CHAPTER 5

SWAT INPUT DATA: .SUB

The subbasin general input file contains information related to a diversity of features within the subbasin. Data contained in the subbasin input file can be grouped into the following categories: subbasin size and location, specification of climatic data used within the subbasin, the amount of topographic relief within the subbasin and its impact on the climate, properties of tributary channels within the subbasin, variables related to climate change, the number of HRUs in the subbasin and the names of HRU input files.

Following is a brief description of the variables in the subbasin general input file. They are listed in the order they appear within the file.

Variable name	Definition
TITLE	The first line of the .sub file is reserved for user comments. The comments may take up to 80 spaces. The title line is not processed by the model and may be left blank. Optional.
SUB_KM	Area of subbasin (km^2). Required.
SUB_LAT	Latitude of subbasin (degrees). The latitude is expressed as a real number with minutes and seconds converted to fractions of a degree. Required.
SUB_ELEV	Elevation of subbasin (m). Required.
IRGAGE	Number of the measured precipitation record used within subbasin. Required if measured precipitation data is to be used in simulation.
ITGAGE	Number of the measured temperature record used within the subbasin. Required if measured temperature data is to be used in simulation.
ISGAGE	Number of the solar radiation record used within the subbasin. Required if measured solar radiation data is to be used in simulation.
IHGAGE	Number of the relative humidity record used within the subbasin. Required if measured relative humidity data is to be used in simulation.
IWGAGE	Number of the wind speed record used within the subbasin. Required if measured wind speed data is to be used in simulation.

Variable name	Definition
WGNFILE	Name of subbasin weather generator data file (**.wgn**). This file is described in Chapter 12. Required.
FCST_REG	Weather forecast region number assigned to subbasin. Weather generator parameters for the forecast region are used to simulate climatic processes during the forecast period of a simulation. Required only if weather forecasting is being incorporated into the simulation.
ELEVB(band)	Elevation at the center of the elevation band (m). Orographic precipitation is a significant phenomenon in certain areas of the world. To account for orographic effects on both precipitation and temperature, SWAT allows up to 10 elevation bands to be defined in each subbasin. The only processes modeled separately for each individual elevation band are the accumulation, sublimation and melting of snow. As with the initial precipitation and temperature data, after amounts of sublimation and snow melt are determined for each elevation band, subbasin average values are calculated. These average values are the values that are used in the remainder of the simulation and reported in the output files. Required if elevation bands are simulated in the subbasin.
ELEVB_FR(band)	Fraction of subbasin area within the elevation band. Values for ELEVB_FR should be between 0.0 and 1.0. Required if elevation bands are simulated in the subbasin.
SNOEB(BAND)	Initial snow water content in elevation band (mm H2O). The amount of snow in the elevation band is expressed as depth of water instead of depth of snow because the density of snow is highly variable. Optional.

Variable name	Definition
PLAPS	Precipitation lapse rate (mm H_2O/km). A positive value denotes an increase in precipitation with an increase in elevation while a negative value denotes a decrease in precipitation with an increase in elevation. The lapse rate is used to adjust precipitation for elevation bands in the subbasin. To adjust the precipitation, the elevation of the recording station or the weather station is compared to the elevation specified for the elevation band. If no elevation bands are defined, the precipitation generated or read in from the .pcp file is used for the subbasin with no adjustment Required if elevation bands are simulated in the subbasin
TLAPS	Temperature lapse rate (ºC/km). A positive value denotes an increase in temperature with an increase in elevation while a negative value denotes a decrease in temperature with an increase in elevation. The lapse rate is used to adjust temperature for elevation bands in the subbasin. To adjust the temperature, the elevation of the recording station or the weather station is compared to the elevation specified for the elevation band. If no elevation bands are defined, the temperature generated or read in from the .tmp file is used for the subbasin with no adjustment. If no value is entered for TLAPS, the model sets TLAPS = -6 ºC/km. Required if elevation bands are simulated in the subbasin.
SNO_SUB	Initial snow water content (mm H2O). The amount of snow in the subbasin is expressed as depth of water instead of depth of snow because the density of snow is highly variable. This value is not used if the subbasin is divided into elevation bands (see variables ELEVB, ELEVB_FR and SNOEB in this file). Optional.

Variable name	Definition
CH_L(1)	Longest "tributary" channel length in subbasin (km). The channel length is the distance along the channel from the subbasin outlet to the most distant point in the subbasin. Required.
CH_S(1)	Average slope of tributary channels (m/m). The average channel slope is computed by taking the difference in elevation between the subbasin outlet and the most distant point in the subbasin and dividing by CH_L. Required.
CH_W(1)	Average width of tributary channels (m). Required.
CH_K(1)	Effective hydraulic conductivity in tributary channel alluvium (mm/hr). This parameter controls transmission losses from surface runoff as it flows to the main channel in the subbasin. Required.
CH_N(1)	Manning's "n" value for the tributary channels Required.
PNDFILE	Name of subbasin pond input data file (**.pnd**). This file is described in Chapter 28. Required.

Table 6-1: Values of Manning's roughness coefficient, *n*, for channel flow (Chow, 1959).[1]

Characteristics of Channel	Median	Range
Excavated or dredged		
Earth, straight and uniform	0.025	0.016-0.033
Earth, winding and sluggish	0.035	0.023-0.050
Not maintained, weeds and brush	0.075	0.040-0.140
Natural streams		
Few trees, stones or brush	0.050	0.025-0.065
Heavy timber and brush	0.100	0.050-0.150

[1] Chow (1959) has a very extensive list of Manning's roughness coefficients. These values represent only a small portion of those he lists in his book.

Variable name	Definition
WUSFILE	Name of subbasin water use management data file (**.wus**). This file is described in Chapter 21. Required.
CO2	Carbon dioxide concentration (ppmv). If no value for CO2 is entered the model will set CO2 = 330 ppmv (ambient CO_2 concentration). Optional. Used only in climate change studies.
RFINC(mon)	Rainfall adjustment (% change). Daily rainfall within the month is adjusted by the specified percentage. For example, setting RFINC = 10 will make rainfall equal to 110% of the original value. Optional. Used only in climate change studies.
TMPINC(mon)	Temperature adjustment (ºC). Daily maximum and minimum temperatures within the month are raised or lowered by the specified amount. Optional. Used only in climate change studies.
RADINC(mon)	Radiation adjustment (MJ/m^2-day). Daily radiation within the month is raised or lowered by the specified amount. Optional. Used only in climate change studies.
HUMINC(mon)	Humidity adjustment. Daily values for relative humidity within the month are raised or lowered by the specified amount. The relative humidity in SWAT is reported as a fraction. Optional. Used only in climate change studies.
HRUTOT	Total number of HRUs modeled in the subbasin. Each subbasin must contain at least one HRU. HRUTOT includes special (pothole, floodplain, riparian) as well as generic HRUs. Required.
POT_HRUFILE	Name of pothole HRU general input data file (**.hru**). This file is described in Chapter 19. Optional.

Variable name	Definition
POT_MGFILE	Name of pothole HRU land use management data file (**.mgt**). This file is described in Chapter 20. Optional.
POT_SOLFILE	Name of pothole HRU soil data file (**.sol**). This file is described in Chapter 22. Optional.
POT_CHMFILE	Name of pothole HRU soil chemical data file (**.chm**). This file is described in Chapter 23. Optional.
POT_GWFILE	Name of pothole HRU groundwater data file (**.gw**). This file is described in Chapter 24. Optional.
FLD_HRUFILE	Name of floodplain HRU general input data file (**.hru**). *Not operational-future feature.*
FLD_MGTFILE	Name of floodplain HRU land use management data file (**.mgt**). *Not operational-future feature.*
FLD_SOLFILE	Name of floodplain HRU soil data file (**.sol**). *Not operational-future feature.*
FLD_CHMFILE	Name of floodplain HRU soil chemical data file (**.chm**). *Not operational-future feature.*
FLD_GWFILE	Name of floodplain HRU groundwater data file (**.gw**). *Not operational-future feature.*
RIP_HRUFILE	Name of riparian zone HRU general input data file (**.hru**). *Not operational-future feature.*
RIP_MGTFILE	Name of riparian zone HRU land use management data file (**.mgt**). *Not operational-future feature.*
RIP_SOLFILE	Name of riparian zone HRU soil data file (**.sol**). *Not operational-future feature.*

Variable name	Definition
RIP_CHMFILE	Name of riparian zone HRU soil chemical data file (**.chm**). *Not operational-future feature.*
RIP_GWFILE	Name of riparian zone HRU groundwater data file (**.gw**). *Not operational-future feature.*
HRUFILE	Name of generic HRU general input data file (**.hru**). This file is described in Chapter 19. Required.
MGTFILE	Name of generic HRU land use management data file (**.mgt**). This file is described in Chapter 20. Required.
SOLFILE	Name of generic HRU soil data file (**.sol**). This file is described in Chapter 22. Required.
CHMFILE	Name of generic HRU soil chemical data file (**.chm**). This file is described in Chapter 23. Required.
GWFILE	Name of generic HRU groundwater data file (**.gw**). This file is described in Chapter 24. Required.
OPSFILE	Name of generic HRU operation scheduling data file (**.ops**). This file is described in Chapter 33.
SEPTFILE	Name of generic HRU septic data file (**.sep**). This file is described in Chapter 34.
SDRFILE	Name of generic HRU subbasin drainage file (**.sdr**) This file is described in Chapter 40.

The subbasin general input file is partially free format and partially fixed format. The variables that are free format will have *free* listed in the **F90Format** column and will not have a position defined. The variables that are fixed format will have a FORTRAN format and position specified.

The free format variables may be placed in any position the user wishes on the line. Values for variables classified as integers *should not* include a decimal while values for variables classified as reals *must* contain a decimal. A blank space denotes the end of an input value and the beginning of the next value if there is another on the line.

The fixed format variables must be entered using the specified format and positioning on the line in order for the model to read them properly.

The format for the subbasin general input file is:

Variable name	Line #	Position	Format	F90 Format
TITLE	1	space 1-80	character	a80
SUB_KM	2		integer	free
Comment line	3	space 1-80	character	a80
Comment line	4	space 1-80	character	a80
SUB_LAT	5		real	free
SUB_ELEV	6		real	free
IRGAGE	7		integer	free
ITGAGE	8		integer	free
ISGAGE	9		integer	free
IHGAGE	10		integer	free
IWGAGE	11		integer	free
WGNFILE	12	space 1-13	character	a13
FCST_REG	13	space 1-13	character	a13
Comment line	14	space 1-80	character	a80
Comment line	15	space 1-80	character	a80
ELEVB(1)	16	space 1-8	decimal (xxxx.xxx)	f8.3
ELEVB(2)	16	space 9-16	decimal (xxxx.xxx)	f8.3
ELEVB(3)	16	space 17-24	decimal (xxxx.xxx)	f8.3
ELEVB(4)	16	space 25-32	decimal (xxxx.xxx)	f8.3

Variable name	Line #	Position	Format	F90 Format
ELEVB(5)	16	space 33-40	decimal (xxxx.xxx)	f8.3
ELEVB(6)	16	space 41-48	decimal (xxxx.xxx)	f8.3
ELEVB(7)	16	space 49-56	decimal (xxxx.xxx)	f8.3
ELEVB(8)	16	space 57-64	decimal (xxxx.xxx)	f8.3
ELEVB(9)	16	space 65-72	decimal (xxxx.xxx)	f8.3
ELEVB(10)	16	space 73-80	decimal (xxxx.xxx)	f8.3
Comment line	17	space 1-80	character	a80
ELEVB_FR(1)	18	space 1-8	decimal (xxxx.xxx)	f8.3
ELEVB_FR(2)	18	space 9-16	decimal (xxxx.xxx)	f8.3
ELEVB_FR(3)	18	space 17-24	decimal (xxxx.xxx)	f8.3
ELEVB_FR(4)	18	space 25-32	decimal (xxxx.xxx)	f8.3
ELEVB_FR(5)	18	space 33-40	decimal (xxxx.xxx)	f8.3
ELEVB_FR(6)	18	space 41-48	decimal (xxxx.xxx)	f8.3
ELEVB_FR(7)	18	space 49-56	decimal (xxxx.xxx)	f8.3
ELEVB_FR(8)	18	space 57-64	decimal (xxxx.xxx)	f8.3
ELEVB_FR(9)	18	space 65-72	decimal (xxxx.xxx)	f8.3
ELEVB_FR(10)	18	space 73-80	decimal (xxxx.xxx)	f8.3
Comment line	19	space 1-80	character	a80
SNOEB(1)	20	space 1-8	decimal (xxxx.xxx)	f8.3
SNOEB(2)	20	space 9-16	decimal (xxxx.xxx)	f8.3
SNOEB(3)	20	space 17-24	decimal (xxxx.xxx)	f8.3
SNOEB(4)	20	space 25-32	decimal (xxxx.xxx)	f8.3
SNOEB(5)	20	space 33-40	decimal (xxxx.xxx)	f8.3
SNOEB(6)	20	space 41-48	decimal (xxxx.xxx)	f8.3
SNOEB(7)	20	space 49-56	decimal (xxxx.xxx)	f8.3
SNOEB(8)	20	space 57-64	decimal (xxxx.xxx)	f8.3
SNOEB(9)	20	space 65-72	decimal (xxxx.xxx)	f8.3
SNOEB(10)	20	space 73-80	decimal (xxxx.xxx)	f8.3
PLAPS	21		real	free
TLAPS	22		real	free
SNO_SUB	23		real	free
Comment line	24	space 1-80	character	a80
CH_L(1)	25		real	free
CH_S(1)	26		real	free

Variable name	Line #	Position	Format	F90 Format
CH_W(1)	27		real	free
CH_K(1)	28		real	free
CH_N(1)	29		real	free
Comment line	30	space 1-80	character	a80
PNDFILE	31	space 1-13	character	a13
Comment line	32	space 1-80	character	a80
WUSFILE	33	space 1-13	character	a13
Comment line	34	space 1-80	character	a80
CO2	35		real	free
Comment line	36	space 1-80	character	a80
RFINC(1)	37	space 1-8	decimal (xxxx.xxx)	f8.3
RFINC(2)	37	space 9-16	decimal (xxxx.xxx)	f8.3
RFINC(3)	37	space 17-24	decimal (xxxx.xxx)	f8.3
RFINC(4)	37	space 25-32	decimal (xxxx.xxx)	f8.3
RFINC(5)	37	space 33-40	decimal (xxxx.xxx)	f8.3
RFINC(6)	37	space 41-48	decimal (xxxx.xxx)	f8.3
Comment line	38	space 1-80	character	a80
RFINC(7)	39	space 1-8	decimal (xxxx.xxx)	f8.3
RFINC(8)	39	space 9-16	decimal (xxxx.xxx)	f8.3
RFINC(9)	39	space 17-24	decimal (xxxx.xxx)	f8.3
RFINC(10)	39	space 25-32	decimal (xxxx.xxx)	f8.3
RFINC(11)	39	space 33-40	decimal (xxxx.xxx)	f8.3
RFINC(12)	39	space 41-48	decimal (xxxx.xxx)	f8.3
Comment line	40	space 1-80	character	a80
TMPINC(1)	41	space 1-8	decimal (xxxx.xxx)	f8.3
TMPINC(2)	41	space 9-16	decimal (xxxx.xxx)	f8.3
TMPINC(3)	41	space 17-24	decimal (xxxx.xxx)	f8.3
TMPINC(4)	41	space 25-32	decimal (xxxx.xxx)	f8.3
TMPINC(5)	41	space 33-40	decimal (xxxx.xxx)	f8.3
TMPINC(6)	41	space 41-48	decimal (xxxx.xxx)	f8.3
Comment line	42	space 1-80	character	a80
TMPINC(7)	43	space 1-8	decimal (xxxx.xxx)	f8.3
TMPINC(8)	43	space 9-16	decimal (xxxx.xxx)	f8.3
TMPINC(9)	43	space 17-24	decimal (xxxx.xxx)	f8.3
TMPINC(10)	43	space 25-32	decimal (xxxx.xxx)	f8.3

Variable name	Line #	Position	Format	F90 Format
TMPINC(11)	43	space 33-40	decimal (xxxx.xxx)	f8.3
TMPINC(12)	43	space 41-48	decimal (xxxx.xxx)	f8.3
Comment line	44	space 1-80	character	a80
RADINC(1)	45	space 1-8	decimal (xxxx.xxx)	f8.3
RADINC(2)	45	space 9-16	decimal (xxxx.xxx)	f8.3
RADINC(3)	45	space 17-24	decimal (xxxx.xxx)	f8.3
RADINC(4)	45	space 25-32	decimal (xxxx.xxx)	f8.3
RADINC(5)	45	space 33-40	decimal (xxxx.xxx)	f8.3
RADINC(6)	45	space 41-48	decimal (xxxx.xxx)	f8.3
Comment line	46	space 1-80	character	a80
RADINC(7)	47	space 1-8	decimal (xxxx.xxx)	f8.3
RADINC(8)	47	space 9-16	decimal (xxxx.xxx)	f8.3
RADINC(9)	47	space 17-24	decimal (xxxx.xxx)	f8.3
RADINC(10)	47	space 25-32	decimal (xxxx.xxx)	f8.3
RADINC(11)	47	space 33-40	decimal (xxxx.xxx)	f8.3
RADINC(12)	47	space 41-48	decimal (xxxx.xxx)	f8.3
Comment line	48	space 1-80	character	a80
HUMINC(1)	49	space 1-8	decimal (xxxx.xxx)	f8.3
HUMINC(2)	49	space 9-16	decimal (xxxx.xxx)	f8.3
HUMINC(3)	49	space 17-24	decimal (xxxx.xxx)	f8.3
HUMINC(4)	49	space 25-32	decimal (xxxx.xxx)	f8.3
HUMINC(5)	49	space 33-40	decimal (xxxx.xxx)	f8.3
HUMINC(6)	49	space 41-48	decimal (xxxx.xxx)	f8.3
Comment line	50	space 1-80	character	a80
HUMINC(7)	51	space 1-8	decimal (xxxx.xxx)	f8.3
HUMINC(8)	51	space 9-16	decimal (xxxx.xxx)	f8.3
HUMINC(9)	51	space 17-24	decimal (xxxx.xxx)	f8.3
HUMINC(10)	51	space 25-32	decimal (xxxx.xxx)	f8.3
HUMINC(11)	51	space 33-40	decimal (xxxx.xxx)	f8.3
HUMINC(12)	51	space 41-48	decimal (xxxx.xxx)	f8.3
Comment line	52	space 1-80	character	a80
HRUTOT	53		integer	free
Comment line	54	space 1-80	character	a80
Comment line	55	space 1-80	character	a80
Comment line	56	space 1-80	character	a80

Variable name	Line #	Position	Format	F90 Format
Comment line	56	space 1-80	character	a80
Comment line	56	space 1-80	character	a80
Comment line	56	space 1-80	character	a80
Comment line	56	space 1-80	character	a80
Comment line	57	space 1-80	character	a80
FLD_HRUFILE	58	space 1-13	character	a13
FLD_MGTFILE	58	space 14-26	character	a13
FLD_SOLFILE	58	space 27-39	character	a13
FLD_CHMFILE	58	space 40-52	character	a13
FLD_GWFILE	58	space 53-65	character	a13
Comment line	59	space 1-80	character	a80
RIP_HRUFILE	60	space 1-13	character	a13
RIP_MGTFILE	60	space 14-26	character	a13
RIP_SOLFILE	60	space 27-39	character	a13
RIP_CHMFILE	60	space 40-52	character	a13
RIP_GWFILE	60	space 53-65	character	a13
Comment line	61	space 1-80	character	a80
HRUFILE	62-END	space 1-13	character	a13
MGTFILE	62-END	space 14-26	character	a13
SOLFILE	62-END	space 27-39	character	a13
CHMFILE	62-END	space 40-52	character	a13
GWFILE	62-END	space 53-65	character	a13
OPSFILE	62-END	space 66-78	character	a13
SEPTFILE	62-END	space 79-91	character	a13
SDRFILE	62-END	space 92-105	character	a13

REFERENCES

Chow, V.T. 1959. Open-channel hydraulics. McGraw-Hill, New York.