maximum half-hour rainfall value
ETFILE	text	Name of potential evapotranspiration input file (.pet).

Chm Contains SWAT soil chemical (.chm) input data

Field Name	Field Type	Definition
SUBBASIN	integer	Subbasin number
HRU	integer	HRU number
LANDUSE	Text	Land cover simulated in HRU
SOIL	text	Name of soil simulated in HRU
SLOPE_CD	text	Name of slope class simulated in HRU
SOL_NO31	float	Initial nitrate conc. in first soil layer (mg/kg)
SOL_NO32	float	Initial nitrate conc. in 2nd soil layer (mg/kg)
SOL_NO33	float	Initial nitrate conc. in third soil layer (mg/kg)
SOL_NO34	float	Initial nitrate conc. in fourth soil layer (mg/kg)
SOL_NO35	float	Initial nitrate conc. in fifth soil layer (mg/kg)
SOL_NO36	float	Initial nitrate conc. in sixth soil layer (mg/kg)
SOL_NO37	float	Initial nitrate conc. in 7th soil layer (mg/kg)
SOL_NO38	float	Initial nitrate conc. in 8th soil layer (mg/kg)
SOL_NO39	float	Initial nitrate conc. in ninth soil layer (mg/kg)
SOL_NO310	float	Initial nitrate in tenth soil layer (mg/kg)
SOL_ORGN1	float	Initial org N conc. in 1st soil layer (mg/kg)
SOL_ORGN2	float	Initial org N conc. in 2nd soil layer (mg/kg)
SOL_ORGN3	float	Initial org N conc. in 3rd soil layer (mg/kg)
SOL_ORGN4	float	Initial org N conc. in 4th soil layer (mg/kg)
SOL_ORGN5	float	Initial org N conc. in 5th soil layer (mg/kg)
SOL_ORGN6	float	Initial org N conc. in 6th soil layer (mg/kg)
SOL_ORGN7	float	Initial org N conc. in 7th soil layer (mg/kg)
SOL_ORGN8	float	Initial org N conc. in 8th soil layer (mg/kg)
SOL_ORGN9	float	Initial org N conc. in 9th soil layer (mg/kg)
SOL_ORGN10	float	Initial org N conc. in 10th soil layer (mg/kg)
SOL_LABP1	float	Initial soluble P conc. in 1st soil layer (mg/kg)
SOL_LABP2	float	Initial soluble P conc. in 2nd soil layer (mg/kg)
SOL_LABP3	float	Initial soluble P conc. in 3rd soil layer (mg/kg)
SOL_LABP4	float	Initial soluble P conc. in 4th soil layer (mg/kg)
SOL_LABP5	float	Initial soluble P conc. in 5th soil layer (mg/kg)
SOL_LABP6	float	Initial soluble P conc. in 6th soil layer (mg/kg)

SOL_LABP7	float	Initial soluble P conc. in 7th soil layer (mg/kg)
SOL_LABP8	float	Initial soluble P conc. in 8th soil layer (mg/kg)
SOL_LABP9	float	Initial soluble P conc. in 9th soil layer (mg/kg)
SOL_LABP10	float	Initial soluble P conc. in 10th soil layer (mg/kg)
SOL_ORGP1	float	Initial org P conc. in 1st soil layer (mg/kg)
SOL_ORGP2	float	Initial org P conc. in 2nd soil layer (mg/kg)
SOL_ORGP3	float	Initial org P conc. in 3rd soil layer (mg/kg)
SOL_ORGP4	float	Initial org P conc. in 4th soil layer (mg/kg)
SOL_ORGP5	float	Initial org P conc. in 5th soil layer (mg/kg)
SOL_ORGP6	float	Initial org P conc. in 6th soil layer (mg/kg)
SOL_ORGP7	float	Initial org P conc. in 7th soil layer (mg/kg)
SOL_ORGP8	float	Initial org P conc. in 8th soil layer (mg/kg)
SOL_ORGP9	float	Initial org P conc. in 9th soil layer (mg/kg)
SOL_ORGP10	float	Initial org P conc. in 10th soil layer (mg/kg)
PESTNAME1	text	Name of pesticide #1
PESTNAME2	text	Name of pesticide #2
PESTNAME3	text	Name of pesticide #3
PESTNAME4	text	Name of pesticide #4
PESTNAME5	text	Name of pesticide #5
PESTNAME6	text	Name of pesticide #6
PESTNAME7	text	Name of pesticide #7
PESTNAME8	text	Name of pesticide #8
PESTNAME9	text	Name of pesticide #9
PESTNAME10	text	Name of pesticide #10
PLT_PST1	float	Initial amount of pesticide #1 on foliage (kg/ha)
PLT_PST2	float	Initial amount of pesticide #2 on foliage (kg/ha)
PLT_PST3	float	Initial amount of pesticide #3 on foliage (kg/ha)
PLT_PST4	float	Initial amount of pesticide #4 on foliage (kg/ha)
PLT_PST5	float	Initial amount of pesticide #5 on foliage (kg/ha)
PLT_PST6	float	Initial amount of pesticide #6 on foliage (kg/ha)
PLT_PST7	float	Initial amount of pesticide #7 on foliage (kg/ha)
PLT_PST8	float	Initial amount of pesticide #8 on foliage (kg/ha)
PLT_PST9	float	Initial amount of pesticide #9 on foliage (kg/ha)
PLT_PST10	float	Initial amount of pesticide #10 on foliage (kg/ha)
SOL_PST1	float	Initial amount of pesticide #1 in soil (kg/ha)
SOL_PST2	float	Initial amount of pesticide #2 in soil (kg/ha)
SOL_PST3	float	Initial amount of pesticide #3 in soil (kg/ha)

SOL_PST4	float	Initial amount of pesticide #4 in soil (kg/ha)
SOL_PST5	float	Initial amount of pesticide #5 in soil (kg/ha)
SOL_PST6	float	Initial amount of pesticide #6 in soil (kg/ha)
SOL_PST7	float	Initial amount of pesticide #7 in soil (kg/ha)
SOL_PST8	float	Initial amount of pesticide #8 in soil (kg/ha)
SOL_PST9	float	Initial amount of pesticide #9 in soil (kg/ha)
SOL_PST10	float	Initial amount of pesticide #10 in soil (kg/ha)
PST_ENR1	float	Enrichment ratio for pesticide #1 in soil
PST_ENR2	float	Enrichment ratio for pesticide #2 in soil
PST_ENR3	float	Enrichment ratio for pesticide #3 in soil
PST_ENR4	float	Enrichment ratio for pesticide #4 in soil
PST_ENR5	float	Enrichment ratio for pesticide #5 in soil
PST_ENR6	Float	Enrichment ratio for pesticide #6 in soil
PST_ENR7	Float	Enrichment ratio for pesticide #7 in soil
PST_ENR8	Float	Enrichment ratio for pesticide #8 in soil
PST_ENR9	Float	Enrichment ratio for pesticide #9 in soil
PST_ENR10	Float	Enrichment ratio for pesticide #10 in soil

Cio: Contains SWAT master watershed control code (.cio) file data

Field Name	**Field Type**	**Definition**
NBYR	integer	Number of calendar years simulated
IYR	integer	Beginning year of simulation
IDAF	integer	Beginning julian day of simulation
IDAL	integer	Ending julian day of simulation
IGEN	float	Random generator seed code.
PCPSIM	integer	Rainfall input code. This variable identifies the method the model will use to process rainfall data. There are two options: 1 gage read for each subbasin 2 gage simulated for each subbasin
IDT	integer	Time step for sub-daily rainfall data
IDIST	integer	Rainfall distribution code: 0 skewed distribution 1 mixed exponential distribution
REXP	Float	Value of exponent for mixed exponential distribution (IDIST = 1)
NRGAGE	integer	Number of precipitation gage (.pcp) files used in the simulation
NRTOT	integer	Total number of precipitation gage records used in the simulation
NRGFIL	integer	Number of precipitation gage records within each .pcp file.
TMPSIM	integer	Temperature input code. This variable identifies the method the model will use to process temperature data. There are two options: 1 daily max/min read for each subbasin 2 daily max/min simulated for each subbasin
NTGAGE	integer	Number of temperature gage (.tmp) files used in the simulation.

NTTOT	integer	Total number of temperature gage records used in the simulation.
NTGFIL	integer	Number of temperature gage records within each .tmp file.
SLRSIM	integer	Solar radiation input code. This variable identifies the method the model will use to process solar radiation data. There are two options: 1 daily solar rad read for each subbasin 2 daily solar rad simulated for each subbasin
NSTOT	integer	Number of solar radiation records within the .slr file.
RHSIM	integer	Relative humidity input code. This variable identifies the method the model will use to process relative humidity data. There are two options: 1 daily values read for each subbasin 2 daily values simulated for each subbasin
NHTOT	integer	Number of relative humidity records within the .hmd file.
WNDSIM	integer	Wind speed input code. This variable identifies the method the model will use to process wind speed data. There are two options: 1 daily values read for each subbasin 2 daily values simulated for each subbasin
NWTOT	integer	Number of wind speed records within the .wnd file.
FCSTYR	Integer	Year that forecast period begins.
FCSTDAY	integer	Day that forecast period begins.
FCSTCYCLES	Integer	Number of times that the forecast period is simulated
DATES	Text	Start date of weather files
DATEF	Text	End date of weather files
FDATES	Text	Start date of forecast period
ISPROJ	Integer	Special project flag 0 not a special project 1 HUMUS dataset 2 Missouri River climate change
ICLB	Integer	Automated method flag
IPRINT	Integer	Print code. This variable governs the frequency that model results are printed to output files. There are three options: 0 monthly 1 daily 2 annually
NYSKIP	Integer	Number of years to not print output
IPRN	Integer	Print code for .std file. There are two options: 0 entire .std file is printed 1 condensed version of .std file is printed
ILOG	Integer	Streamflow print code. There are two

		options: 0 print streamflow in .rch file 1 print log of streamflow in .rch file
IPRP	Integer	Print code for .pso file. There are two options: 0 do not print pesticide output 1 print pesticide output
IPRS	Integer	Print code for soil chemical files

GageDates: This table contains the first and last dates of observed weather files. It is used to determine the common overlap period between the different types of weather input files.

Field Name	Field Type	Definition
Type	Text	Type of weather time series: RNG = Precipitation gage TMPG = Temperature gage SLRG = Solar gage WNDG = Wind gage RLHG = Humidity gage
MinDate	Date	Minimum common date of time series type
MaxDate	Date	Maximum common date for time series type

Gw: Contains SWAT groundwater (.gw) input data

Field Name	Field Type	Definition
SUBBASIN	integer	SUBBASIN NUMBER
HRU	Float	HRU number
LANDUSE	Text	Land cover simulated in HRU
SOIL	Text	Name of soil simulated in HRU
SLOPE_CD	Text	Name of slope class simulated in HRU
SHALLST	float	Initial depth of water in the shallow aquifer (mm H2O)
DEEPST	float	Initial depth of water in the deep aquifer (mm H2O)
GW_DELAY	float	Groundwater delay (days)
ALPHA_BF	float	Baseflow alpha factor (days)
GWQMIN	float	Threshold depth of water in the shallow aquifer for return flow to occur (mm H2O)
GW_REVAP	float	Groundwater "revap" coefficient
REVAPMN	float	Threshold depth of water in the shallow aquifer for "revap" to occur (mm H2O)
RCHRG_DP	float	Deep aquifer percolation fraction
GWHT	float	Initial groundwater height (m)
GW_SPYLD	float	Specific yield of the shallow aquifer (m3/m3)
SHALLST_N	Float	Nitrate concentration in shallow aquifer (mg/L)
GWSOLP	float	Soluble P concentration in baseflow (mg/L)
HLIFW_NGW	Float	Half-life of nitrate in shallow groundwater (days)

Hru: Contains SWAT HRU general (.hru) input data

Field Name	Field Type	Definition
SUBBASIN	integer	SUBBASIN NUMBER
HRU	Float	HRU number
LANDUSE	Text	Land cover simulated in HRU
SOIL	Text	Name of soil simulated in HRU
SLOPE_CD	Text	Name of slope class simulated in HRU
HRU_FR	Float	Fraction of total watershed area in HRU
SLSUBBSN	Float	Average slope length (m)
HRU_SLOPE	Float	Average slope steepness (m/m)
OV_N	Float	Manning's "n" value for overland flow
LAT_TTIME	Float	Lateral flow travel time (days)
LAT_SED	Float	Sediment conc in lateral and groundwater flow (mg/L)
SLSOIL	Float	Slope length for lateral flow (m)
CANMX	Float	Maximum canopy storage (mm H2O)
ESCO	Float	Soil evaporation compensation factor
EPCO	Float	Plant uptake compensation factor
RSDIN	Float	Initial residue cover (kg/ha)
ERORGN	Float	Organic N enrichment ratio
ERORGP	Float	Organic P enrichment ratio
POT_FR	Float	Fraction of HRU area that drains into the pothole
FLD_FR	Float	Fraction of HRU area that drains into the flood plain
RIP_F	Float	Fraction of HRU area that drains into the riparian area
POT_TILE	Float	Average daily outflow to main channel from tile flow (m3/s)
POT_VOLX	Float	Maximum volume of water stored in the pothole (104 m3)
POT_VOL	Float	Initial volume of water stored in the pothole (104 m3)
POT_NSED	Float	Equilibrium sediment concentration in pothole (mg/L)
POT_NO3L	Float	Not currently active. Nitrate removal rate in pothole (1/day).
DEP_IMP	integer	Depth to impervious layer in soil profile (mm)

hrus: This table contains records of all the HRUs within the watershed, after area thresholds have been applied and the. These represent all the HRUs that will be modeled.

Field Name	Field Type	Definition
Subbasin	Integer	The grid code of the subbasin
ARSUB	float	The area of the subbasin (hectares)
LANDUSE	text	The SWAT land use lookup code
ARLU	Float	The area of the land use within the subbasin (hectares)
SOIL	Text	The soil lookup code

ARSO	float	The area of the soil within the land use, within the subbasin (hectares)
SLP	Text	The slope range code
ARSLP	Float	The area of the slope within the soil within the land use, within the subbasin (hectares)
SLOPE	Float	The mean slope within the HRU
UNIQUECOMB	text	Unique string for the HRU composed of a concatenation of the land use, soil, and slope text codes
HRU_ID	integer	SWAT HRU ID

LuExempt: This table contains records of the SWAT land use classes that have been designated as being exempt from the area thresholds defined during HRU delineation.

Field Name	**Field Type**	**Definition**
LANDUSE	text	The SWAT land use lookup code for the land use that is exempt of the land use area threshold during HRU delineation

luso: This table contains records of the SWAT land use classes that have been designated as being exempt from the area thresholds defined during HRU delineation.

Field Name	**Field Type**	**Definition**
SUBBASIN	integer	SUBBASIN NUMBER
LANDUSE: There will exit 1 field name for each land use within the watersehed	double	The are of the land use within the subbasin

MasterProgress: This table contains information about the SWAT project, including data paths, datasets, and the steps that have been completed in the model.

Field Name	**Field Type**	**Definition**
WorkDir	Text	Full path to the SWAT project directory (does not end with a "\")
OutputGDB	Text	Name of the project geodatabase (does not include database name extension ".mdb")
RasterGDB	Text	Name of the project raster database (does not include database name extension ".mdb")
SwatGDB	Text	The full path and file name to the SWAT parameter geodatabase
WshdGrid	Text	Name of the watershed grid within the project raster geodatabase
ClipDemGrid	Text	Name of the clipped DEM grid within the

		project raster geodatabase
SoilOption	Text	A text string describing the option used for the soil dataset lookup table. Valid values include: “name”, “s5id”, “stmuid”, “stmuid+name”, “stmuid+seqnum”
NumLuClasses	Integer	The number of different land use classes found in the land use dataset over the extent of the watershed
DoneWSDel	integer	A flag indicating if watershed delineation if completed
DoneSoilLand	Integer	A flag indicating if land use and soils analysis is completed
DoneWeather	Integer	A flag indicating if weather analysis is completed
DoneModelSetup	integer	A flag indicating if SWAT input tables and file have been written

Mgt:Contains SWAT general management (.mgt) input data.

Field Name	**Field Type**	**Definition**
SUBBASIN	integer	SUBBASIN NUMBER
HRU	Float	HRU number
LANDUSE	Text	Land cover simulated in HRU
SOIL	Text	Name of soil simulated in HRU
SLOPE_CD	Text	Name of slope class simulated in HRU
IGRO	Integer	Land cover status code: 0 no land cover growing 1 land cover growing
PLANT_ID	Integer	Land cover identification number
LAI_INIT	float	Initial leaf area index
BIO_INIT		Initial dry weight biomass (kg/ha)
PHU_PLT	Float	Total number of heat units needed to bring plant to maturity
BIOMIX	Float	Biological mixing efficiency
CN2	Integer	Initial SCS runoff curve number for moisture condition II
USLE_P	Float	USLE equation support practice factor
BIO_MIN	Float	Minimum plant biomass for grazing (kg/ha)
FILTERW	Float	Width of edge-of-field filter strip (m)
IURBAN	Integer	Urban simulation code: 0 no urban sections in HRU 1 urban sections, simulate w/ USGS 2 urban sections, simulate w/ buildup/washoff
URBLU	Integer	Urban land type id # from urban database
IRRSC	Integer	Irrigation code: 0 no irrigation 1 divert water from reach 2 divert water from reservoir 3 divert water from shallow aquifer 4 divert water from deep aquifer 5 divert water from unlimited source

IRRNO	Integer	Irrigation source location
FLOWMIN	Float	Minimum in-stream flow for irrigation diversions (m3/s)
DIVMAX	Float	Maximum daily irrigation diversion from the reach (mm)
FLOWFR	Float	Fraction of available flow that is allowed to be applied to the HRU
DDRAIN	Float	Depth to subsurface drain (mm)
TDRAIN	Float	Time to drain soil to field capacity (hours)
GDRAIN	Float	Drain tile lag time (hours)
NROT	Integer	Number of years of rotation
HUSC	Integer	Flag if scheduling is by heat units: 1 = by date 0 = by heat units
ISCROP	Integer	Flag if land use is a growing: 1 = is a crop 0 = is not a crop

Mgt2: Contains SWAT operation specific management (.mgt) input data

Field Name	**Field Type**	**Definition**
SUBBASIN	Integer	SUBBASIN NUMBER
HRU	Float	HRU number
LANDUSE	Text	Land cover simulated in HRU
SOIL	Text	Name of soil simulated in HRU
SLOPE_CD	Text	Name of slope class simulated in HRU
CROP	Integer	Crop ID for crop grown for given year
YEAR	Integer	Rotation year
MONTH	Integer	Month operation takes place
DAY	Integer	Day operation takes place
HUSC	Float	Time operation takes place based on heat unit scheduling
MGT_OP	Integer	Management operation number 1 plant 2 irrigation 3 fertilizer 4 pesticide 5 harvest/kill 6 tillage 7 harvest 8 kill 9 grazing 10 auto irrigation 11 auto fertilization 12 sweep 13 release/impound 14 continuous fertilization
HEATUNITS	Float	Total heat units for cover/plant to reach maturity (plant)
PLANT_ID	Integer	Land cover/plant ID number from plant growth database (plant)
CURYR_MAT	Integer	Current age of trees (years)

LAI_INIT	Float	Initial leaf area index (plant)
BIO_INIT	Float	Initial dry weight biomass (kg/ha) (plant)
HI_TARG	Float	Harvest index target (plant)
BIO_TARG	Float	Biomass target (metric tons/ha) (plant)
CNOP	Float	SCS II runoff curve number (plant, harv/kill, tillage)
IRR_AMT	Float	Depth of irrigation water applied (mm) (irr)
FERT_ID	Integer	Fertilizer ID number (fert, autofert)
FRT_KG	Float	Amount of fertilizer applied (kg/ha) (fert)
FRT_SURFACE	Float	Fraction of fertilizer applied to top 10mm of soil
PEST_ID	Integer	Pesticide ID number (pest)
PST_KG	Float	Amount of pesticide applied (kg/ha) (pest)
TILLAGE_ID	Integer	Tillage implement code (till)
HARVEFF	Float	Harvest efficiency (harv)
HI_OVR	Float	Harvest index override (harv)
GRZ_DAYS	Integer	Number of consecutive days of grazing (graz)
MANURE_ID	Integer	Manure identification code from fertilizer database
BIO_EAT	Float	Dry weight of biomass consumed daily (kg/ha) (graz)
BIO_TRMP	Float	Dry weight of biomass trampled daily (kg/ha) (graz)
MANURE_KG	Float	Dry weight of manure deposited daily (kg/ha) (graz)
WSTRS_ID	Integer	Water stress identifier
AUTO_WSTR	Float	Water stress factor of cover/plant that triggers irrigation (autoirr)
AFERT_ID	Integer	Fertilizer identification number from the fertilizer database
AUTO_NSTRS	Float	Nitrogen stress factor of cover/plant that triggers fertilization (autofert)
AUTO_NAPP	Float	Maximum amount of mineral N allowed in any one application (kg N/ha) (autofert)
AUTO_NYR	Float	Maximum amount of mineral N allowed to be applied during a year (kg N/ha) (autofert)
AUTO_EFF	Float	Application efficiency (autofert)
AFRT_SURFACE	Float	Fraction of fertilizer applied to top 10mm of soil (autofert)
SWEEPEFF	Float	Removal efficiency of sweeping operation (sweep)
FR_CURB	Float	Fraction of curb length available for sweeping (sweep)
IMP_TRIG	Integer	Release/impound action code: 0 initial water impoundment 1 initiate water release
FERT_DAYS	Integer	Duration or length of period (days) the continuous fertilizer operation takes place in the HRU
CFRT_ID	Integer	Fertilizer/manure identification number from fertilizer database
IFRT_FREQ	Integer	Application frequency (days).

CFRT_KG	Float	Amount of fertilizer/manure applied to ground in each application (kg/ha)

Pnd.dbf: Contains SWAT pond/wetland (.pnd) input data

Field Name	Field Type	Definition
SUBBASIN	integer	SUBBASIN NUMBER
PND_FR	float	Fraction of subbasin area that drains into ponds
PND_PSA	float	Surface area of ponds when filled to principal spillway (ha)
PND_PVOL	float	Volume of water stored in ponds when filled to the principal spillway (104 m3 H2O)
PND_ESA	float	Surface area of ponds when filled to emergency spillway (ha)
PND_EVOL	float	Volume of water in ponds when filled to the emergency spillway (104 m3 H2O)
PND_VOL	float	Initial volume of water in ponds (104 m3 H2O)
PND_SED	float	Initial sediment concentration in pond water (mg/L)
PND_NSED	float	Normal sediment concentration in pond water (mg/L)
PND_K	float	Hydraulic conductivity through bottom of ponds (mm/hr)
IFLOD1	integer	Beginning month of non-flood season
IFLOD2	integer	Ending month of non-flood season
NDTARG	integer	Number of days needed to reach target storage from current pond storage
PSETL1	float	Phosphorus settling rate in pond during 1st period (m/year)
PSETL2	Float	Phosphorus settling rate in pond during 2nd period (m/year)
NSETL1	Float	Nitrogen settling rate in pond during 1st period (m/year)
NSETL2	Float	Nitrogen settling rate in pond during 2nd period (m/year)
CHLAP	Float	Chlorophyll a production coefficient for ponds
SECCIP	Float	Water clarity coefficient for ponds
PND_NO3	Float	Initial concentration of NO3-N in ponds (mg N/L)
PND_SOLP	Float	Initial concentration of soluble P in pond (mg P/L)
PND_ORGN	Float	Initial concentration of organic N in pond (mg N/L)
PND_ORGP	Float	Initial concentration of organic P in pond (mg P/L)
IPND1	Integer	Beginning month of 1st settling period
IPND2	Integer	Ending month of 1st settling period
WET_FR	Float	Fraction of subbasin area that drains into wetlands
WET_NSA	Float	Surface area of wetlands at normal water

		level (ha)
WET_NVOL	Float	Volume of water stored in wetlands when filled to normal water level (104 m3 H2O)
WET_MXSA	Float	Surface area of wetlands at maximum water level (ha)
WET_MXVOL	Float	Volume of water stored in wetlands when filled to maximum water level (104 m3 H2O)
WET_VOL	Float	Initial volume of water in wetlands (104 m3 H2O)
WET_SED	Float	Initial sediment concentration in wetland water (mg/L)
WET_NSED	Float	Normal sediment concentration in wetland water (mg/L)
WET_K	Float	Hydraulic conductivity of bottom of wetlands (mm/hr)
PSETLW1	Float	Phosphorus settling rate in wetland during 1st period (m/year)
PSETLW2	Float	Phosphorus settling rate in wetland during 2nd period (m/year)
NSETLW1	Float	Nitrogen settling rate in wetland during 1st period (m/year)
NSETLW2	Float	Nitrogen settling rate in wetland during 2nd period (m/year)
CHLAW	Float	Chlorophyll a production coefficient for wetlands
SECCIW	Float	Water clarity coefficient for wetlands
WET_NO3	Float	Initial concentration of NO3-N in wetlands (mg N/L)
WET_SOLP	Float	Initial concentration of soluble P in wetlands (mg P/L)
WET_ORGN	Float	Initial concentration of organic N in wetlands (mg N/L)
WET_ORGP	Float	Initial concentration of organic P in wetlands (mg P/L)

Pp: This table contains SWAT point source data and inputs for constant discharges.

Field Name	**Field Type**	**Definition**
SUBBASIN	integer	SUBBASIN NUMBER
FLOCNST	float	Average daily flow (m3)
SEDCNST	float	Average daily sediment loading (metric tons)
ORGNCNST	float	Average daily organic N loading (kg)
ORGPCNST	float	Average daily organic P loading (kg)
NO3CNST	Float	Average daily NO3 loading (kg)
NH3CNST	Float	Average daily NH4 loading (kg)
NO2CNST	Float	Average daily NO2 loading (kg)
MINPCNST	Float	Average daily mineral P loading (kg)
CBODCNST	Float	Average daily loading of CBOD (kg CBOD/day)
DISOXCNST	Float	Average daily loading of dissolved oxygen (kg O2/day)
CHLACNST	Float	Average daily loading of chlorophyll a

		(kg/day).
SOLPSTCNST	Float	Average daily loading of soluble pesticide (mg ai/day).
SRBPSTCNST	Float	Average daily loading of sorbed pesticide (mg ai/day)
BACTPCNST	Float	Average daily loading of persistent bacteria
BACTLPCNST	Float	Average daily loading of less persistent bacteria
CMTL1CNST	Float	Average daily loading of metal #1 (kg)
CMTL2CNST	Float	Average daily loading of metal #2 (kg)
CMTL3CNST	Float	Average daily loading of metal #3 (kg)
PCSIDS	Text	Not currently used
ANNUALREC	Text	Path to the annual observed records file
MONTHLYREC	Text	Path to the monthly observed records file
DAILYREC	Text	Path to the daily observed records file
TYPE	Integer	The type of input records (corresponds to the fig.fig command code): 7 = recmon 8 = recyear 10 = recday 11 = reccnst

Ppi: This table contains SWAT inlet data and inputs for constant discharges.

Field Name	**Field Type**	**Definition**
SUBBASIN	integer	SUBBASIN NUMBER
FLOCNST	float	Average daily flow (m3)
SEDCNST	float	Average daily sediment loading (metric tons)
ORGNCNST	float	Average daily organic N loading (kg)
ORGPCNST	float	Average daily organic P loading (kg)
NO3CNST	Float	Average daily NO3 loading (kg)
NH3CNST	Float	Average daily NH4 loading (kg)
NO2CNST	Float	Average daily NO2 loading (kg)
MINPCNST	Float	Average daily mineral P loading (kg)
CBODCNST	Float	Average daily loading of CBOD (kg CBOD/day)
DISOXCNST	Float	Average daily loading of dissolved oxygen (kg O2/day)
CHLACNST	Float	Average daily loading of chlorophyll a (kg/day).
SOLPSTCNST	Float	Average daily loading of soluble pesticide (mg ai/day).
SRBPSTCNST	Float	Average daily loading of sorbed pesticide (mg ai/day)
BACTPCNST	Float	Average daily loading of persistent bacteria
BACTLPCNST	Float	Average daily loading of less persistent bacteria
CMTL1CNST	Float	Average daily loading of metal #1 (kg)
CMTL2CNST	Float	Average daily loading of metal #2 (kg)
CMTL3CNST	Float	Average daily loading of metal #3 (kg)
PCSIDS	Text	Not currently used
ANNUALREC	Text	Path to the annual observed records file

MONTHLYREC	Text	Path to the monthly observed records file
DAILYREC	Text	Path to the daily observed records file
TYPE	Integer	The type of input records (corresponds to the fig.fig command code): 7 = recmon 8 = recyear 10 = recday 11 = reccnst

Res: This database table contains SWAT reservoir (.res) input data

Field Name	Field Type	Definition
SUBBASIN	integer	Subbasin number
MORES	integer	Month the reservoir becomes operational
IYRES	integer	Year of simulation the reservoir becomes operational
RES_ESA	float	Reservoir surface area when the reservoir is filled to the emergency spillway (ha)
RES_EVOL	float	Volume of water stored in reservoir when filled to the emergency spillway (104 m3)
RES_PSA	float	Reservoir surface area when the reservoir is filled to the principal spillway (ha)
RES_PVOL	float	Volume of water stored in reservoir when filled to the principal spillway (104 m3)
RES_VOL	float	Initial reservoir volume (104 m3)
RES_SED	float	Initial sediment concentration in the reservoir (mg/L)
RES_NSED	float	Normal sediment concentration in the reservoir (mg/L)
RES_K	float	Hydraulic conductivity of the reservoir bottom (mm/hr)
IRESCO	integer	Outflow simulation code (see SWAT User Manual)
OFLOWMX1	float	Maximum daily outflow for January (m3/s)
OFLOWMX2	float	Maximum daily outflow for February (m3/s)
OFLOWMX3	float	Maximum daily outflow for March (m3/s)
OFLOWMX4	float	Maximum daily outflow for April (m3/s)
OFLOWMX5	float	Maximum daily outflow for May (m3/s)
OFLOWMX6	float	Maximum daily outflow for June (m3/s)
OFLOWMX7	float	Maximum daily outflow for July (m3/s)
OFLOWMX8	float	Maximum daily outflow for August (m3/s)
OFLOWMX9	float	Maximum daily outflow for September (m3/s)
OFLOWMX10	float	Maximum daily outflow for October (m3/s)
OFLOWMX11	float	Maximum daily outflow for November (m3/s)
OFLOWMX12	float	Maximum daily outflow for December (m3/s)
OFLOWMN1	float	Minimum daily outflow for January (m3/s)
OFLOWMN2	float	Minimum daily outflow for February (m3/s)
OFLOWMN3	float	Minimum daily outflow for March (m3/s)
OFLOWMN4	float	Minimum daily outflow for April (m3/s)
OFLOWMN5	float	Minimum daily outflow for May (m3/s)

OFLOWMN6	float	Minimum daily outflow for June (m3/s)
OFLOWMN7	float	Minimum daily outflow for July (m3/s)
OFLOWMN8	float	Minimum daily outflow for August (m3/s)
OFLOWMN9	float	Minimum daily outflow for September (m3/s)
OFLOWMN10	float	Minimum daily outflow for October (m3/s)
OFLOWMN11	float	Minimum daily outflow for November (m3/s)
OFLOWMN12	float	Minimum daily outflow for December (m3/s)
RES_RR	float	Average daily principal spillway release rate (m3/s)
RESMONO	text	Name of file containing monthly outflow data
IFLOD1R	integer	Beginning month of non-flood season
IFLOD2R	integer	Ending month of non-flood season
NDTARG	integer	Number of days to reach target storage from current storage
STARG1	float	Target reservoir storage in January (104 m3)
STARG2	float	Target reservoir storage in February (104 m3)
STARG3	float	Target reservoir storage in March (104 m3)
STARG4	float	Target reservoir storage in April (104 m3)
STARG5	float	Target reservoir storage in May (104 m3)
STARG6	float	Target reservoir storage in June (104 m3)
STARG7	float	Target reservoir storage in July (104 m3)
STARG8	float	Target reservoir storage in August (104 m3)
STARG9	float	Target reservoir storage in September (104 m3)
STARG10	float	Target reservoir storage in October (104 m3)
STARG11	float	Target reservoir storage in November (104 m3)
STARG12	float	Target reservoir storage in December (104 m3)
RESDAYO	text	Name of file containing daily outflow data
WURESN1	float	Average amount of water withdrawn from reservoir in January for consumptive use (104 m3)
WURESN2	float	Average amount of water withdrawn from reservoir in February for consumptive use (104 m3)
WURESN3	float	Average amount of water withdrawn from reservoir in March for consumptive use (104 m3)
WURESN4	float	Average amount of water withdrawn from reservoir in April for consumptive use (104 m3)
WURESN5	float	Average amount of water withdrawn from reservoir in May for consumptive use (104 m3)
WURESN6	float	Average amount of water withdrawn from reservoir in June for consumptive use (104 m3)
WURESN7	float	Average amount of water withdrawn from reservoir in July for consumptive use (104

		m3)
WURESN8	float	Average amount of water withdrawn from reservoir in August for consumptive use (104 m3)
WURESN9	float	Average amount of water withdrawn from reservoir in September for consumptive use (104 m3)
WURESN10	float	Average amount of water withdrawn from reservoir in October for consumptive use (104 m3)
WURESN11	float	Average amount of water withdrawn from reservoir in November for consumptive use (104 m3)
WURESN12	float	Average amount of water withdrawn from reservoir in December for consumptive use (104 m3)
WURTNF	float	Fraction of water removed from reservoir via WURESN that is returned and becomes flow out of reservoir
IRES1	Integer	Beginning month of 1st nutrient settling period
IRES2	Integer	Ending month of 1st nutrient settling period
PSETLR1	float	Phosphorus settling rate in 1st settling period (m/year)
PSETLR2	float	Phosphorus settling rate in 2nd settling period (m/year)
NSETLR1	float	Nitrogen settling rate in 1st settling period (m/year)
NSETLR2	float	Nitrogen settling rate in 2nd settling period (m/year)
CHLAR	float	Chlorophyll a production coefficient.
SECCIR	float	Water clarity coefficient
RES_ORGP	float	Initial concentration of org P in reservoir (mg P/L)
RES_SOLP	float	Initial concentration of soluble P in reservoir (mg P/L)
RES_ORGN	float	Initial concentration of org N in reservoir (mg N/L)
RES_NO3	float	Initial concentration of nitrate in reservoir (mg N/L)
RES_NH3	float	Initial concentration of NH3-N in reservoir (mg N/L)
RES_NO2	float	Initial concentration of nitrite in reservoir (mg N/L)
LKPST_CONC	float	Initial pesticide concentration in reservoir water (mg/m3)
LKPST_REA	float	Reaction coefficient of the pesticide in reservoir water (1/day)
LKPST_VOL	float	Volatilization coefficient of the pesticide from the reservoir (m/day)
LKPST_KOC	float	Pesticide partition coefficient between water and sediment (m3/g)
LKPST_STL	float	Settling velocity of pesticide sorbed to sediment (m/day)

LKPST_RSP	float	Resuspension velocity of pesticide sorbed to sediment (m/day)
LKPST_MIX	float	Pesticide diffusion or mixing velocity (m/day)
LKSPSTCONC	float	Initial pesticide concentration in sediment (mg/m3)
LKSPST_REA	float	Reaction coefficient of pesticide in sediment (1/day)
LKSPST_BRY	float	Burial velocity of pesticide in sediment (m/day)
LKSPST_ACT	float	Depth of active sediment layer in reservoir (m)
RES_D50	float	Median particle diameter of sediment (µm).

Rte: Contains SWAT main channel (.rte) input data

Field Name	Field Type	Definition
SUBBASIN	integer	SUBBASIN NUMBER
CH_W2	float	Average width of main channel (m)
CH_D	float	Average depth of main channel (m)
CH_S2	float	Average slope of main channel (m/m)
CH_L2	float	Length of main channel (km)
CH_N2	float	Manning's "n" value for the main channel
CH_K2	float	Effective hydraulic conductivity in main channel alluvium (mm/hr)
CH_EROD	float	Channel erodibility factor
CH_COV	float	Channel cover factor
CH_WDR	float	Channel width-depth ratio
ALPHA_BNK	float	Baseflow alpha factor for bank storage (days)

slope: This table contains slope characteristics for all the HRUs (prior to reduction using the are thresholds).

Field Name	Field Type	Definition
Subbasin	Integer	The grid code of the subbasin
LU_NUM	Double	ArcSWAT internal land use ID
LU_CODE	Text	The SWAT land use lookup code
SOIL_NUM	Double	ArcSWAT internal soil ID
SOIL_CODE	Text	The soil lookup code
SLOPE_NUM	Double	ArcSWAT internal slope ID
SLOPE_CODE	Text	The slope range code
MEAN_SLOPE	Double	Slope of HRU (%)
AREA	Double	Area of the HRU [meters2]

SlopeRemap: This table contains the reclass table for the multiple slope classes.

Field Name	Field Type	Definition
SlopeLo	Integer	The low range for the slope class
SlopeHi	Double	The high range for the slope class

SlopeClass	Text	The adjusted high end for the slope class used by the raster reclass algorithm
SlopeName	Double	The slope range code

Sol: Contains SWAT soil (.sol) input data

Field Name	Field Type	Definition
SUBBASIN	integer	Subbasin number
HRU	integer	HRU number
LANDUSE	Text	Land cover simulated in HRU
SOIL	Text	Name of soil simulated in HRU
SLOPE_CD	Text	Name of slope class simulated in HRU
SNAME	character	Soil series name
NLAYERS	integer	Number of layers in soil profile
HYDGRP	character	Soil hydrologic group
SOL_ZMX	Float	Maximum rooting depth of soil profile (mm)
ANION_EXCL	Float	Fraction of porosity from which anions are excluded
SOL_CRK	float	Potential or maximum crack volume of the soil profile expressed as a fraction of total soil volume
TEXTURE	Text	Texture of soil layers (optional)
SOL_Z1	Float	Depth to bottom of first soil layer (mm)
SOL_BD1	Float	Moist bulk density of first soil layer (Mg/m3)
SOL_AWC1	Float	Available water capacity of first soil layer (mm/mm)
SOL_K1	Float	Saturated hydraulic conductivity of first soil layer (mm/hr)
SOL_CBN1	Float	Organic carbon content of first soil layer (%)
CLAY1	Float	Clay content of first soil layer (%)
SILT1	Float	Silt content of first soil layer (%)
SAND1	Float	Sand content of first soil layer (%)
ROCK1	Float	Rock content of first soil layer (%)
SOL_ALB1	Float	Moist soil albedo of first soil layer
USLE_K1	Float	USLE equation soil erodibility (K) factor
SOL_EC1	Float	Electrical conductivity of first soil layer (dS/m)
SOL_Z2	Float	Depth to bottom of second soil layer (mm)
SOL_BD2	Float	Moist bulk density of second soil layer (Mg/m3)
SOL_AWC2	Float	Available water capacity of second soil layer (mm/mm)
SOL_K2	Float	Saturated hydraulic conductivity of second soil layer (mm/hr)
SOL_CBN2	Float	Organic carbon content of second soil layer (%)
CLAY2	Float	Clay content of second soil layer (%)
SILT2	Float	Silt content of second soil layer (%)
SAND2	Float	Sand content of second soil layer (%)
ROCK2	Float	Rock content of second soil layer (%)
SOL_ALB2	Float	Moist soil albedo of second soil layer
USLE_K2	Float	USLE equation soil erodibility (K) factor
SOL_EC2	Float	Electrical conductivity of second soil layer

		(dS/m)
SOL_Z3	Float	Depth to bottom of third soil layer (mm)
SOL_BD3	Float	Moist bulk density of third soil layer (Mg/m3)
SOL_AWC3	Float	Available water capacity of third soil layer (mm/mm)
SOL_K3	Float	Saturated hydraulic conductivity of third soil layer (mm/hr)
SOL_CBN3	Float	Organic carbon content of third soil layer (%)
CLAY3	Float	Clay content of third soil layer (%)
SILT3	Float	Silt content of third soil layer (%)
SAND3	Float	Sand content of third soil layer (%)
ROCK3	Float	Rock content of third soil layer (%)
SOL_ALB3	Float	Moist soil albedo of third soil layer
USLE_K3	Float	USLE equation soil erodibility (K) factor
SOL_EC3	Float	Electrical conductivity of third soil layer (dS/m)
SOL_Z4	Float	Depth to bottom of fourth soil layer (mm)
SOL_BD4	Float	Moist bulk density of fourth soil layer (Mg/m3)
SOL_AWC4	Float	Available water capacity of fourth soil layer (mm/mm)
SOL_K4	Float	Saturated hydraulic conductivity of fourth soil layer (mm/hr)
SOL_CBN4	Float	Organic carbon content of fourth soil layer (%)
CLAY4	Float	Clay content of fourth soil layer (%)
SILT4	Float	Silt content of fourth soil layer (%)
SAND4	Float	Sand content of fourth soil layer (%)
ROCK4	Float	Rock content of fourth soil layer (%)
SOL_ALB4	Float	Moist soil albedo of fourth soil layer
USLE_K4	Float	USLE equation soil erodibility (K) factor
SOL_EC4	Float	Electrical conductivity of fourth soil layer (dS/m)
SOL_Z5	Float	Depth to bottom of fifth soil layer (mm)
SOL_BD5	Float	Moist bulk density of fifth soil layer (Mg/m3)
SOL_AWC5	Float	Available water capacity of fifth soil layer (mm/mm)
SOL_K5	Float	Saturated hydraulic conductivity of fifth soil layer (mm/hr)
SOL_CBN5	Float	Organic carbon content of fifth soil layer (%)
CLAY5	Float	Clay content of fifth soil layer (%)
SILT5	Float	Silt content of fifth soil layer (%)
SAND5	Float	Sand content of fifth soil layer (%)
ROCK5	Float	Rock content of fifth soil layer (%)
SOL_ALB5	Float	Moist soil albedo of fifth soil layer
USLE_K5	Float	USLE equation soil erodibility (K) factor
SOL_EC5	Float	Electrical conductivity of fifth soil layer (dS/m)
SOL_Z6	Float	Depth to bottom of sixth soil layer (mm)
SOL_BD6	Float	Moist bulk density of sixth soil layer (Mg/m3)
SOL_AWC6	Float	Available water capacity of sixth soil layer (mm/mm)
SOL_K6	Float	Saturated hydraulic conductivity of sixth soil

		layer (mm/hr)
SOL_CBN6	Float	Organic carbon content of sixth soil layer (%)
CLAY6	Float	Clay content of sixth soil layer (%)
SILT6	Float	Silt content of sixth soil layer (%)
SAND6	Float	Sand content of sixth soil layer (%)
ROCK6	Float	Rock content of sixth soil layer (%)
SOL_ALB6	Float	Moist soil albedo of sixth soil layer
USLE_K6	Float	USLE equation soil erodibility (K) factor
SOL_EC6	Float	Electrical conductivity of sixth soil layer (dS/m)
SOL_Z7	Float	Depth to bottom of seventh soil layer (mm)
SOL_BD7	Float	Moist bulk density of seventh soil layer (Mg/m3)
SOL_AWC7	Float	Available water capacity of seventh soil layer (mm/mm)
SOL_K7	Float	Saturated hydraulic conductivity of seventh soil layer (mm/hr)
SOL_CBN7	Float	Organic carbon content of seventh soil layer (%)
CLAY7	Float	Clay content of seventh soil layer (%)
SILT7	Float	Silt content of seventh soil layer (%)
SAND7	Float	Sand content of seventh soil layer (%)
ROCK7	Float	Rock content of seventh soil layer (%)
SOL_ALB7	Float	Moist soil albedo of seventh soil layer
USLE_K7	Float	USLE equation soil erodibility (K) factor
SOL_EC7	Float	Electrical conductivity of seventh soil layer (dS/m)
SOL_Z8	Float	Depth to bottom of eighth soil layer (mm)
SOL_BD8	Float	Moist bulk density of eighth soil layer (Mg/m3)
SOL_AWC8	Float	Available water capacity of eighth soil layer (mm/mm)
SOL_K8	Float	Saturated hydraulic conductivity of eighth soil layer (mm/hr)
SOL_CBN8	Float	Organic carbon content of eighth soil layer (%)
CLAY8	Float	Clay content of eighth soil layer (%)
SILT8	Float	Silt content of eighth soil layer (%)
SAND8	Float	Sand content of eighth soil layer (%)
ROCK8	Float	Rock content of eighth soil layer (%)
SOL_ALB8	Float	Moist soil albedo of eighth soil layer
USLE_K8	Float	USLE equation soil erodibility (K) factor
SOL_EC8	Float	Electrical conductivity of eighth soil layer (dS/m)
SOL_Z9	Float	Depth to bottom of ninth soil layer (mm)
SOL_BD9	Float	Moist bulk density of ninth soil layer (Mg/m3)
SOL_AWC9	Float	Available water capacity of ninth soil layer (mm/mm)
SOL_K9	Float	Saturated hydraulic conductivity of ninth soil layer (mm/hr)
SOL_CBN9	Float	Organic carbon content of ninth soil layer (%)
CLAY9	Float	Clay content of ninth soil layer (%)

SILT9	Float	Silt content of ninth soil layer (%)
SAND9	Float	Sand content of ninth soil layer (%)
ROCK9	Float	Rock content of ninth soil layer (%)
SOL_ALB9	Float	Moist soil albedo of ninth soil layer
USLE_K9	Float	USLE equation soil erodibility (K) factor
SOL_EC9	Float	Electrical conductivity of ninth soil layer (dS/m)
SOL_Z10	Float	Depth to bottom of tenth soil layer (mm)
SOL_BD10	Float	Moist bulk density of tenth soil layer (Mg/m3)
SOL_AWC10	Float	Available water capacity of tenth soil layer (mm/mm)
SOL_K10	Float	Saturated hydraulic conductivity of tenth soil layer (mm/hr)
SOL_CBN10	Float	Organic carbon content of tenth soil layer (%)
CLAY10	Float	Clay content of tenth soil layer (%)
SILT10	Float	Silt content of tenth soil layer (%)
SAND10	Float	Sand content of tenth soil layer (%)
ROCK10	Float	Rock content of tenth soil layer (%)
SOL_ALB10	Float	Moist soil albedo of tenth soil layer
USLE_K10	Float	USLE equation soil erodibility (K) factor
SOL_EC10	Float	Electrical conductivity of tenth soil layer (dS/m)

SplitHrus: This table contains records of the SWAT land use classes that have been designated as being split into sub-HRUs during HRU delineation.

Field Name	**Field Type**	**Definition**
LANDUSE	text	The parent SWAT land use defined from GIS land use dataset
SUBLU	text	The sub-land use that will comprise a fraction of the parent land use
PERCENT	float	Percent of the parent land use that the sub-land use will comprise

Sub: Contains SWAT general HRU attribute (.sub) input data

Field Name	**Field Type**	**Definition**
SUBBASIN	integer	Subbasin number
SUB_KM	float	Subbasin are in kn^2
LATITUDE	float	Latitude of subbasin
ELEV	float	Elevation of subbasin (m)
IRGAGE	Integer	Number of precip gage used in subbasin
ITGAGE	Integer	Number of temp gage used in subbasin
ISGAGE	Integer	Number of solar gage used in subbasin
IHGAGE	Integer	Number of humidity gage used in subbasin
IWGAGE	Integer	Number of wind gage used in subbasin
ELEVB1	Float	Elevation at center of elevation band #1 (m)
ELEVB2	Float	Elevation at center of elevation band #2 (m)
ELEVB3	Float	Elevation at center of elevation band #3 (m)

ELEVB4	Float	Elevation at center of elevation band #4 (m)
ELEVB5	Float	Elevation at center of elevation band #5 (m)
ELEVB6	Float	Elevation at center of elevation band #6 (m)
ELEVB7	Float	Elevation at center of elevation band #7 (m)
ELEVB8	float	Elevation at center of elevation band #8 (m)
ELEVB9	float	Elevation at center of elevation band #9 (m)
ELEVB10	float	Elevation at center of elevation band #10 (m)
ELEVB_FR1	float	Fraction of subbasin area within elevation band #1
ELEVB_FR2	float	Fraction of subbasin area within elevation band #2
ELEVB_FR3	float	Fraction of subbasin area within elevation band #3
ELEVB_FR4	float	Fraction of subbasin area within elevation band #4
ELEVB_FR5	float	Fraction of subbasin area within elevation band #5
ELEVB_FR6	float	Fraction of subbasin area within elevation band #6
ELEVB_FR7	float	Fraction of subbasin area within elevation band #7
ELEVB_FR8	float	Fraction of subbasin area within elevation band #8
ELEVB_FR9	float	Fraction of subbasin area within elevation band #9
ELEVB_FR10	float	Fraction of subbasin area within elevation band #10
SNOEB1	float	Initial snow water content in elevation band #1
SNOEB2	float	Initial snow water content in elevation band #2
SNOEB3	float	Initial snow water content in elevation band #3
SNOEB4	float	Initial snow water content in elevation band #4
SNOEB5	float	Initial snow water content in elevation band #5
SNOEB6	float	Initial snow water content in elevation band #6
SNOEB7	float	Initial snow water content in elevation band #7
SNOEB8	float	Initial snow water content in elevation band #8
SNOEB9	float	Initial snow water content in elevation band #9
SNOEB10	float	Initial snow water content in elevation band #10
PLAPS	float	Precipitation laps rate (mm H2O/km)
TLAPS	float	Temperature laps rate (ºC/km)
SNO_SUB	float	Initial snow water content (mm H2O)
CH_L1	float	Longest tributary channel length in subbasin (km)
CH_S1	float	Average slope of tributary channels (m/m)
CH_W1	float	Average width of tributary channels (m)

CH_K1	float	Effective hydraulic conductivity in tributary channel alluvium (mm/hr)
CH_N1	float	Manning's "n" value for the tributary channels
CO2	float	Carbon dioxide concentration (ppmv).
RFINC1	float	Rainfall adjustment for January (%)
RFINC2	float	Rainfall adjustment for February (%)
RFINC3	float	Rainfall adjustment for March (%)
RFINC4	float	Rainfall adjustment for April (%)
RFINC5	float	Rainfall adjustment for May (%)
RFINC6	float	Rainfall adjustment for June (%)
RFINC7	float	Rainfall adjustment for July (%)
RFINC8	float	Rainfall adjustment for August (%)
RFINC9	float	Rainfall adjustment for September (%)
RFINC10	float	Rainfall adjustment for October (%)
RFINC11	float	Rainfall adjustment for November (%)
RFINC12	float	Rainfall adjustment for December (%)
TMPINC1	float	Temperature adjustment for January (ºC)
TMPINC2	float	Temperature adjustment for February (ºC)
TMPINC3	float	Temperature adjustment for March (ºC)
TMPINC4	float	Temperature adjustment for April (ºC)
TMPINC5	float	Temperature adjustment for May (ºC)
TMPINC6	float	Temperature adjustment for June (ºC)
TMPINC7	float	Temperature adjustment for July (ºC)
TMPINC8	float	Temperature adjustment for August (ºC)
TMPINC9	float	Temperature adjustment for September (ºC)
TMPINC10	float	Temperature adjustment for October (ºC)
TMPINC11	float	Temperature adjustment for November (ºC)
TMPINC12	float	Temperature adjustment for December (ºC)
RADINC1	float	Radiation adjustment for January (MJ/m2)
RADINC2	float	Radiation adjustment for February (MJ/m2)
RADINC3	float	Radiation adjustment for March (MJ/m2)
RADINC4	float	Radiation adjustment for April (MJ/m2)
RADINC5	float	Radiation adjustment for May (MJ/m2)
RADINC6	float	Radiation adjustment for June (MJ/m2)
RADINC7	float	Radiation adjustment for July (MJ/m2)
RADINC8	float	Radiation adjustment for August (MJ/m2)
RADINC9	float	Radiation adjustment for September (MJ/m2)
RADINC10	float	Radiation adjustment for October (MJ/m2)
RADINC11	float	Radiation adjustment for November (MJ/m2)
RADINC12	float	Radiation adjustment for December (MJ/m2)
HUMINC1	float	Humidity adjustment for January
HUMINC2	float	Humidity adjustment for February
HUMINC3	float	Humidity adjustment for March
HUMINC4	float	Humidity adjustment for April
HUMINC5	float	Humidity adjustment for May
HUMINC6	float	Humidity adjustment for June
HUMINC7	float	Humidity adjustment for July
HUMINC8	float	Humidity adjustment for August
HUMINC9	float	Humidity adjustment for September
HUMINC10	float	Humidity adjustment for October
HUMINC11	float	Humidity adjustment for November
HUMINC12	float	Humidity adjustment for December

HRUTOT	integer	Total number of HRUs in subbasin
IPOT	integer	Number of HRU that is defined as a pothole
FCST_REG	integer	Climate forecast region number

SubHMD: This table contains a listing of the humidity stations associated with each subbasin.

Field Name	Field Type	Definition
SUBBASIN	integer	Subbasin number
MinDist	Float	The minimum distance from the subbasin centroid to a humidity station
MinRec	Float	The record number of the humidity station in the humidity station list table that corresponds to the station that is closest to the subbasin centroid
Station	Text	The name of the humidity station
OrderID	Integer	The order that the humidity station will fall in the ascii pcp*.pcp

SubPcp: This table contains a listing of the precipitation stations associated with each subbasin.

Field Name	Field Type	Definition
SUBBASIN	integer	Subbasin number
MinDist	Float	The minimum distance from the subbasin centroid to a precipitation station
MinRec	Float	The record number of the precipitation station in the precipitation station list table that corresponds to the station that is closest to the subbasin centroid
Station	Text	The name of the precipitation station
OrderID	Integer	The order that the precipitation station will fall in the ascii pcp*.pcp

SubSlr: This table contains a listing of the solar stations associated with each subbasin.

Field Name	Field Type	Definition
SUBBASIN	integer	Subbasin number
MinDist	Float	The minimum distance from the subbasin centroid to a solar station
MinRec	Float	The record number of the solar station in the solar station list table that corresponds to the station that is closest to the subbasin centroid
Station	Text	The name of the solar station
OrderID	Integer	The order that the precipitation station will fall in the ascii tmp*.tmp

SubTmp: This table contains a listing of the temperature stations associated with each subbasin.

Field Name	Field Type	Definition
SUBBASIN	integer	Subbasin number
MinDist	Float	The minimum distance from the subbasin centroid to a temperature station
MinRec	Float	The record number of the temperature station in the temperature station list table that corresponds to the station that is closest to the subbasin centroid
Station	Text	The name of the temperature station
OrderID	Integer	The order that the precipitation station will fall in the ascii tmp*.tmp

SubWnd: This table contains a listing of the wind stations associated with each subbasin.

Field Name	Field Type	Definition
SUBBASIN	integer	Subbasin number
MinDist	Float	The minimum distance from the subbasin centroid to a wind station
MinRec	Float	The record number of the wind station in the wind station list table that corresponds to the station that is closest to the subbasin centroid
Station	Text	The name of the wind station
OrderID	Integer	The order that the wind station will fall in the ascii pcp*.pcp

Swq: Contains SWAT stream water quality (.swq) input data

Field Name	Field Type	Definition
SUBBASIN	integer	Subbasin number
RS1	float	Local algal settling rate in the reach (m/day)
RS2	float	Benthic source rate for dissolved phosphorus in the reach (mg P/(m2·day))
RS3	float	Benthic source rate for NH4-N in the reach (mg N/(m2·day))
RS4	float	Rate coefficient for organic N settling in the reach (day-1)
RS5	float	Organic phosphorus settling rate in the reach (day-1)
RS6	float	Rate coefficient for settling of arbitrary non-conservative constituent in the reach (day-1)
RS7	float	Benthic source rate for arbitrary non-conservative constituent in the reach (mg ANC/(m2·day))
RK1	float	CBOD deoxygenation rate coefficient in the reach (day-1)
RK2	float	Oxygen reaeration rate in accordance with Fickian diffusion in the reach (day-1)
RK3	float	Rate of loss of CBOD due to settling in the reach (day-1)

RK4	float	Benthic oxygen demand rate in the reach (mg O2/(m2·day))
RK5	float	Coliform die-off rate in the reach (day-1)
RK6	float	Decay rate for arbitrary non-conservative constituent in the reach (day-1)
BC1	float	Rate constant for biological oxidation of NH4 to NO2 in the reach (day-1)
BC2	float	Rate constant for biological oxidation of NO2 to NO3 in the reach (day-1)
BC3	float	Rate constant for hydrolysis of organic N to NH4 in the reach (day-1)
BC4	float	Rate constant for mineralization of organic P to dissolved P in the reach (day-1)
CHPST_REA	float	Pesticide reaction coefficient in reach (day-1)
CHPST_VOL	float	Pesticide volatilization coefficient in reach (m/day)
CHPST_KOC	float	Pesticide partition coefficient between water and air in reach (m3/day)
CHPST_STL	float	Settling velocity for pesticide sorbed to sediment (m/day)
CHPST_RSP	float	Resuspension velocity for pesticide sorbed to sediment (m/day)
CHPST_MIX	float	Mixing velocity for pesticide in reach (m/day)
SEDPST_CONC	float	Initial pesticide concentration in reach bed sediment (mg/m3 sediment)
SEDPST_REA	float	Pesticide reaction coefficient in reach bed sediment (day-1)
SEDPST_BRY	float	Pesticide burial velocity in reach bed sediment (m/day)
SEDPST_ACT	float	Depth of active sediment layer for pesticide (m)

TimeSeries: This table contains time series data in the ArcHydro definition format. This table is currently only used to store observed point source, inlet, and reservoir loadings.

Field Name	Field Type	Definition
FeatureID	integer	The HydroID that the time series relates to
TSTypeID	text	Time series type ID
TSDateTime	date	The date and time of the time series data point
TSValue	float	The value of the observation

TSType: This table contains time series types in the ArcHydro definition format. These time series types are currently used for observed loadings for point source, inlets, and reservoir inputs.

Field Name	Field Type	Definition
TYTypeID	integer	Time series type ID
Variable	text	Time series type description
Units	Text	Units for time series
isTRegular	integer	Flag if measurements are at regular intervals
TSInterval	Integer	Interval of measurements

DataType	Integer	Time series type
Origin	integer	Origin of data series

uncomb: This table contains unique HRUs constructed from land use, soils, and slope classes within each subbasin, prior to reduction of HRUs based on area thresholds.

Field Name	**Field Type**	**Definition**
Subbasin	Integer	The grid code of the subbasin
UNCOMB	Text	Unique string for the HRU composed of a concatenation of the land use, soil, and slope text codes
AREA	Double	Area of the HRU [hectares]

Wgn: Contains SWAT weather generator (.wgn) input data

Field Name	**Field Type**	**Definition**
SUBBASIN	integer	Subbasin number
STATION	text	Name of weather station
WLATITUDE	float	Latitude of weather station
WLONGITUDE	float	Longitude of weather station
WELEV	float	Elevation of weather station
RAIN_YRS	float	Number of years of data used to determine values for RAIN_HHMX
TMPMX1	float	Average maximum air temperature for January (ºC)
TMPMX2	float	Average maximum air temperature for February (ºC)
TMPMX3	float	Average maximum air temperature for March (ºC)
TMPMX4	float	Average maximum air temperature for April (ºC)
TMPMX5	float	Average maximum air temperature for May (ºC)
TMPMX6	float	Average maximum air temperature for June (ºC)
TMPMX7	float	Average maximum air temperature for July (ºC)
TMPMX8	float	Average maximum air temperature for August (ºC)
TMPMX9	float	Average maximum air temperature for September (ºC)
TMPMX10	float	Average maximum air temperature for October (ºC)
TMPMX11	float	Average maximum air temperature for November (ºC)
TMPMX12	float	Average maximum air temperature for December (ºC)
TMPMN1	float	Average minimum air temperature for January (ºC)
TMPMN2	float	Average minimum air temperature for

		February (ºC)
TMPMN3	float	Average minimum air temperature for March (ºC)
TMPMN4	float	Average minimum air temperature for April (ºC)
TMPMN5	float	Average minimum air temperature for May (ºC)
TMPMN6	float	Average minimum air temperature for June (ºC)
TMPMN7	float	Average minimum air temperature for July (ºC)
TMPMN8	float	Average minimum air temperature for August (ºC)
TMPMN9	float	Average minimum air temperature for September (ºC)
TMPMN10	float	Average minimum air temperature for October (ºC)
TMPMN11	float	Average minimum air temperature for November (ºC)
TMPMN12	float	Average minimum air temperature for December (ºC)
TMPSTDMX1	float	Standard deviation of maximum air temperature for January (ºC)
TMPSTDMX2	float	Standard deviation of maximum air temperature for February (ºC)
TMPSTDMX3	float	Standard deviation of maximum air temperature for March (ºC)
TMPSTDMX4	float	Standard deviation of maximum air temperature for April (ºC)
TMPSTDMX5	float	Standard deviation of maximum air temperature for May (ºC)
TMPSTDMX6	float	Standard deviation of maximum air temperature for June (ºC)
TMPSTDMX7	float	Standard deviation of maximum air temperature for July (ºC)
TMPSTDMX8	float	Standard deviation of maximum air temperature for August (ºC)
TMPSTDMX9	float	Standard deviation of maximum air temperature for September (ºC)
TMPSTDMX10	float	Standard deviation of maximum air temperature for October (ºC)
TMPSTDMX11	float	Standard deviation of maximum air temperature for November (ºC)
TMPSTDMX12	float	Standard deviation of maximum air temperature for December (ºC)
TMPSTDMN1	float	Standard deviation of minimum air temperature for January (ºC)
TMPSTDMN2	float	Standard deviation of minimum air temperature for February (ºC)
TMPSTDMN3	float	Standard deviation of minimum air temperature for March (ºC)
TMPSTDMN4	float	Standard deviation of minimum air temperature for April (ºC)
TMPSTDMN5	float	Standard deviation of minimum air

		temperature for May (ºC)
TMPSTDMN6	float	Standard deviation of minimum air temperature for June (ºC)
TMPSTDMN7	float	Standard deviation of minimum air temperature for July (ºC)
TMPSTDMN8	float	Standard deviation of minimum air temperature for August (ºC)
TMPSTDMN9	float	Standard deviation of minimum air temperature for September (ºC)
TMPSTDMN10	float	Standard deviation of minimum air temperature for October (ºC)
TMPSTDMN11	float	Standard deviation of minimum air temperature for November (ºC)
TMPSTDMN12	float	Standard deviation of minimum air temperature for December (ºC)
PCPMM1	float	Average precipitation in January (mm/day)
PCPMM2	float	Average precipitation in February (mm/day)
PCPMM3	float	Average precipitation in March (mm/day)
PCPMM4	float	Average precipitation in April (mm/day)
PCPMM5	float	Average precipitation in May (mm/day)
PCPMM6	float	Average precipitation in June (mm/day)
PCPMM7	float	Average precipitation in July (mm/day)
PCPMM8	float	Average precipitation in August (mm/day)
PCPMM9	float	Average precipitation in September (mm/day)
PCPMM10	float	Average precipitation in October (mm/day)
PCPMM11	float	Average precipitation in November (mm/day)
PCPMM12	float	Average precipitation in December (mm/day)
PCPSTD1	float	Standard deviation for daily precipitation in January (mm/day)
PCPSTD2	float	Standard deviation for daily precipitation in February (mm/day)
PCPSTD3	float	Standard deviation for daily precipitation in March (mm/day)
PCPSTD4	float	Standard deviation for daily precipitation in April (mm/day)
PCPSTD5	float	Standard deviation for daily precipitation in May (mm/day)
PCPSTD6	float	Standard deviation for daily precipitation in June (mm/day)
PCPSTD7	float	Standard deviation for daily precipitation in July (mm/day)
PCPSTD8	float	Standard deviation for daily precipitation in August (mm/day)
PCPSTD9	float	Standard deviation for daily precipitation in September (mm/day)
PCPSTD10	float	Standard deviation for daily precipitation in October (mm/day)
PCPSTD11	float	Standard deviation for daily precipitation in November (mm/day)
PCPSTD12	float	Standard deviation for daily precipitation in December (mm/day)
PCPSKW1	float	Skew coefficient for daily precipitation in January

PCPSKW2	float	Skew coefficient for daily precipitation in February
PCPSKW3	float	Skew coefficient for daily precipitation in March
PCPSKW4	float	Skew coefficient for daily precipitation in April
PCPSKW5	float	Skew coefficient for daily precipitation in May
PCPSKW6	float	Skew coefficient for daily precipitation in June
PCPSKW7	float	Skew coefficient for daily precipitation in July
PCPSKW8	float	Skew coefficient for daily precipitation in August
PCPSKW9	float	Skew coefficient for daily precipitation in September
PCPSKW10	float	Skew coefficient for daily precipitation in October
PCPSKW11	float	Skew coefficient for daily precipitation in November
PCPSKW12	float	Skew coefficient for daily precipitation in December
PR_W1_1	float	Probability of wet day following dry day in January
PR_W1_2	float	Probability of wet day following dry day in February
PR_W1_3	float	Probability of wet day following dry day in March
PR_W1_4	float	Probability of wet day following dry day in April
PR_W1_5	float	Probability of wet day following dry day in May
PR_W1_6	float	Probability of wet day following dry day in June
PR_W1_7	float	Probability of wet day following dry day in July
PR_W1_8	float	Probability of wet day following dry day in August
PR_W1_9	float	Probability of wet day following dry day in September
PR_W1_10	float	Probability of wet day following dry day in October
PR_W1_11	float	Probability of wet day following dry day in November
PR_W1_12	float	Probability of wet day following dry day in December
PR_W2_1	float	Probability of wet day following wet day in January
PR_W2_2	float	Probability of wet day following wet day in February
PR_W2_3	float	Probability of wet day following wet day in March
PR_W2_4	float	Probability of wet day following wet day in April
PR_W2_5	float	Probability of wet day following wet day in May

PR_W2_6	float	Probability of wet day following wet day in June
PR_W2_7	float	Probability of wet day following wet day in July
PR_W2_8	float	Probability of wet day following wet day in August
PR_W2_9	float	Probability of wet day following wet day in September
PR_W2_10	float	Probability of wet day following wet day in October
PR_W2_11	float	Probability of wet day following wet day in November
PR_W2_12	float	Probability of wet day following wet day in December
PCPD1	float	Average number of days of precipitation in January
PCPD2	float	Average number of days of precipitation in February
PCPD3	float	Average number of days of precipitation in March
PCPD4	float	Average number of days of precipitation in April
PCPD5	float	Average number of days of precipitation in May
PCPD6	float	Average number of days of precipitation in June
PCPD7	float	Average number of days of precipitation in July
PCPD8	float	Average number of days of precipitation in August
PCPD9	float	Average number of days of precipitation in September
PCPD10	float	Average number of days of precipitation in October
PCPD11	float	Average number of days of precipitation in November
PCPD12	float	Average number of days of precipitation in December
RAINHHMX1	float	Maximum 0.5 h rainfall in January for entire period of record (mm)
RAINHHMX2	float	Maximum 0.5 h rainfall in February for entire period of record (mm)
RAINHHMX3	float	Maximum 0.5 h rainfall in March for entire period of record (mm)
RAINHHMX4	float	Maximum 0.5 h rainfall in April for entire period of record (mm)
RAINHHMX5	float	Maximum 0.5 h rainfall in May for entire period of record (mm)
RAINHHMX6	float	Maximum 0.5 h rainfall in June for entire period of record (mm)
RAINHHMX7	float	Maximum 0.5 h rainfall in July for entire period of record (mm)
RAINHHMX8	float	Maximum 0.5 h rainfall in August for entire period of record (mm)

RAINHHMX9	float	Maximum 0.5 h rainfall in September for entire period of record (mm)
RAINHHMX10	float	Maximum 0.5 h rainfall in October for entire period of record (mm)
RAINHHMX11	float	Maximum 0.5 h rainfall in November for entire period of record (mm)
RAINHHMX12	float	Maximum 0.5 h rainfall in December for entire period of record (mm)
SOLARAV1	float	Average daily solar radiation for January (MJ/m2/day)
SOLARAV2	float	Average daily solar radiation for February (MJ/m2/day)
SOLARAV3	float	Average daily solar radiation for March (MJ/m2/day)
SOLARAV4	float	Average daily solar radiation for April (MJ/m2/day)
SOLARAV5	float	Average daily solar radiation for May (MJ/m2/day)
SOLARAV6	float	Average daily solar radiation for June (MJ/m2/day)
SOLARAV7	float	Average daily solar radiation for July (MJ/m2/day)
SOLARAV8	float	Average daily solar radiation for August (MJ/m2/day)
SOLARAV9	float	Average daily solar radiation for September (MJ/m2/day)
SOLARAV10	float	Average daily solar radiation for October (MJ/m2/day)
SOLARAV11	float	Average daily solar radiation for November (MJ/m2/day)
SOLARAV12	float	Average daily solar radiation for December (MJ/m2/day)
DEWPT1	float	Average dew point in January (ºC)
DEWPT2	float	Average dew point in February (ºC)
DEWPT3	float	Average dew point in March (ºC)
DEWPT4	float	Average dew point in April (ºC)
DEWPT5	float	Average dew point in May (ºC)
DEWPT6	float	Average dew point in June (ºC)
DEWPT7	float	Average dew point in July (ºC)
DEWPT8	float	Average dew point in August (ºC)
DEWPT9	float	Average dew point in September (ºC)
DEWPT10	float	Average dew point in October (ºC)
DEWPT11	float	Average dew point in November (ºC)
DEWPT12	float	Average dew point in December (ºC)
WNDAV1	float	Average wind speed in January (m/s)
WNDAV2	float	Average wind speed in February (m/s)
WNDAV3	float	Average wind speed in March (m/s)
WNDAV4	float	Average wind speed in April (m/s)
WNDAV5	float	Average wind speed in May (m/s)
WNDAV6	float	Average wind speed in June (m/s)
WNDAV7	float	Average wind speed in July (m/s)
WNDAV8	float	Average wind speed in August (m/s)
WNDAV9	float	Average wind speed in September (m/s)

WNDAV10	float	Average wind speed in October (m/s)
WNDAV11	float	Average wind speed in November (m/s)
WNDAV12	float	Average wind speed in December (m/s)

Wus: Contains SWAT consumptive water use (.wus) input data

Field Name	**Field Type**	**Definition**
SUBBASIN	integer	Subbasin number
WUPND1	float	Average daily water removal from the pond in January (104 m3/day)
WUPND2	float	Average daily water removal from the pond in February (104 m3/day)
WUPND3	float	Average daily water removal from the pond in March (104 m3/day)
WUPND4	float	Average daily water removal from the pond in April (104 m3/day)
WUPND5	float	Average daily water removal from the pond in May (104 m3/day)
WUPND6	float	Average daily water removal from the pond in June (104 m3/day)
WUPND7	float	Average daily water removal from the pond in July (104 m3/day)
WUPND8	float	Average daily water removal from the pond in August (104 m3/day)
WUPND9	float	Average daily water removal from the pond in September (104 m3/day)
WUPND10	float	Average daily water removal from the pond in October (104 m3/day)
WUPND11	float	Average daily water removal from the pond in November (104 m3/day)
WUPND12	float	Average daily water removal from the pond in December (104 m3/day)
WURCH1	float	Average daily water removal from the reach in January (104 m3/day)
WURCH2	float	Average daily water removal from the reach in February (104 m3/day)
WURCH3	float	Average daily water removal from the reach in March (104 m3/day)
WURCH4	float	Average daily water removal from the reach in April (104 m3/day)
WURCH5	float	Average daily water removal from the reach in May (104 m3/day)
WURCH6	float	Average daily water removal from the reach in June (104 m3/day)
WURCH7	float	Average daily water removal from the reach in July (104 m3/day)
WURCH8	float	Average daily water removal from the reach in August (104 m3/day)
WURCH9	float	Average daily water removal from the reach in September (104 m3/day)
WURCH10	float	Average daily water removal from the reach in October (104 m3/day)
WURCH11	float	Average daily water removal from the reach

		in November (104 m3/day)
WURCH12	float	Average daily water removal from the reach in December (104 m3/day)
WUSHAL1	float	Average daily water removal from the shallow aquifer in January (104 m3/day)
WUSHAL2	float	Average daily water removal from the shallow aquifer in February (104 m3/day)
WUSHAL3	float	Average daily water removal from the shallow aquifer in March (104 m3/day)
WUSHAL4	float	Average daily water removal from the shallow aquifer in April (104 m3/day)
WUSHAL5	float	Average daily water removal from the shallow aquifer in May (104 m3/day)
WUSHAL6	float	Average daily water removal from the shallow aquifer in June (104 m3/day)
WUSHAL7	float	Average daily water removal from the shallow aquifer in July (104 m3/day)
WUSHAL8	float	Average daily water removal from the shallow aquifer in August (104 m3/day)
WUSHAL9	float	Average daily water removal from the shallow aquifer in September (104 m3/day)
WUSHAL10	float	Average daily water removal from the shallow aquifer in October (104 m3/day)
WUSHAL11	float	Average daily water removal from the shallow aquifer in November (104 m3/day)
WUSHAL12	float	Average daily water removal from the shallow aquifer in December (104 m3/day)
WUDEEP1	float	Average daily water removal from the deep aquifer in January (104 m3/day)
WUDEEP2	float	Average daily water removal from the deep aquifer in February (104 m3/day)
WUDEEP3	float	Average daily water removal from the deep aquifer in March (104 m3/day)
WUDEEP4	float	Average daily water removal from the deep aquifer in April (104 m3/day)
WUDEEP5	float	Average daily water removal from the deep aquifer in May (104 m3/day)
WUDEEP6	float	Average daily water removal from the deep aquifer in June (104 m3/day)
WUDEEP7	float	Average daily water removal from the deep aquifer in July (104 m3/day)
WUDEEP8	float	Average daily water removal from the deep aquifer in August (104 m3/day)
WUDEEP9	float	Average daily water removal from the deep aquifer in September (104 m3/day)
WUDEEP10	float	Average daily water removal from the deep aquifer in October (104 m3/day)
WUDEEP11	float	Average daily water removal from the deep aquifer in November (104 m3/day)
WUDEEP12	float	Average daily water removal from the deep aquifer in December (104 m3/day)

Wwq: Contains SWAT watershed water quality (.wwq) input data

Field Name	Field Type	Definition
LAO	integer	Qual2E light averaging option
IGROPT	integer	Qual2E algae growth limiting option
AI0	float	Ratio of chlorophyll-a to algal biomass (µg-chla/mg algae)
AI1	float	Fraction of algal biomass that is nitrogen (mg N/mg alg)
AI2	float	Fraction of algal biomass that is phosphorus (mg P/mg alg)
AI3	float	Rate of oxygen production per unit algal photosynthesis (mg O2/mg alg)
AI4	float	Rate of oxygen uptake per unit of algal respiration (mg O2/mg alg)
AI5	float	The rate of oxygen uptake per unit of NH3-N oxidation (mg O2/mg NH3-N)
AI6	float	The rate of oxygen uptake per unit of NO2-N oxidation (mg O2/mg NO2-N)
MUMAX	float	Maximum specific algal growth rate (day-1)
RHOQ	float	Algal respiration rate (day-1)
TFACT	float	Fraction of solar radiation computed in the temperature heat balance that is photosynthetically active
K_L	float	Light saturation coefficient (kJ/(m2·min))
K_N	float	Michaelis-Menton half-saturation constant for nitrogen (mg N/L)
K_P	float	Michaelis-Menton half-saturation constant for phosphorus (mg P/L)
LAMBDA0	float	Non-algal portion of the light extinction coefficient (m-1)
LAMBDA1	float	Linear algal self-shading coefficient (m-1·(µg chla/L)-1)
LAMBDA2	float	Nonlinear algal self-shading coefficient (m-1·(µg chla/L)-2/3)
P_N	float	Algal preference factor for ammonia

APPENDIX 2: ARCSWAT RASTER GEODATABASE SPATIAL DATA

This appendix describes the spatial data found in the SWAT Project raster geodatabase ("RasterStore.mdb") created by the ArcSWAT interface. The datasets created and stored in this database are generated during the basin delineation process and used throughout remainder of the SWAT interface processes. The datasets and tables are listed alphabetically.

ClipDem: This grid represents the unmodified DEM clipped to the extent of the delineated watershed. It is derived from "SourceDem" grid.

DigitStream: This grid represents the burn-in streams defined by the user if the burn-in option is chosen.

FillDem: This grid represents the filled DEM clipped to the extent of the mask. If stream burning was performed, then the burned streams are represented in the FillDem.

FlowAcc: This grid represents the flow accumulation based off the FillDem.

FlowDir: This grid represents the flow direction based off the FillDem.

Mask: This grid represents focus area for all watershed delineation operations.

Slope: This grid represents slope (%) calculated from the SourceDem, clipped to the watershed boundary.

SourceDem: This grid represents the raw DEM loaded from the user-defined DEM. It is an exact copy of the user-defined DEM managed by the RasterStore geodatabase.

StreamLink: This grid represents the streams defined by the interface during the stream definition. This grid is not created if user-defined watersheds and streams are imported. Each raster value represents a different stream segment that terminates at an outlet.

TargetDem: This grid represents the DEM that has been modified by a mask, burn-in and filling. It is the DEM for which the watershed delineation operation is applied.

Watershed: This dataset is a raster representation of the "Watershed" feature class. Each raster value represents a different subbasin.

APPENDIX 3: ARCSWAT PARAMETER DATABASE SPATIAL DATA AND TABLES

This appendix describes the tables found in the "SWAT2005.mdb" geodatabase included with the ArcSWAT interface. The tables are listed alphabetically.

Spatial Data

US\weatherstations: This feature class contains the points for all the U.S. weather generator stations, including their parameters. See the description of "Statwgn" in the Tabular Data section that follows for details the attributes for this dataset.

Tabular Data

autoinpar: This table contains parameters, their calibration ranges and setting values for use with the ArcSWAT auto-calibration and sensitivity analysis tools.

Field Name	**Field Type**	**Definition**
PARAMETER	text	Name of SWAT input variable
TYPE	Integer	The type describes the physical level at which a parameter mat be varied: 1 = basin-level parameter 2 = subbasin-level parameter 3 = hru-level parameter 4 = crop-level parameter
CODE	Integer	The numeric ID of the parameter
MIN	Float	Minimum value allowed for SWAT input variable
MAX	Float	Maximum value allowed for SWAT input variable
IMET	Integer	Code for how a parameter will be varied within its range: 1 = any value within range 2 = adding/ subtracting an absolute value 3 = adding/subtracting a percent or value
SENSGRP	Integer	Code for which sensitivity analysis group the parameter belongs: 1 = flow 2 = sediment 3 = water quality

autooutpar: This table contains a lookup for SWAT output parameters that can be evaluated during sensitivity analysis and calibration.

Field Name	**Field Type**	**Definition**
PARAMETER	text	Name of SWAT output variable
CODE	Integer	The numeric ID of the parameter

BsnRng: This table contains appropriate parameter ranges for the SWAT .bsn inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CRNAME	text	Name of SWAT input variable from .bsn file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
PAGE	Integer	N/A
POS	Integer	N/A
FORMAT	Integer	N/A
TITLE	Integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

ChmRng: This table contains appropriate parameter ranges for the SWAT .chm inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CRNAME	Text	Name of SWAT input variable from .chm file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
MOFLAG	Float	N/A
TYPE	Integer	N/A
FORMAT	Float	N/A
TITLE	Text	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

CodRng: This table contains appropriate parameter ranges for the SWAT .cod inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CNUM	integer	Unique variable number--used by ArcSWAT interface only
CRNAME	text	Name of SWAT input variable from .cod file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

Crop/CropDefault: The crop table holds SWAT input values for variables stored in the land cover/plant growth database (crop.dat) file. The interface comes with a set of default land covers/plants whose input values are preset. The user may edit the preset input values and add values for additional land cover/plants via the Edit Databases feature described in Section 15. The preset plant growth parameter values for the default land covers are stored in the cropdefault table so that they may be recovered at any time. Detailed descriptions of the variables may be found in the SWAT User Manual.

Field Name	Field Type	Definition
ICNUM	Integer	Land cover/plant code from crop.dat
CPNM	Text	4-character code to represent the land cover/plant name
IDC	Integer	Land cover/plant classification: warm season annual legume cold season annual legume perennial legume warm season annual cold season annual perennial tree
CROPNAME	Text	Full land cover/plant name
BIO_E	float	Biomass/energy ratio or radiation use efficiency value for land cover/plant ((kg/ha)/(MJ/m2))
HVSTI	float	Harvest index for land cover/plant ((kg/ha)/(kg/ha))
BLAI	float	Maximum potential leaf area index for land cover/plant
FRGRW1	Float	Fraction of BLAI corresponding to first point on the optimal leaf area development curve for land cover/plant
LAIMX1	Float	Percent growing season corresponding to first point on the optimal leaf area development curve for land cover/plant
FRGRW2	Float	Fraction of BLAI corresponding to second point on the optimal leaf area development curve for land cover/plant
LAIMX2	Float	Percent growing season corresponding to second point on the optimal leaf area development curve for land cover/plant
DLAI	float	Fraction of land cover/plant's growing season when leaf area declines
CHTMX	float	Maximum canopy height for land cover/plant (m)
RDMX	float	Maximum root depth for land cover/plant (m)
T_OPT	float	Optimal temperature for growth of land cover/plant (ºC)
T_BASE	float	Minimum temperature for growth of land cover/plant (ºC)
CNYLD	float	Normal fraction of nitrogen in seed for land cover/plant (kg N/kg seed)
CPYLD	float	Normal fraction of phosphorus in seed for land cover/plant (kg P/kg seed)
BN1	float	Normal fraction of nitrogen in land cover/plant at emergence (kg N/kg biomass)
BN2	float	Normal fraction of nitrogen in land cover/plant at 0.5 maturity (kg N/kg biomass)

BN3	float	Normal fraction of nitrogen in land cover/plant at 1.0 maturity (kg N/kg biomass)
BP1	float	Normal fraction of phosphorus in land cover/plant at emergence (kg P/kg biomass)
BP2	float	Normal fraction of phosphorus in land cover/plant at 0.5 maturity (kg P/kg biomass)
BP3	float	Normal fraction of phosphorus in land cover/plant at 1.0 maturity (kg P/kg biomass)
WSYF	float	Lower limit of harvest index
USLE_C	float	Minimum value of USLE C factor for land cover/plant
GSI	float	Maximum stomatal conductance for land cover/plant (m/s)
VPDFR	Float	Vapor pressure deficit corresponding to the second point on the stomatal conductance curve.
FRGMAX	Float	Fraction of maximum stomatal conductance corresponding to the second point on the stomatal conductance curve.
WAVP	Float	Rate of decline in radiation use efficiency per unit increase in vapor pressure deficit
CO2HI	float	Elevated CO2 atmospheric concentration corresponding to the second point on the radiation use efficiency curve.
BIOEHI	float	Biomass-energy ratio corresponding to the second point on the radiation use efficiency curve.
RSDCO_PL	float	Plant residue decomposition coefficient.
OV_N	Float	Default Manning's "n" value for overland flow for land cover/plant
CN2A	Float	Default SCS CN value for moisture condition II used for the land cover/plant in HRUs where the plant is growing on a soil with a hydrologic group classification of A
CN2B	Float	Default SCS CN value for moisture condition II used for the land cover/plant in HRUs where the plant is growing on a soil with a hydrologic group classification of B
CN2C	Float	Default SCS CN value for moisture condition II used for the land cover/plant in HRUs where the plant is growing on a soil with a hydrologic group classification of C
CN2D	float	Default SCS CN value for moisture condition II used for the land cover/plant in HRUs where the plant is growing on a soil with a hydrologic group classification of D
FERTFIELD	integer	Fertilizer flag 1: include auto-fertilizer operation in default mgt file 0: do not include auto-fertilizer operation in default mgt file
MAT_YRS	float	Number of years required for tree species to reach full development (years).
BMX_TREES	float	Maximum biomass for a forest (metric

		tons/ha).
EXT_COEF	float	Light extinction coefficient.

CropRng: This table contains appropriate parameter ranges for the SWAT crop database inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CNUM	integer	Unique variable number--used by ArcSWAT interface only
CRNAME	text	Name of SWAT input variable from land cover/plant growth database (crop.dat) file
MIN	float	Minimum value allowed for SWAT input variables with a precision of 2 places behind the decimal
MAX	float	Maximum value allowed for SWAT input variables with a precision of 2 places behind the decimal
DEF	Text	Short definition of SWAT input variable displayed in yellow pop-up messages
FORMAT	integer	N/A

Fert/FertDefault: The fert table holds SWAT input values for variables stored in the fertilizer database (fert.dat) file. The interface comes with a set of default fertilizers/manure whose input values are pre-set. The user may edit the pre-set input values and add values for additional fertilizers/manure via the Edit Databases feature described in Section 15. The pre-set fertilizer parameter values for the default fertilizers/manure are stored in the fertdefault table so that they may be recovered at any time. Detailed descriptions of the variables may be found in the SWAT User Manual.

Field Name	Field Type	Definition
IFNUM	Integer	Fertilizer number
FERTNM	Text	8-character name for fertilizer
FMINN	float	Fraction of mineral N (NO3 and NH4) in fertilizer (kg N/kg fert)
FMINP	float	Fraction of mineral P in fertilizer (kg P/kg fert)
FORGN	float	Fraction of organic N in fertilizer (kg N/kg fert)
FORGP	float	Fraction of organic P in fertilizer (kg P/kg fert)
FNH3N	float	Fraction of mineral N in fertilizer applied as ammonia N (kg NH3-N/kg min N)
BACTPDB	float	Concentration of persistent bacteria in manure/fertilizer (# bacteria/kg manure)
BACTLPDB	float	Concentration of less-persistent bacteria in manure/fertilizer (# bacteria/kg manure)
BACTKDDB	float	Bacterial partition coefficient
FERTNAME	Text	Full name or description of fertilizer/manure
MANURE	integer	Manure flag. A value of “1” indicates that this is a manure.

FertRng: This table contains appropriate parameter ranges for the SWAT fertilizer database inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
FNUM	integer	Unique variable number--used by ArcSWAT interface only
FLDNAM	text	Name of SWAT input variable from fertilizer database (fert.dat) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
FORMAT		
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

GwRng: This table contains appropriate parameter ranges for the SWAT .gw inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CNUM	integer	Unique variable number--used by ArcSWAT interface only
CRNAME	text	Name of SWAT input variable from groundwater (.gw) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
POS	integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

HruRng: This table contains appropriate parameter ranges for the SWAT .hru inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
HNAME	text	Name of SWAT input variable from HRU general data (.hru) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
FORMAT	Integer	N/A
POS	integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

Irr: This table contains appropriate parameter value for SWAT irrigation source options. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
IRRNUM	Integer	Irrigation source ID
IRRNAME	text	Irrigation source description

MgtDate: This table contains valid date values for SWAT management operations.

Field Name	Field Type	Definition
MONTH	Integer	Month number
DAY	Integer	Days in the month
MONAME	integer	Month name

MgtOpRng: This table contains appropriate parameter ranges for the SWAT management operations. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
VARIABLE	Text	Name of SWAT input variable from management operations data (.mgt2) file
CRNAME	Text	Name of SWAT input variable from management operations data (.mgt2) file
MIN	Float	Minimum value allowed for SWAT input variable
MAX	Float	Maximum value allowed for SWAT input variable
FORMAT	Float	N/A
POS	Float	N/A
TYPE	Float	N/A
NMGT	Float	Management operation number parameter is related to
TXT	Float	N/A
TXL	Float	N/A
DEF	Text	Short definition of SWAT input variable displayed in yellow pop-up messages

MgtRng: This table contains appropriate parameter ranges for the SWAT general management parameters. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
VARIABLE		Name of SWAT input variable from management operations data (.mgt2) file
CRNAME		Name of SWAT input variable from management operations data (.mgt2) file
MIN		Minimum value allowed for SWAT input variable
MAX		Maximum value allowed for SWAT input variable
FORMAT		N/A
POS		N/A
DEF		Short definition of SWAT input variable

		displayed in yellow pop-up messages

MgtSCS: This table contains values for SCS curve numbers for various crop conditions and hydrologic soil groups.

Field Name	Field Type	Definition
CONDITION	Text	Land cover description
CONSUB	Text	Secondary land cover description
CROP	Text	Cropping practice
COVER	Text	Crop cover
A	Float	Hydrologic group A curve number
B	Float	Hydrologic group B curve number
C	Float	Hydrologic group C curve number
D	float	Hydrologic group D curve number

MgtType: This table contains values and descriptions of the various SWAT management operations available.

Field Name	Field Type	Definition
OP	Text	Operation description
OP1	Text	Operation name
OPNUM	integer	Operation ID

Nlcd_lu: This table contains lookup value for the 1992 NLCD.

Field Name	Field Type	Definition
VALUE_	integer	NLCD raster value
LANDUSE	Text	4-character SWAT land cover code for NLCD value

OvnRng: This table contains values for Manning's n numbers for various land cover conditions.

Field Name	Field Type	Definition
CONDITION	Text	Type of channel
CONSUB	Text	Channel description
CONSUB2	Text	Secondary channel description
VALUE	Float	Default value
VALMIN	Float	Min value
VALMAX	Float	Max value

Pest/PestDefault: The pest table holds SWAT input values for variables stored in the pesticide database (pest.dat) file. The interface comes with a set of default pesticides whose input values are pre-set. The user may edit the pre-set input values and add values for additional pesticides via the Edit Databases feature described in Section 15. The pre-set pesticide parameter values for the default pesticides are stored in the pestdefault table so that they may be recovered at any time. Detailed descriptions of the variables may be found in the SWAT User Manual.

Field Name	Field Type	Definition
IPNUM	integer	Number of pesticide
PNAME	text	16-character name of pesticide product
SKOC	float	Soil adsorption coefficient normalized for soil organic carbon content (mg/kg)/(mg/L)
WOF	float	Wash-off fraction
HLIFE_F	float	Degradation half-life of the chemical on the foliage (days)
HLIFE_S	float	Degradation half-life of the chemical in the soil (days)
AP_EF	float	Application efficiency
WSOL	float	Solubility of the chemical in water (mg/L)
HENRY	integer	Henry's Law Constant for the chemical (unitless)
PESTNAME	text	Pesticide name

Pestrng.dbf: This table contains appropriate parameter ranges for the SWAT pesticide database inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
FNUM	integer	Unique variable number--used by ArcSWAT interface only
PNAME	text	Name of SWAT input variable from pesticide database (pest.dat) file
MIN	float	Minimum value allowed for SWAT input variables with a precision of 2 places behind the decimal
MAX	float	Maximum value allowed for SWAT input variables with a precision of 2 places behind the decimal
FORMAT	integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

PndRng This table contains appropriate parameter ranges for the SWAT .pnd inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CNUM	integer	Unique variable number--used by ArcSWAT interface only
CRNAME	text	Name of SWAT input variable from pond/wetland (.pnd) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input

		variable
POS	Integer	N/A
FORMAT	Integer	N/A
TYPE	integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

ResRng: This table contains appropriate parameter ranges for the SWAT .res inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CRNAME	text	Name of SWAT input variable from reservoir (.res) file
NAME	text	Parameter name
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
FORMAT	Integer	N/A
TYPE	integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

RteRng: This table contains appropriate parameter ranges for the SWAT .rte inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CNUM	integer	Unique variable number--used by ArcSWAT interface only
CRNAME	text	Name of SWAT input variable from main channel data (.rte) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
POS	Integer	N/A
FORMAT	integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

SoilRng: This table contains appropriate parameter ranges for the SWAT user soils database inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
FIELD	text	Name of SWAT input variable from soil data (.sol) file
MOFLAG		
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input

		variable
HYDGRP1	text	Character code option #1 allowed for SWAT input variable
HYDGRP2	text	Character code option #2 allowed for SWAT input variable
HYDGRP3	text	Character code option #3 allowed for SWAT input variable
HYDGRP4	text	Character code option #4 allowed for SWAT input variable
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages
FORMAT	integer	N/A

Soilsus: This table contains a listing of all the U.S. STATSGO soils components.

Field Name	Field Type	Definition
MUID	text	The MUID name of the soil
STMUID	Text	The state MUID name of the soil
SEQN	integer	The soil sequence number
NAME	Text	The soul component name
S5ID	Text	The soils 5 database ID

Statwgn: This table contains the parameters for the U.S. nationwide network of weather generator stations. Detailed descriptions of the variables may be found in the SWAT User Manual.

Field Name	Field Type	Definition
STATE	text	statwgn.dbf only: 2-character FIPS code for state that the weather station is located in
STATION	text	Name of weather station
WLATITUDE	float	Latitude of weather station
WLONGITUDE	float	Longitude of weather station
WELEV	float	Elevation of weather station
ID	integer	statwgn.dbf only: Sequence number of weather station within listing for state
RAIN_YRS	float	Number of years of data used to determine values for RAIN_HHMX
TMPMX1	float	Average maximum air temperature for January (ºC)
TMPMX2	float	Average maximum air temperature for February (ºC)
TMPMX3	float	Average maximum air temperature for March (ºC)
TMPMX4	float	Average maximum air temperature for April (ºC)
TMPMX5	float	Average maximum air temperature for May (ºC)
TMPMX6	float	Average maximum air temperature for June (ºC)
TMPMX7	float	Average maximum air temperature for July (ºC)
TMPMX8	float	Average maximum air temperature for

		August (ºC)
TMPMX9	float	Average maximum air temperature for September (ºC)
TMPMX10	float	Average maximum air temperature for October (ºC)
TMPMX11	float	Average maximum air temperature for November (ºC)
TMPMX12	float	Average maximum air temperature for December (ºC)
TMPMN1	float	Average minimum air temperature for January (ºC)
TMPMN2	float	Average minimum air temperature for February (ºC)
TMPMN3	float	Average minimum air temperature for March (ºC)
TMPMN4	float	Average minimum air temperature for April (ºC)
TMPMN5	float	Average minimum air temperature for May (ºC)
TMPMN6	float	Average minimum air temperature for June (ºC)
TMPMN7	float	Average minimum air temperature for July (ºC)
TMPMN8	float	Average minimum air temperature for August (ºC)
TMPMN9	float	Average minimum air temperature for September (ºC)
TMPMN10	float	Average minimum air temperature for October (ºC)
TMPMN11	float	Average minimum air temperature for November (ºC)
TMPMN12	float	Average minimum air temperature for December (ºC)
TMPSTDMX1	float	Standard deviation of maximum air temperature for January (ºC)
TMPSTDMX2	float	Standard deviation of maximum air temperature for February (ºC)
TMPSTDMX3	float	Standard deviation of maximum air temperature for March (ºC)
TMPSTDMX4	float	Standard deviation of maximum air temperature for April (ºC)
TMPSTDMX5	float	Standard deviation of maximum air temperature for May (ºC)
TMPSTDMX6	float	Standard deviation of maximum air temperature for June (ºC)
TMPSTDMX7	float	Standard deviation of maximum air temperature for July (ºC)
TMPSTDMX8	float	Standard deviation of maximum air temperature for August (ºC)
TMPSTDMX9	float	Standard deviation of maximum air temperature for September (ºC)
TMPSTDMX10	float	Standard deviation of maximum air temperature for October (ºC)
TMPSTDMX11	float	Standard deviation of maximum air

		temperature for November (ºC)
TMPSTDMX12	float	Standard deviation of maximum air temperature for December (ºC)
TMPSTDMN1	float	Standard deviation of minimum air temperature for January (ºC)
TMPSTDMN2	float	Standard deviation of minimum air temperature for February (ºC)
TMPSTDMN3	float	Standard deviation of minimum air temperature for March (ºC)
TMPSTDMN4	float	Standard deviation of minimum air temperature for April (ºC)
TMPSTDMN5	float	Standard deviation of minimum air temperature for May (ºC)
TMPSTDMN6	float	Standard deviation of minimum air temperature for June (ºC)
TMPSTDMN7	float	Standard deviation of minimum air temperature for July (ºC)
TMPSTDMN8	float	Standard deviation of minimum air temperature for August (ºC)
TMPSTDMN9	float	Standard deviation of minimum air temperature for September (ºC)
TMPSTDMN10	float	Standard deviation of minimum air temperature for October (ºC)
TMPSTDMN11	float	Standard deviation of minimum air temperature for November (ºC)
TMPSTDMN12	float	Standard deviation of minimum air temperature for December (ºC)
PCPMM1	float	Average precipitation in January (mm)
PCPMM2	float	Average precipitation in February (mm)
PCPMM3	float	Average precipitation in March (mm)
PCPMM4	float	Average precipitation in April (mm)
PCPMM5	float	Average precipitation in May (mm)
PCPMM6	float	Average precipitation in June (mm)
PCPMM7	float	Average precipitation in July (mm)
PCPMM8	float	Average precipitation in August (mm)
PCPMM9	float	Average precipitation in September (mm)
PCPMM10	float	Average precipitation in October (mm)
PCPMM11	float	Average precipitation in November (mm)
PCPMM12	float	Average precipitation in December (mm)
PCPSTD1	float	Standard deviation for daily precipitation in January (mm/day)
PCPSTD2	float	Standard deviation for daily precipitation in February (mm/day)
PCPSTD3	float	Standard deviation for daily precipitation in March (mm/day)
PCPSTD4	float	Standard deviation for daily precipitation in April (mm/day)
PCPSTD5	float	Standard deviation for daily precipitation in May (mm/day)
PCPSTD6	float	Standard deviation for daily precipitation in June (mm/day)
PCPSTD7	float	Standard deviation for daily precipitation in July (mm/day)
PCPSTD8	float	Standard deviation for daily precipitation in

		August (mm/day)
PCPSTD9	float	Standard deviation for daily precipitation in September (mm/day)
PCPSTD10	float	Standard deviation for daily precipitation in October (mm/day)
PCPSTD11	float	Standard deviation for daily precipitation in November (mm/day)
PCPSTD12	float	Standard deviation for daily precipitation in December (mm/day)
PCPSKW1	float	Skew coefficient for daily precipitation in January
PCPSKW2	float	Skew coefficient for daily precipitation in February
PCPSKW3	float	Skew coefficient for daily precipitation in March
PCPSKW4	float	Skew coefficient for daily precipitation in April
PCPSKW5	float	Skew coefficient for daily precipitation in May
PCPSKW6	float	Skew coefficient for daily precipitation in June
PCPSKW7	float	Skew coefficient for daily precipitation in July
PCPSKW8	float	Skew coefficient for daily precipitation in August
PCPSKW9	float	Skew coefficient for daily precipitation in September
PCPSKW10	float	Skew coefficient for daily precipitation in October
PCPSKW11	float	Skew coefficient for daily precipitation in November
PCPSKW12	float	Skew coefficient for daily precipitation in December
PR_W1_1	float	Probability of wet day following dry day in January
PR_W1_2	float	Probability of wet day following dry day in February
PR_W1_3	float	Probability of wet day following dry day in March
PR_W1_4	float	Probability of wet day following dry day in April
PR_W1_5	float	Probability of wet day following dry day in May
PR_W1_6	float	Probability of wet day following dry day in June
PR_W1_7	float	Probability of wet day following dry day in July
PR_W1_8	float	Probability of wet day following dry day in August
PR_W1_9	float	Probability of wet day following dry day in September
PR_W1_10	float	Probability of wet day following dry day in October
PR_W1_11	float	Probability of wet day following dry day in November
PR_W1_12	float	Probability of wet day following dry day in

		December
PR_W2_1	float	Probability of wet day following wet day in January
PR_W2_2	float	Probability of wet day following wet day in February
PR_W2_3	float	Probability of wet day following wet day in March
PR_W2_4	float	Probability of wet day following wet day in April
PR_W2_5	float	Probability of wet day following wet day in May
PR_W2_6	float	Probability of wet day following wet day in June
PR_W2_7	float	Probability of wet day following wet day in July
PR_W2_8	float	Probability of wet day following wet day in August
PR_W2_9	float	Probability of wet day following wet day in September
PR_W2_10	float	Probability of wet day following wet day in October
PR_W2_11	float	Probability of wet day following wet day in November
PR_W2_12	float	Probability of wet day following wet day in December
PCPD1	float	Average number of days of precipitation in January
PCPD2	float	Average number of days of precipitation in February
PCPD3	float	Average number of days of precipitation in March
PCPD4	float	Average number of days of precipitation in April
PCPD5	float	Average number of days of precipitation in May
PCPD6	float	Average number of days of precipitation in June
PCPD7	float	Average number of days of precipitation in July
PCPD8	float	Average number of days of precipitation in August
PCPD9	float	Average number of days of precipitation in September
PCPD10	float	Average number of days of precipitation in October
PCPD11	float	Average number of days of precipitation in November
PCPD12	float	Average number of days of precipitation in December
RAINHHMX1	float	Maximum 0.5 h rainfall in January for entire period of record (mm)
RAINHHMX2	float	Maximum 0.5 h rainfall in February for entire period of record (mm)
RAINHHMX3	float	Maximum 0.5 h rainfall in March for entire

		period of record (mm)
RAINHHMX4	float	Maximum 0.5 h rainfall in April for entire period of record (mm)
RAINHHMX5	float	Maximum 0.5 h rainfall in May for entire period of record (mm)
RAINHHMX6	float	Maximum 0.5 h rainfall in June for entire period of record (mm)
RAINHHMX7	float	Maximum 0.5 h rainfall in July for entire period of record (mm)
RAINHHMX8	float	Maximum 0.5 h rainfall in August for entire period of record (mm)
RAINHHMX9	float	Maximum 0.5 h rainfall in September for entire period of record (mm)
RAINHHMX10	float	Maximum 0.5 h rainfall in October for entire period of record (mm)
RAINHHMX11	float	Maximum 0.5 h rainfall in November for entire period of record (mm)
RAINHHMX12	float	Maximum 0.5 h rainfall in December for entire period of record (mm)
SOLARAV1	float	Average daily solar radiation for January (MJ/m2/day)
SOLARAV2	float	Average daily solar radiation for February (MJ/m2/day)
SOLARAV3	float	Average daily solar radiation for March (MJ/m2/day)
SOLARAV4	float	Average daily solar radiation for April (MJ/m2/day)
SOLARAV5	float	Average daily solar radiation for May (MJ/m2/day)
SOLARAV6	float	Average daily solar radiation for June (MJ/m2/day)
SOLARAV7	float	Average daily solar radiation for July (MJ/m2/day)
SOLARAV8	float	Average daily solar radiation for August (MJ/m2/day)
SOLARAV9	float	Average daily solar radiation for September (MJ/m2/day)
SOLARAV10	float	Average daily solar radiation for October (MJ/m2/day)
SOLARAV11	float	Average daily solar radiation for November (MJ/m2/day)
SOLARAV12	float	Average daily solar radiation for December (MJ/m2/day)
DEWPT1	float	Average dew point in January (ºC)
DEWPT2	float	Average dew point in February (ºC)
DEWPT3	float	Average dew point in March (ºC)
DEWPT4	float	Average dew point in April (ºC)
DEWPT5	float	Average dew point in May (ºC)
DEWPT6	float	Average dew point in June (ºC)
DEWPT7	float	Average dew point in July (ºC)
DEWPT8	float	Average dew point in August (ºC)
DEWPT9	float	Average dew point in September (ºC)
DEWPT10	float	Average dew point in October (ºC)
DEWPT11	float	Average dew point in November (ºC)

DEWPT12	float	Average dew point in December (ºC)
WNDAV1	float	Average wind speed in January (m/s)
WNDAV2	float	Average wind speed in February (m/s)
WNDAV3	float	Average wind speed in March (m/s)
WNDAV4	float	Average wind speed in April (m/s)
WNDAV5	float	Average wind speed in May (m/s)
WNDAV6	float	Average wind speed in June (m/s)
WNDAV7	float	Average wind speed in July (m/s)
WNDAV8	float	Average wind speed in August (m/s)
WNDAV9	float	Average wind speed in September (m/s)
WNDAV10	float	Average wind speed in October (m/s)
WNDAV11	float	Average wind speed in November (m/s)
WNDAV12	float	Average wind speed in December (m/s)

SubRng: This table contains appropriate parameter ranges for the SWAT .sub inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CNUM	integer	Unique variable number--used by ArcSWAT interface only
CRNAME	text	Name of SWAT input variable from general HRU data (.sub) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages
FORMAT	Integer	N/A
RAD	Integer	N/A
TOP	integer	N/A

SwqRng: This table contains appropriate parameter ranges for the SWAT .swq inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CRNAME	text	Name of SWAT input variable from stream water quality data (.swq) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
POS	Integer	N/A
TYPE	Integer	N/A
FORMAT	Integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

Till/TillDefault: The till table holds SWAT input values for variables stored in the tillage database (till.dat) file. The interface comes with a set of default tillage operations whose input values are pre-set. The user may edit the pre-set input values and add values for additional tillage operations via the Edit Databases feature described in Section 14. The pre-set tillage parameter values for the default tillage operations are stored in the tilldefault table so that they may be recovered at any time. Detailed descriptions of the variables may be found in the SWAT User Manual.

Field Name	**Field Type**	**Definition**
ITNUM	integer	Number of tillage operation
TILLNM	text	8-character code representing the tillage operation name
EFTMIX	float	Mixing efficiency of the tillage operation
DEPTIL	float	Depth of mixing caused by the tillage operation (mm)
OPNAME	text	Full name or description of tillage operation
OPNUM	integer	4-digit number of tillage operation used to link to other database tables

Tillrng: This table contains appropriate parameter ranges for the SWAT tillage database inputs. This table is NOT currently linked to the interface.

Field Name	**Field Type**	**Definition**
CNUM	integer	Unique variable number--used by ArcSWAT interface only
OPNAME	text	Name of SWAT input variable from tillage database (till.dat) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	Float	Maximum value allowed for SWAT input variable
FORMAT	Integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

TSType: This table contains time series types in the ArcHydro definition format. These time series types are currently used for observed loadings for point source, inlet, and reservoir inputs.

Field Name	**Field Type**	**Definition**
TYTypeID	integer	Time series type ID
Variable	text	Time series type description
Units	Text	Units for time series
isTRegular	integer	Flag if measurements are at regular intervals
TSInterval	Integer	Interval of measurements
DataType	Integer	Time series type
Origin	integer	Origin of data series

Urban/UrbanDefault: The urban table holds SWAT input values for variables stored in the urban database (urban.dat) file. The interface comes with a set of default urban land types whose input values are pre-set. The user may edit the pre-set input values and add values for additional urban land types via the Edit Databases feature described in Section 15. The pre-set urban parameter values for the default urban land types are stored in the urbandefault table so that they may be recovered at any time. Detailed descriptions of the variables may be found in the SWAT User Manual.

Field Name	Field Type	Definition
IUNUM	integer	Number of urban land type
URBNAME	text	4-character code for urban land type
URBFLNM	text	Full name or description of urban land type
FIMP	float	Fraction total impervious area in urban land type
FCIMP	float	Fraction directly connected impervious area in urban land type
CURBDEN	float	Curb length density in urban land type (km/ha)
URBCOEF	float	Wash-off coefficient for removal of constituents from impervious area (mm-1)
DIRTMX	float	Maximum amount of solids allowed to build up on impervious areas (kg/curb km)
THALF	float	Number of days for amount of solids on impervious areas to build up from 0 kg/curb km to 1/2 DIRTMX (days)
TNCONC	float	Concentration of total nitrogen in suspended solid load from impervious areas (mg N/kg sediment)
TPCONC	float	Concentration of total phosphorus in suspended solid load from impervious areas (mg P/kg sediment)
TNO3CONC	float	Concentration of nitrate in suspended solid load from impervious areas (mg NO3-N/kg sediment)
OV_N	Float	Manning's roughness for pervious fraction
CN2A	Float	Curve number for hydro group A for pervious fraction
CN2B	Float	Curve number for hydro group B for pervious fraction
CN2C	Float	Curve number for hydro group C for pervious fraction
CN2D	Float	Curve number for hydro group D for pervious fraction
URBCN2	Float	Curve number for impervious fraction

Urbanrng.dbf: This table contains appropriate parameter ranges for the SWAT urban database inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
UNUM	Integer	Unique variable number--used by ArcSWAT interface only
URBNAME	Text	Name of SWAT input variable from urban database (urban.dat) file

MIN	Float	Minimum value allowed for SWAT input variable
MAX	Float	Maximum value allowed for SWAT input variable
FORMAT	Integer	N/A
DEF	Text	Short definition of SWAT input variable displayed in yellow pop-up messages

Usersoil/usersoildefault: This table contains the user soil descriptions. The usersoildefault table provides the set of user soil types initially provided with the interface. This table serves as a backup for the proper field and data type formatting of the usersoil table.

Field Name	Field Type	Definition
MUID	text	(statsgo tables only): STATSGO polygon number
SEQN	integer	(statsgo tables only): Sequence number of soil in STATSGO polygon listing
SNAME	text	Soil name
S5ID	text	(statsgo tables only): Soils5 ID number
CMPPCT	float	(statsgo tables only): percent of STATSGO polygon area covered by soil
NLAYERS	integer	Number of layers in soil profile
HYDGRP	text	Soil hydrologic group
SOL_ZMX	Float	Maximum rooting depth of profile
ANION_EXCL	Float	Fraction of porosity from which anions are excluded.
SOL_CRK	Float	Crack volume potential of soil
TEXTURE	text	Oil texture
SOL_Z1	Float	Depth to bottom of first soil layer (mm)
SOL_BD1	float	Moist bulk density of first soil layer (Mg/m3)
SOL_AWC1	float	Available water capacity of the first soil layer (mm H2O/mm soil)
SOL_K1	float	Saturated hydraulic conductivity of first soil layer (mm/hr)
SOL_CBN1	float	Organic carbon content of first soil layer (%)
CLAY1	float	Clay content of first soil layer (%)
SILT1	float	Silt content of first soil layer (%)
SAND1	float	Sand content of first soil layer (%)
ROCK1	float	Rock content of first soil layer (%)
SOL_ALB1	float	Moist soil albedo
USLE_K1	float	USLE equation soil erodibility (K) factor
SOL_EC1	float	Electrical conductivity
SOL_Z2	float	Depth to bottom of second soil layer (mm)
SOL_BD2	float	Moist bulk density of second soil layer (Mg/m3)
SOL_AWC2	float	Available water capacity of the second soil layer (mm H2O/mm soil)
SOL_K2	float	Saturated hydraulic conductivity of second soil layer (mm/hr)
SOL_CBN2	float	Organic carbon content of second soil layer (%)
CLAY2	float	Clay content of second soil layer (%)

SILT2	float	Silt content of second soil layer (%)
SAND2	float	Sand content of second soil layer (%)
ROCK2	float	Rock content of second soil layer (%)
SOL_ALB2	float	Moist soil albedo
USLE_K2	float	USLE equation soil erodibility (K) factor
SOL_EC2	float	Electrical conductivity
SOL_Z3	float	Depth to bottom of third soil layer (mm)
SOL_BD3	float	Moist bulk density of third soil layer(Mg/m3)
SOL_AWC3	float	Available water capacity of the third soil layer (mm H2O/mm soil)
SOL_K3	float	Saturated hydraulic conductivity of third soil layer (mm/hr)
SOL_CBN3	float	Organic carbon content of third soil layer (%)
CLAY3	float	Clay content of third soil layer (%)
SILT3	float	Silt content of third soil layer (%)
SAND3	float	Sand content of third soil layer (%)
ROCK3	float	Rock content of third soil layer (%)
SOL_ALB3	float	Moist soil albedo
USLE_K3	float	USLE equation soil erodibility (K) factor
SOL_EC3	float	Electrical conductivity
SOL_Z4	float	Depth to bottom of fourth soil layer (mm)
SOL_BD4	float	Moist bulk density of fourth soil layer (Mg/m3)
SOL_AWC4	float	Available water capacity of the fourth soil layer (mm H2O/mm soil)
SOL_K4	float	Saturated hydraulic conductivity of fourth soil layer (mm/hr)
SOL_CBN4	float	Organic carbon content of fourth soil layer (%)
CLAY4	float	Clay content of fourth soil layer (%)
SILT4	float	Silt content of fourth soil layer (%)
SAND4	float	Sand content of fourth soil layer (%)
ROCK4	float	Rock content of fourth soil layer (%)
SOL_ALB4	float	Moist soil albedo
USLE_K4	float	USLE equation soil erodibility (K) factor
SOL_EC4	float	Electrical conductivity
SOL_Z5	float	Depth to bottom of fifth soil layer (mm)
SOL_BD5	float	Moist bulk density of fifth soil layer (Mg/m3)
SOL_AWC5	float	Available water capacity of the fifth soil layer (mm H2O/mm soil)
SOL_K5	float	Saturated hydraulic conductivity of fifth soil layer (mm/hr)
SOL_CBN5	float	Organic carbon content of fifth soil layer (%)
CLAY5	float	Clay content of fifth soil layer (%)
SILT5	float	Silt content of fifth soil layer (%)
SAND5	float	Sand content of fifth soil layer (%)
ROCK5	float	Rock content of fifth soil layer (%)
SOL_ALB5	float	Moist soil albedo
USLE_K5	float	USLE equation soil erodibility (K) factor
SOL_EC5	float	Electrical conductivity
SOL_Z6	float	Depth to bottom of sixth soil layer (mm)
SOL_BD6	float	Moist bulk density of sixth soil layer(Mg/m3)
SOL_AWC6	float	Available water capacity of the sixth soil

		layer (mm H2O/mm soil)
SOL_K6	float	Saturated hydraulic conductivity of sixth soil layer (mm/hr)
SOL_CBN6	float	Organic carbon content of sixth soil layer (%)
CLAY6	float	Clay content of sixth soil layer (%)
SILT6	float	Silt content of sixth soil layer (%)
SAND6	float	Sand content of sixth soil layer (%)
ROCK6	float	Rock content of sixth soil layer (%)
SOL_ALB6	float	Moist soil albedo
USLE_K6	float	USLE equation soil erodibility (K) factor
SOL_EC6	float	Electrical conductivity
SOL_Z7	float	Depth to bottom of seventh soil layer (mm)
SOL_BD7	float	Moist bulk density of seventh soil layer (Mg/m3)
SOL_AWC7	float	Available water capacity of the seventh soil layer (mm H2O/mm soil)
SOL_K7	float	Saturated hydraulic conductivity of seventh soil layer (mm/hr)
SOL_CBN7	float	Organic carbon content of seventh soil layer (%)
CLAY7	float	Clay content of seventh soil layer (%)
SILT7	float	Silt content of seventh soil layer (%)
SAND7	float	Sand content of seventh soil layer (%)
ROCK7	float	Rock content of seventh soil layer (%)
SOL_ALB7	float	Moist soil albedo
USLE_K7	float	USLE equation soil erodibility (K) factor
SOL_EC7	float	Electrical conductivity
SOL_Z8	float	Depth to bottom of eighth soil layer (mm)
SOL_BD8	float	Moist bulk density of eighth soil layer (Mg/m3)
SOL_AWC8	float	Available water capacity of the eighth soil layer (mm H2O/mm soil)
SOL_K8	float	Saturated hydraulic conductivity of eighth soil layer (mm/hr)
SOL_CBN8	float	Organic carbon content of eighth soil layer (%)
CLAY8	float	Clay content of eighth soil layer (%)
SILT8	float	Silt content of eighth soil layer (%)
SAND8	float	Sand content of eighth soil layer (%)
ROCK8	float	Rock content of eighth soil layer (%)
SOL_ALB8	float	Moist soil albedo
USLE_K8	float	USLE equation soil erodibility (K) factor
SOL_EC8	float	Electrical conductivity
SOL_Z9	float	Depth to bottom of ninth soil layer (mm)
SOL_BD9	float	Moist bulk density of ninth soil layer (Mg/m3)
SOL_AWC9	float	Available water capacity of the ninth soil layer (mm H2O/mm soil)
SOL_K9	float	Saturated hydraulic conductivity of ninth soil layer (mm/hr)
SOL_CBN9	float	Organic carbon content of ninth soil layer (%)
CLAY9	float	Clay content of ninth soil layer (%)
SILT9	float	Silt content of ninth soil layer (%)

SAND9	float	Sand content of ninth soil layer (%)
ROCK9	float	Rock content of ninth soil layer (%)
SOL_ALB9	float	Moist soil albedo
USLE_K9	float	USLE equation soil erodibility (K) factor
SOL_EC9	float	Electrical conductivity
SOL_Z10	float	Depth to bottom of tenth soil layer (mm)
SOL_BD10	float	Moist bulk density of tenth soil layer (Mg/m3)
SOL_AWC10	float	Available water capacity of the tenth soil layer (mm H2O/mm soil)
SOL_K10	float	Saturated hydraulic conductivity of tenth soil layer (mm/hr)
SOL_CBN10	float	Organic carbon content of tenth soil layer (%)
CLAY10	float	Clay content of tenth soil layer (%)
SILT10	float	Silt content of tenth soil layer (%)
SAND10	float	Sand content of tenth soil layer (%)
ROCK10	float	Rock content of tenth soil layer (%)
SOL_ALB10	float	Moist soil albedo
USLE_K10	float	USLE equation soil erodibility (K) factor
SOL_EC10	float	Electrical conductivity

Userwgn: Data for user-added weather stations is stored in userwgn.dbf. Detailed descriptions of the variables may be found in the SWAT User Manual.

Field Name	**Field Type**	**Definition**
STATION	text	Name of weather station
WLATITUDE	float	Latitude of weather station
WLONGITUDE	float	Longitude of weather station
WELEV	float	Elevation of weather station
RAIN_YRS	float	Number of years of data used to determine values for RAIN_HHMX
TMPMX1	float	Average maximum air temperature for January (ºC)
TMPMX2	float	Average maximum air temperature for February (ºC)
TMPMX3	float	Average maximum air temperature for March (ºC)
TMPMX4	float	Average maximum air temperature for April (ºC)
TMPMX5	float	Average maximum air temperature for May (ºC)
TMPMX6	float	Average maximum air temperature for June (ºC)
TMPMX7	float	Average maximum air temperature for July (ºC)
TMPMX8	float	Average maximum air temperature for August (ºC)
TMPMX9	float	Average maximum air temperature for September (ºC)
TMPMX10	float	Average maximum air temperature for October (ºC)

TMPMX11	float	Average maximum air temperature for November (ºC)
TMPMX12	float	Average maximum air temperature for December (ºC)
TMPMN1	float	Average minimum air temperature for January (ºC)
TMPMN2	float	Average minimum air temperature for February (ºC)
TMPMN3	float	Average minimum air temperature for March (ºC)
TMPMN4	float	Average minimum air temperature for April (ºC)
TMPMN5	float	Average minimum air temperature for May (ºC)
TMPMN6	float	Average minimum air temperature for June (ºC)
TMPMN7	float	Average minimum air temperature for July (ºC)
TMPMN8	float	Average minimum air temperature for August (ºC)
TMPMN9	float	Average minimum air temperature for September (ºC)
TMPMN10	float	Average minimum air temperature for October (ºC)
TMPMN11	float	Average minimum air temperature for November (ºC)
TMPMN12	float	Average minimum air temperature for December (ºC)
TMPSTDMX1	float	Standard deviation of maximum air temperature for January (ºC)
TMPSTDMX2	float	Standard deviation of maximum air temperature for February (ºC)
TMPSTDMX3	float	Standard deviation of maximum air temperature for March (ºC)
TMPSTDMX4	float	Standard deviation of maximum air temperature for April (ºC)
TMPSTDMX5	float	Standard deviation of maximum air temperature for May (ºC)
TMPSTDMX6	float	Standard deviation of maximum air temperature for June (ºC)
TMPSTDMX7	float	Standard deviation of maximum air temperature for July (ºC)
TMPSTDMX8	float	Standard deviation of maximum air temperature for August (ºC)
TMPSTDMX9	float	Standard deviation of maximum air temperature for September (ºC)
TMPSTDMX10	float	Standard deviation of maximum air temperature for October (ºC)
TMPSTDMX11	float	Standard deviation of maximum air temperature for November (ºC)
TMPSTDMX12	float	Standard deviation of maximum air temperature for December (ºC)
TMPSTDMN1	float	Standard deviation of minimum air temperature for January (ºC)

TMPSTDMN2	float	Standard deviation of minimum air temperature for February (ºC)
TMPSTDMN3	float	Standard deviation of minimum air temperature for March (ºC)
TMPSTDMN4	float	Standard deviation of minimum air temperature for April (ºC)
TMPSTDMN5	float	Standard deviation of minimum air temperature for May (ºC)
TMPSTDMN6	float	Standard deviation of minimum air temperature for June (ºC)
TMPSTDMN7	float	Standard deviation of minimum air temperature for July (ºC)
TMPSTDMN8	float	Standard deviation of minimum air temperature for August (ºC)
TMPSTDMN9	float	Standard deviation of minimum air temperature for September (ºC)
TMPSTDMN10	float	Standard deviation of minimum air temperature for October (ºC)
TMPSTDMN11	float	Standard deviation of minimum air temperature for November (ºC)
TMPSTDMN12	float	Standard deviation of minimum air temperature for December (ºC)
PCPMM1	float	Average precipitation in January (mm)
PCPMM2	float	Average precipitation in February (mm)
PCPMM3	float	Average precipitation in March (mm)
PCPMM4	float	Average precipitation in April (mm)
PCPMM5	float	Average precipitation in May (mm)
PCPMM6	float	Average precipitation in June (mm)
PCPMM7	float	Average precipitation in July (mm)
PCPMM8	float	Average precipitation in August (mm)
PCPMM9	float	Average precipitation in September (mm)
PCPMM10	float	Average precipitation in October (mm)
PCPMM11	float	Average precipitation in November (mm)
PCPMM12	float	Average precipitation in December (mm)
PCPSTD1	float	Standard deviation for daily precipitation in January (mm/day)
PCPSTD2	float	Standard deviation for daily precipitation in February (mm/day)
PCPSTD3	float	Standard deviation for daily precipitation in March (mm/day)
PCPSTD4	float	Standard deviation for daily precipitation in April (mm/day)
PCPSTD5	float	Standard deviation for daily precipitation in May (mm/day)
PCPSTD6	float	Standard deviation for daily precipitation in June (mm/day)
PCPSTD7	float	Standard deviation for daily precipitation in July (mm/day)
PCPSTD8	float	Standard deviation for daily precipitation in August (mm/day)
PCPSTD9	float	Standard deviation for daily precipitation in September (mm/day)
PCPSTD10	float	Standard deviation for daily precipitation in October (mm/day)

PCPSTD11	float	Standard deviation for daily precipitation in November (mm/day)
PCPSTD12	float	Standard deviation for daily precipitation in December (mm/day)
PCPSKW1	float	Skew coefficient for daily precipitation in January
PCPSKW2	float	Skew coefficient for daily precipitation in February
PCPSKW3	float	Skew coefficient for daily precipitation in March
PCPSKW4	float	Skew coefficient for daily precipitation in April
PCPSKW5	float	Skew coefficient for daily precipitation in May
PCPSKW6	float	Skew coefficient for daily precipitation in June
PCPSKW7	float	Skew coefficient for daily precipitation in July
PCPSKW8	float	Skew coefficient for daily precipitation in August
PCPSKW9	float	Skew coefficient for daily precipitation in September
PCPSKW10	float	Skew coefficient for daily precipitation in October
PCPSKW11	float	Skew coefficient for daily precipitation in November
PCPSKW12	float	Skew coefficient for daily precipitation in December
PR_W1_1	float	Probability of wet day following dry day in January
PR_W1_2	float	Probability of wet day following dry day in February
PR_W1_3	float	Probability of wet day following dry day in March
PR_W1_4	float	Probability of wet day following dry day in April
PR_W1_5	float	Probability of wet day following dry day in May
PR_W1_6	float	Probability of wet day following dry day in June
PR_W1_7	float	Probability of wet day following dry day in July
PR_W1_8	float	Probability of wet day following dry day in August
PR_W1_9	float	Probability of wet day following dry day in September
PR_W1_10	float	Probability of wet day following dry day in October
PR_W1_11	float	Probability of wet day following dry day in November
PR_W1_12	float	Probability of wet day following dry day in December
PR_W2_1	float	Probability of wet day following wet day in January
PR_W2_2	float	Probability of wet day following wet day in February

PR_W2_3	float	Probability of wet day following wet day in March
PR_W2_4	float	Probability of wet day following wet day in April
PR_W2_5	float	Probability of wet day following wet day in May
PR_W2_6	float	Probability of wet day following wet day in June
PR_W2_7	float	Probability of wet day following wet day in July
PR_W2_8	float	Probability of wet day following wet day in August
PR_W2_9	float	Probability of wet day following wet day in September
PR_W2_10	float	Probability of wet day following wet day in October
PR_W2_11	float	Probability of wet day following wet day in November
PR_W2_12	float	Probability of wet day following wet day in December
PCPD1	float	Average number of days of precipitation in January
PCPD2	float	Average number of days of precipitation in February
PCPD3	float	Average number of days of precipitation in March
PCPD4	float	Average number of days of precipitation in April
PCPD5	float	Average number of days of precipitation in May
PCPD6	float	Average number of days of precipitation in June
PCPD7	float	Average number of days of precipitation in July
PCPD8	float	Average number of days of precipitation in August
PCPD9	float	Average number of days of precipitation in September
PCPD10	float	Average number of days of precipitation in October
PCPD11	float	Average number of days of precipitation in November
PCPD12	float	Average number of days of precipitation in December
RAINHHMX1	float	Maximum 0.5 h rainfall in January for entire period of record (mm)
RAINHHMX2	float	Maximum 0.5 h rainfall in February for entire period of record (mm)
RAINHHMX3	float	Maximum 0.5 h rainfall in March for entire period of record (mm)
RAINHHMX4	float	Maximum 0.5 h rainfall in April for entire period of record (mm)
RAINHHMX5	float	Maximum 0.5 h rainfall in May for entire period of record (mm)

RAINHHMX6	float	Maximum 0.5 h rainfall in June for entire period of record (mm)
RAINHHMX7	float	Maximum 0.5 h rainfall in July for entire period of record (mm)
RAINHHMX8	float	Maximum 0.5 h rainfall in August for entire period of record (mm)
RAINHHMX9	float	Maximum 0.5 h rainfall in September for entire period of record (mm)
RAINHHMX10	float	Maximum 0.5 h rainfall in October for entire period of record (mm)
RAINHHMX11	float	Maximum 0.5 h rainfall in November for entire period of record (mm)
RAINHHMX12	float	Maximum 0.5 h rainfall in December for entire period of record (mm)
SOLARAV1	float	Average daily solar radiation for January (MJ/m2/day)
SOLARAV2	float	Average daily solar radiation for February (MJ/m2/day)
SOLARAV3	float	Average daily solar radiation for March (MJ/m2/day)
SOLARAV4	float	Average daily solar radiation for April (MJ/m2/day)
SOLARAV5	float	Average daily solar radiation for May (MJ/m2/day)
SOLARAV6	float	Average daily solar radiation for June (MJ/m2/day)
SOLARAV7	float	Average daily solar radiation for July (MJ/m2/day)
SOLARAV8	float	Average daily solar radiation for August (MJ/m2/day)
SOLARAV9	float	Average daily solar radiation for September (MJ/m2/day)
SOLARAV10	float	Average daily solar radiation for October (MJ/m2/day)
SOLARAV11	float	Average daily solar radiation for November (MJ/m2/day)
SOLARAV12	float	Average daily solar radiation for December (MJ/m2/day)
DEWPT1	float	Average dew point in January (ºC)
DEWPT2	float	Average dew point in February (ºC)
DEWPT3	float	Average dew point in March (ºC)
DEWPT4	float	Average dew point in April (ºC)
DEWPT5	float	Average dew point in May (ºC)
DEWPT6	float	Average dew point in June (ºC)
DEWPT7	float	Average dew point in July (ºC)
DEWPT8	float	Average dew point in August (ºC)
DEWPT9	float	Average dew point in September (ºC)
DEWPT10	float	Average dew point in October (ºC)
DEWPT11	float	Average dew point in November (ºC)
DEWPT12	float	Average dew point in December (ºC)
WNDAV1	float	Average wind speed in January (m/s)
WNDAV2	float	Average wind speed in February (m/s)
WNDAV3	float	Average wind speed in March (m/s)
WNDAV4	float	Average wind speed in April (m/s)

WNDAV5	float	Average wind speed in May (m/s)
WNDAV6	float	Average wind speed in June (m/s)
WNDAV7	float	Average wind speed in July (m/s)
WNDAV8	float	Average wind speed in August (m/s)
WNDAV9	float	Average wind speed in September (m/s)
WNDAV10	float	Average wind speed in October (m/s)
WNDAV11	float	Average wind speed in November (m/s)
WNDAV12	float	Average wind speed in December (m/s)

Usgs: This is the land use conversion table for land use map grids using the USGS land use/land cover classification system.

Field Name	Field Type	Definition
VALUE	integer	map category number (equivalent to the USGS LULC code)
LANDUSE	text	SWAT land cover/plant code

Wgnrng: This table contains appropriate parameter ranges for the SWAT weather generator inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
WGNAME	text	WGN parameter name
CRNAME	text	Name of SWAT input variable from weather generator data (.wgn) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages
MOFLAG	integer	Unique variable number--used by ArcSWAT interface only
FORMAT	Integer	N/A
FORMAT1	text	N/A

WusRng: This table contains appropriate parameter ranges for the SWAT .wus inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CNUM	integer	Unique variable number--used by ArcSWAT interface only
CRNAME	text	Name of SWAT input variable from water use data (.wus) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
RAD	Integer	N/A
FORMAT	integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

WwqRng: This table contains appropriate parameter ranges for the SWAT .wwq inputs. This table is NOT currently linked to the interface.

Field Name	Field Type	Definition
CRNAME	text	Name of SWAT input variable from watershed water quality (.wwq) file
MIN	float	Minimum value allowed for SWAT input variable
MAX	float	Maximum value allowed for SWAT input variable
POS	Integer	N/A
FORMAT	integer	N/A
DEF	text	Short definition of SWAT input variable displayed in yellow pop-up messages

APPENDIX 4: ARCSWAT PROJECT DIRECTORY STRUCTURE

This appendix describes the directory structure created for a SWAT project by the ArcSWAT interface. The directories are described in an outline format below.

1. Project Folder: This is the top-level folder name defined using the "New SWAT Project" option from "SWAT Project Setup" menu. All project-specific SWAT files and folders are placed under this folder.

    a. ProjectFolder.mdb: This is the SWAT Project geodatabase

    b. RasterSTore.mdb: This is the SWAT Raster geodatabase

    c. RasterStore.idb: This folder contains the actual raster files referenced by the RasterStore.mdb geodatabase

    d. Scenarios: This folder contains sub-folders containing the files required for different SWAT model runs

        i. Default: This folder contains the SWAT model input files accessed by the ArcSWAT interface during model setup and input table editing.

            1. Scen: This folder can contain SWAT input scenario information (not currently active)

            2. TablesIn: This folder will contain a copy of the SWAT project geodatabase for a given model scenario. This copy of the SWAT project geodatabase represents a snapshot of the input tables when the model scenario was run, and does NOT exist for the "Default" scenario.

            3. TablesOut: This folder can contain SWAT output tables (not currently active)

            4. TxtInOut: This folder contains all of the input and output text files used and generated by the SWAT2005 model. The files in this folder will be continually updated as input text files are re-written and the model re-run.

ii. SimXX: Folders representing saved SWAT simulations will be saved at the same level as the “Default” folder. These folders will have the same sub-directory structure as the “Default” folder described above.

1. Scen: This folder can contain SWAT input scenario information (not currently active)

2. TablesIn: The “TablesIn” folder will always contain a snapshot of the SWAT Project geodatabase as it existed when the simulation was run.

3. TablesOut: This folder can contain SWAT output tables (not currently active)

4. TxtInOut: This folder contains all of the input and output text files used and generated by the SWAT2005 model for this saved output scenario.

   a. AutoCal: This folder will get created if auto-calibration is run for the simulation. It will contain a copy of all the files in the parent TxtInOut folder, which then get modified as the parameter values are explored during the model calibration process.

   b. Sensitivity: This folder will get created if sensitivity analysis is run for the simulation. It will contain a copy of all the files in the parent TxtInOut folder, which then get modified as the parameter values are explored during the model calibration process.

e. Watershed: This folder contains sub-folders of temporary spatial and tabular datasets created by the ArcSWAT interface, as well as output used for integration with the VizSWAT output analysis application and other data not stored in the SWAT geodatabases.

i. Grid: This folder contains raster datasets created by the ArcSWAT interface

ii. Shapes: This folder contains shapefiles of SWAT GIS layers exported by the ArcSWAT interface for use by VizSWAT

iii. Tables: This folder may contain temporary tables created by ArcSWAT

iv. Text: This folder contains the watershed, and HRU reports generated by the ArcSWAT interface.

APPENDIX 5: US STATE FIPS CODES

Alabama	AL	01	Nebraska	NE	31
Arizona	AZ	04	Nevada	NV	32
Arkansas	AR	05	New Hampshire	NH	33
California	CA	06	New Jersey	NJ	34
Colorado	CO	08	New Mexico	NM	35
Connecticut	CT	09	New York	NY	36
Delaware	DE	10	North Carolina	NC	37
Florida	FL	12	North Dakota	ND	38
Georgia	GA	13	Ohio	OH	39
Idaho	ID	16	Oklahoma	OK	40
Illinois	IL	17	Oregon	OR	41
Indiana	IN	18	Pennsylvania	PA	42
Iowa	IA	19	Rhode Island	RI	44
Kansas	KS	20	South Carolina	SC	45
Kentucky	KY	21	South Dakota	SD	46
Louisiana	LA	22	Tennessee	TN	47
Maine	ME	23	Texas	TX	48
Maryland	MD	24	Utah	UT	49
Massachusetts	MA	25	Vermont	VT	50
Michigan	MI	26	Virginia	VA	51
Minnesota	MN	27	Washington	WA	53
Mississippi	MS	28	West Virginia	WV	54
Missouri	MO	29	Wisconsin	WI	55
Montana	MT	30	Wyoming	WY	56