

# CE 3354 ENGINEERING HYDROLOGY

LECTURE 14: UNIT HYDROGRAPHS

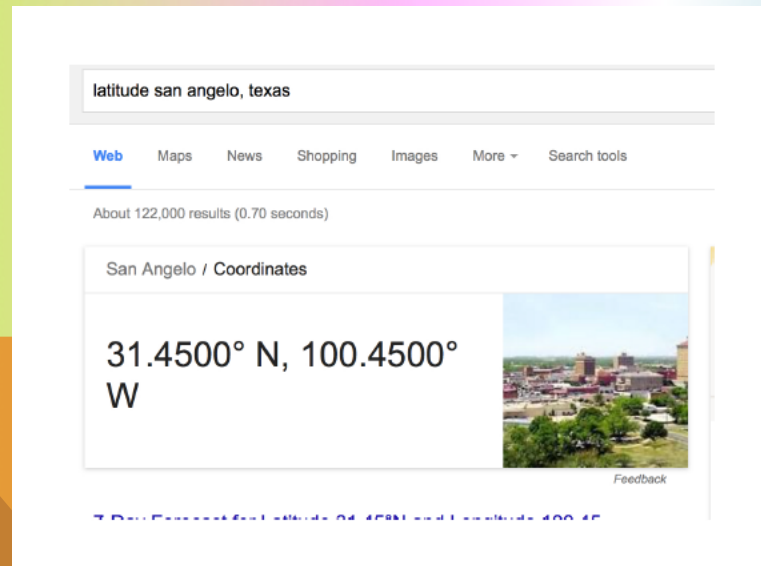
# OUTLINE

- ES6 Solution Sketch
- Unit Hydrographs/HMS Workshop
  - CMM pp. 201-223
- HMS Workshop

# ES-6 SOLUTION SKETCH

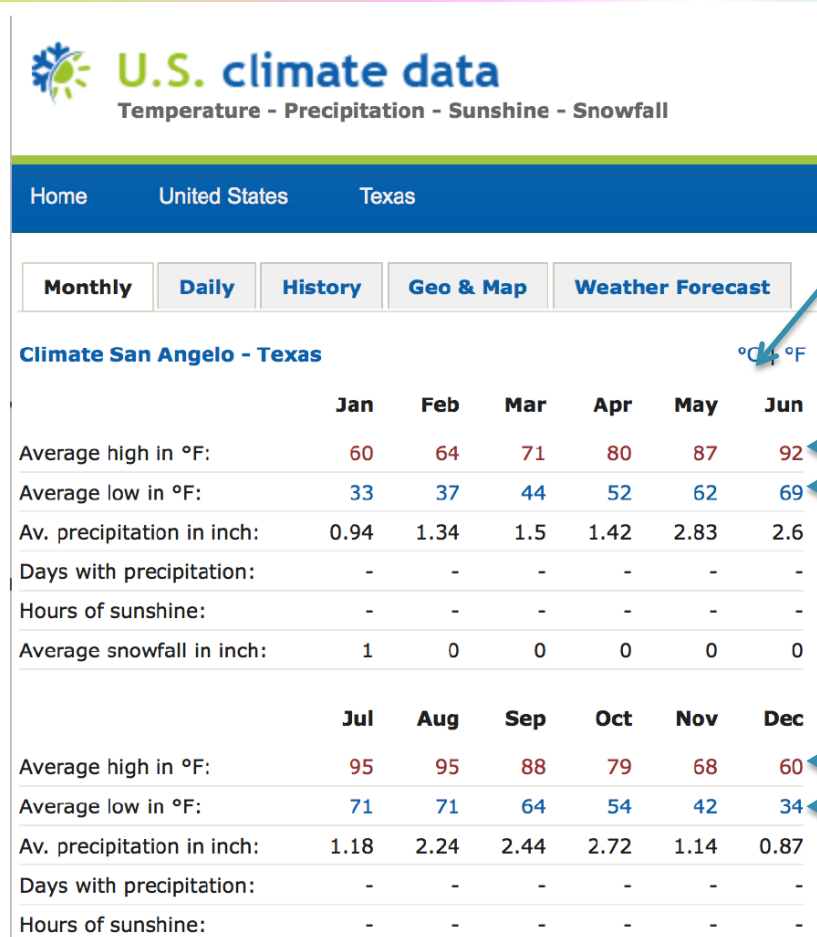
## ES 6 was application of two different evaporation models

1. Estimate the monthly evapotranspiration depths for the San Angelo (Concho County) area using the Blaney-Criddle method.<sup>1</sup>
  - **The Blaney-Criddle method uses location (latitude) and mean monthly temperatures in Celsius**
  - Google search <Latitude and Longitude for San Angelo, Texas>



# ES-6 SOLUTION SKETCH

- The Blaney-Criddle method uses location (latitude) and mean monthly temperatures in Celsius
- Google search <Mean Monthly Temperature for San Angelo, Texas>



U.S. climate data  
Temperature - Precipitation - Sunshine - Snowfall

Home United States Texas

Monthly Daily History Geo & Map Weather Forecast

Climate San Angelo - Texas °C, °F

	Jan	Feb	Mar	Apr	May	Jun
Average high in °F:	60	64	71	80	87	92
Average low in °F:	33	37	44	52	62	69
Av. precipitation in inch:	0.94	1.34	1.5	1.42	2.83	2.6
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-
Average snowfall in inch:	1	0	0	0	0	0
	Jul	Aug	Sep	Oct	Nov	Dec
Average high in °F:	95	95	88	79	68	60
Average low in °F:	71	71	64	54	42	34
Av. precipitation in inch:	1.18	2.24	2.44	2.72	1.14	0.87
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-

Need in Celsius,  
So either convert or  
select Celsius

# ES-6 SOLUTION SKETCH

Put these results into Blaney-Criddle equation

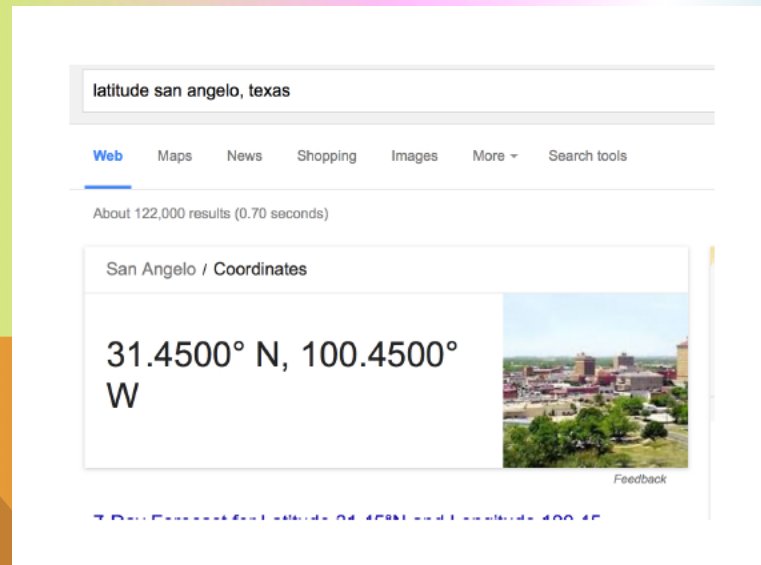
Month	T_mean	p-Value	ET_o	T-high	T-low
Jan	8	0.24	2.8032	15.3	0.7
Feb	10.15	0.25	3.16725	17.5	2.8
Mar	14.3	0.27	3.93606	21.7	6.9
Apr	18.9	0.29	4.84126	26.7	11.1
May	23.65	0.31	5.85249	30.7	16.6
Jun	26.9	0.32	6.51968	33.4	20.4
Jul	28.45	0.31	6.53697	35.1	21.8
Aug	28.15	0.3	6.2847	34.8	21.5
Sep	24.25	0.28	5.3634	31	17.5
Oct	19	0.26	4.3524	26	12
Nov	12.95	0.24	3.34968	20.2	5.7
Dec	8.2	0.23	2.70756	15.5	0.9

# ES-6 SOLUTION SKETCH

## ES 6 was application of two different evaporation models

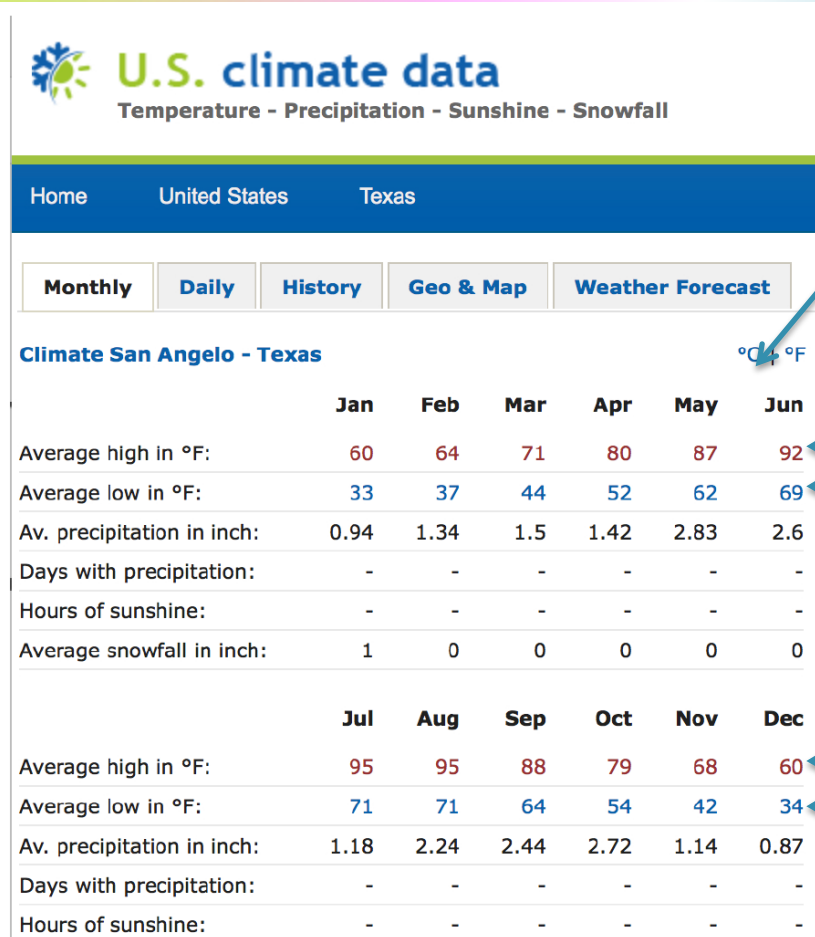
2. Estimate the monthly evapotranspiration depths for the San Angelo (Concho County) area using the Thornwaithe method.<sup>2</sup>

- **The Thornwaithe method uses location (latitude) and mean monthly temperatures in Celsius**
  - Google search <Latitude and Longitude for San Angelo, Texas>



# ES-6 SOLUTION SKETCH

- The Thornwaithe method uses location (latitude) and mean monthly temperatures in Celsius
- Google search <Mean Monthly Temperature for San Angelo, Texas>



U.S. climate data  
Temperature - Precipitation - Sunshine - Snowfall

Home United States Texas

Monthly Daily History Geo & Map Weather Forecast

Climate San Angelo - Texas °C °F

	Jan	Feb	Mar	Apr	May	Jun
Average high in °F:	60	64	71	80	87	92
Average low in °F:	33	37	44	52	62	69
Av. precipitation in inch:	0.94	1.34	1.5	1.42	2.83	2.6
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-
Average snowfall in inch:	1	0	0	0	0	0

	Jul	Aug	Sep	Oct	Nov	Dec
Average high in °F:	95	95	88	79	68	60
Average low in °F:	71	71	64	54	42	34
Av. precipitation in inch:	1.18	2.24	2.44	2.72	1.14	0.87
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-

Need in Celsius,  
So either convert or  
select Celsius

# ES-6 SOLUTION SKETCH

Put these results into Thornwaithe method

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Thornwaithe Method Worksheet														
2	Instructions:														
3	(1) Enter mean monthly air temperature in data field														
4	(2) Enter nearest latitude of study area (see data table to see latitudes available)														
5	<b>Required Data</b>		January	February	March	April	May	June	July	August	September	October	November	December	
6	Mean Monthly Air Temperature (°C)		8	10.15	14.3	18.9	23.65	26.9	28.45	28.15	24.25	19	12.95	8.2	
7	Station Latitude (°North)		30												
8	<b>Computed Values</b>														
9	Monthly Thermal Index (i)		2.03722	2.92112	4.90838	7.48725	10.5133	12.7763	13.9072	13.6858	10.9198	7.54731	4.22412	2.11482	
10	Monthly Correction Coefficient (F(λ))		0.9	0.87	1.03	1.08	1.18	1.17	1.2	1.14	1.03	0.98	0.89	0.88	
11	Annual Thermal Index (I)		93.0426												
12	Exponent (a)		2.03	6.75E-07	7.71E-05	1.79E-02	0.49239								
13	Monthly Potential ET (mm)		10.6	16.6	39.5	73.0	125.9	162.2	186.5	173.4	115.7	67.0	27.9	10.9	
15		Latitude North													
16			January	February	March	April	May	June	July	August	September	October	November	December	
17	50		0.74	0.78	1.02	1.15	1.33	1.36	1.37	1.25	1.06	0.92	0.76	0.7	
18	49		0.75	0.79	1.02	1.14	1.32	1.34	1.35	1.24	1.05	0.93	0.76	0.71	
19	48		0.76	0.8	1.02	1.14	1.31	1.33	1.34	1.23	1.05	0.93	0.77	0.72	
20	47		0.77	0.8	1.02	1.14	1.3	1.32	1.33	1.22	1.04	0.93	0.78	0.73	
21	46		0.79	0.81	1.02	1.13	1.29	1.31	1.32	1.22	1.04	0.94	0.79	0.74	
22	45		0.8	0.81	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75	
23	44		0.81	0.82	1.02	1.13	1.27	1.29	1.3	1.2	1.04	0.95	0.8	0.76	
24	43		0.81	0.82	1.02	1.12	1.26	1.28	1.29	1.2	1.04	0.95	0.81	0.77	
25	42		0.82	0.83	1.03	1.12	1.26	1.27	1.28	1.19	1.04	0.95	0.82	0.79	
26	41		0.83	0.83	1.03	1.11	1.25	1.26	1.27	1.19	1.04	0.96	0.82	0.8	
27	40		0.84	0.83	1.03	1.11	1.24	1.25	1.27	1.18	1.04	0.96	0.83	0.81	



# ES6 SOLUTION SKETCH

## Blaney-Criddle Results:

The results indicate a high value of about  $1/4$  inch/day during the summer months, and about  $1/10$  inch per day in the winter months.

## Thornwaithe Results:

The results indicate a daily rate of about  $1/4$  inch/day per day in the summer months and about 0.01 inches per day in the winter months.

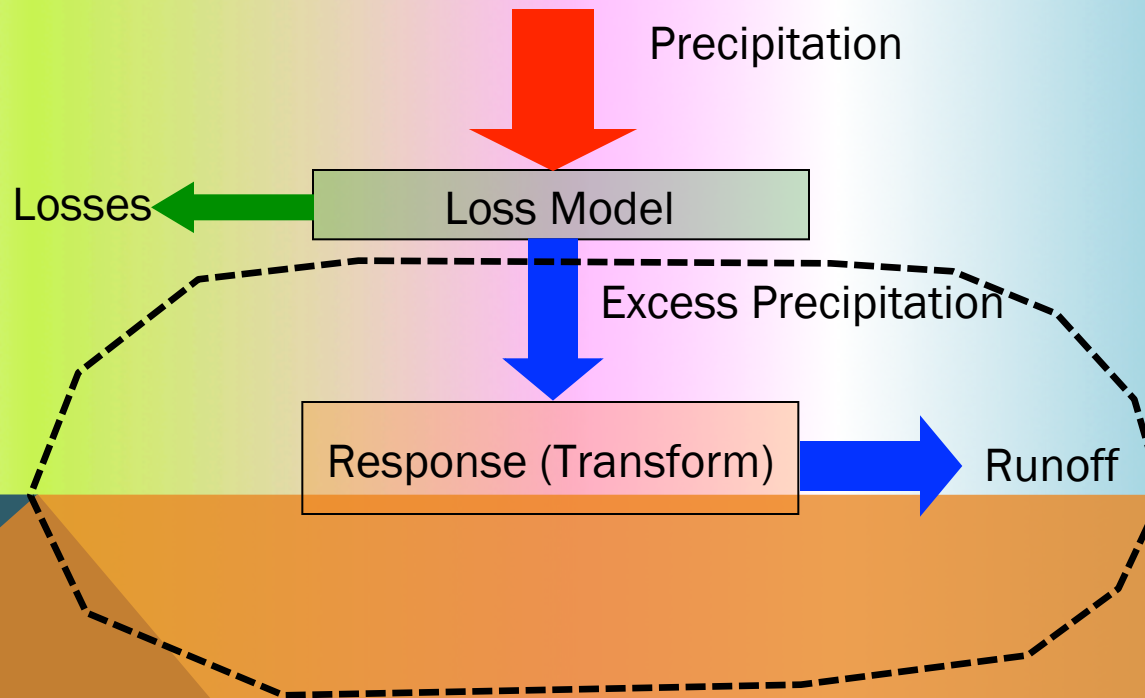
## Is evaporation for a 24-hour storm?

3. How important are these estimates in the drainage analysis project for a storm lasting 24-48 hours? Probably not terribly important for rainfall rates in excess of 1 inches per hour.



# RESPONSE MODEL

**Response models convert the excess precipitation signal into a direct runoff hydrograph at the point of interest**



# CE 3354 ENGINEERING HYDROLOGY

LECTURE 15: HEC-HMS WORKSHOP - ASH CREEK EXAMPLE

# PURPOSE

Illustrate the steps to create a functioning precipitation-runoff model in HEC-HMS

- Only a small set of HEC-HMS capabilities are employed
  - Basin Model
    - Sub-Basin: IaCI Loss Model; DUH Transform Model
  - Meterological Model
  - Control Specifications
  - Time-Series: Rain Gage
  - Time-Series: Discharge Gage
- Realistic parameter values are employed from class references

# LEARNING OBJECTIVES

Familiarize students with the HEC-HMS Graphical User Interface.

- Reinforce the concepts of “Projects” as a data-storage paradigm.

Simulate the rainfall-runoff response of a single sub-basin Texas watershed using:

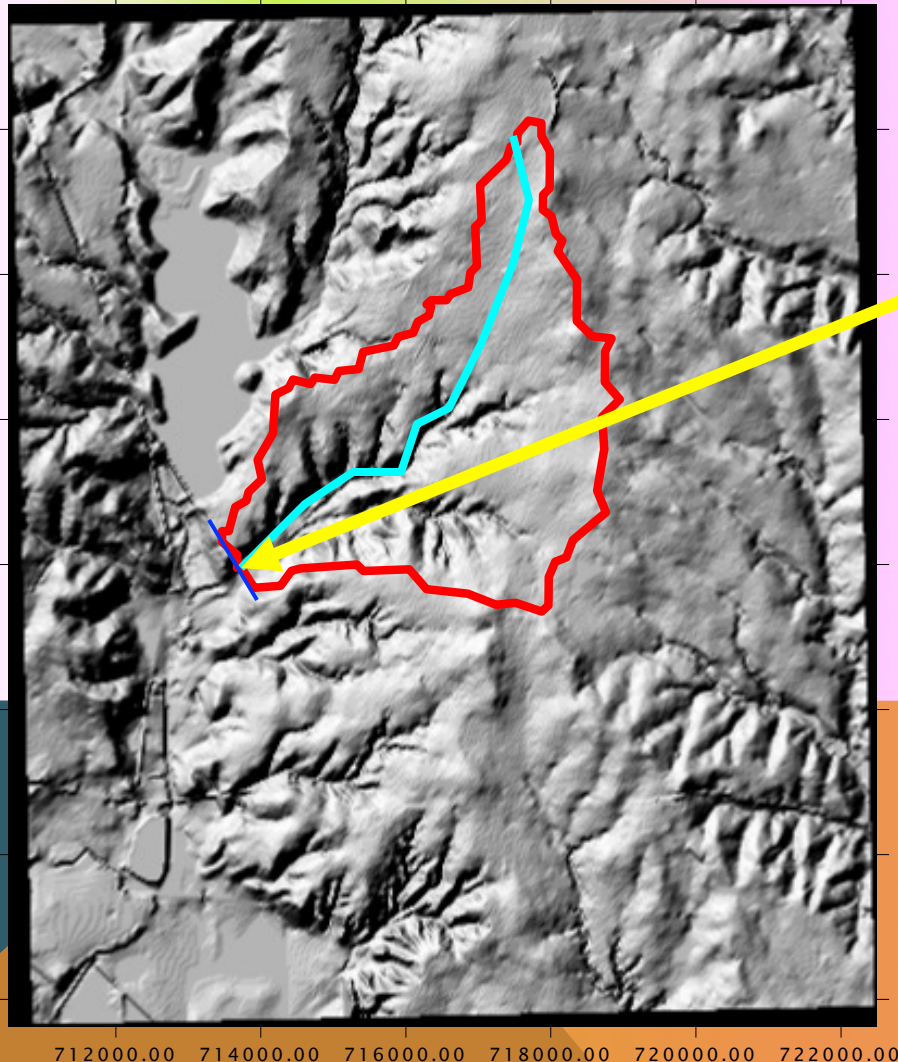
- Initial loss and constant rate loss model
- SCS Unit Hydrograph transformation model
- User-specified hyetograph.

# PROBLEM STATEMENT

Simulate the response of the Ash Creek watershed at Highland Road for a 5-year, 3-hour storm, under current development conditions.

- Treat the entire watershed as a single sub-basin.

# PROBLEM STATEMENT



## Watershed Outlet

- Highland Road and Ash Creek, Dallas, TX.
- Area is residential subdivisions, light industrial parks, and some open parkland.
- White Rock Lake is water body to the North-West



# PRECIPITATION ESTIMATION

## Precipitation

- Estimate 5-year, 3-hour storm depth using the DDF Atlas



In cooperation with the Texas Department of Transportation

## Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas



Scientific Investigations Report 2004–5041  
(TxDOT Implementation Report 5–1301–01–1)

U.S. Department of the Interior  
U.S. Geological Survey

# PRECIPITATION ESTIMATION



In cooperation with the Texas Department of Transportation

**Empirical, Dimensionless, Cumulative-Rainfall Hyetographs Developed From 1959–86 Storm Data for Selected Small Watersheds in Texas**



Scientific Investigations Report 2004–5075  
(TxDOT Research Report 0–4194–3)

U.S. Department of the Interior  
U.S. Geological Survey

## Precipitation

- Approximate the storm temporal distribution using dimensionless hyetograph.

# LOSS MODEL ESTIMATION

## Runoff Generation (Loss)

- Estimate the initial loss and constant rate loss using TxDOT 0-4193-7



In cooperation with the Texas Department of Transportation

### An Initial-Abstraction, Constant-Loss Model for Unit Hydrograph Modeling for Applicable Watersheds in Texas



Scientific Investigations Report 2007-5243  
(Texas Department of Transportation Research Report 0-4193-7)

U.S. Department of the Interior  
U.S. Geological Survey

# TRANSFORMATION MODEL ESTIMATION

## Unit Hydrograph Timing Parameters

- Example will use the SCS DUH, but will parameterize assuming GUHAS regression is appropriate.



U.S. Geological Survey;  
Texas Tech University, Center for  
Multidisciplinary Research in Transportation;  
University of Houston;  
Lamar University

**UNIT HYDROGRAPH ESTIMATION FOR  
APPLICABLE TEXAS WATERSHEDS**



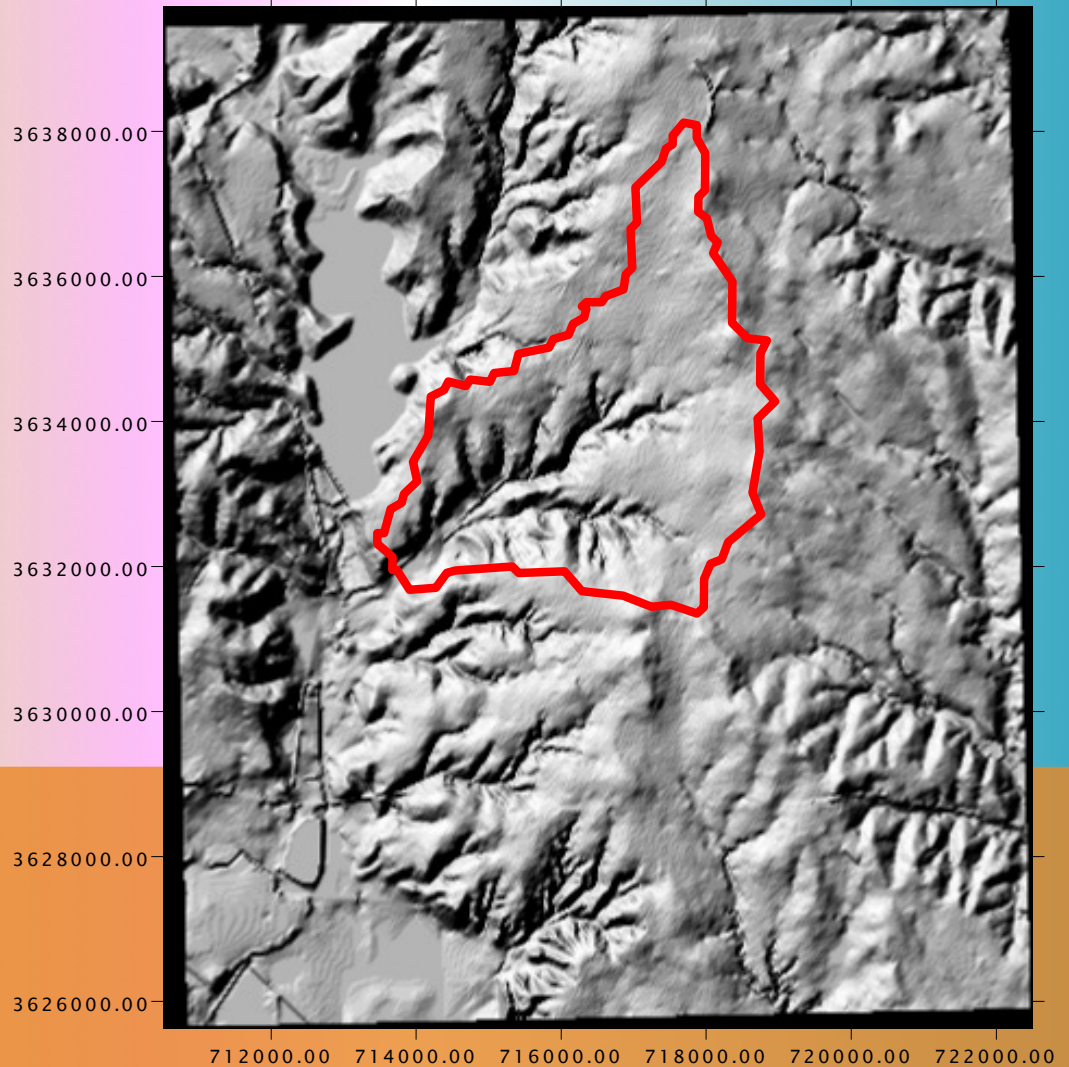
Research Report 0-4193-4

Texas Department of Transportation  
Research Project 0-4193

# PHYSICAL PROPERTIES

## Watershed Properties

- AREA=6.92 mi<sup>2</sup>
- MCL=5.416 mi
- MCS=0.005595
- CN=86
- R=0



# BUILDING THE MODEL – DATA PREPARATION

HEC-HMS will require us to construct, external to HMS the following:

- A Hyetograph (rainfall)
- Loss model parameters
- Transform model parameters

In this example will use Excel to build some input data required by the program.

# RAINFALL DEPTH

Use the DDF atlas to find the 5-year, 3-hour storm depth for Dallas Texas.

- About 2.8 in.

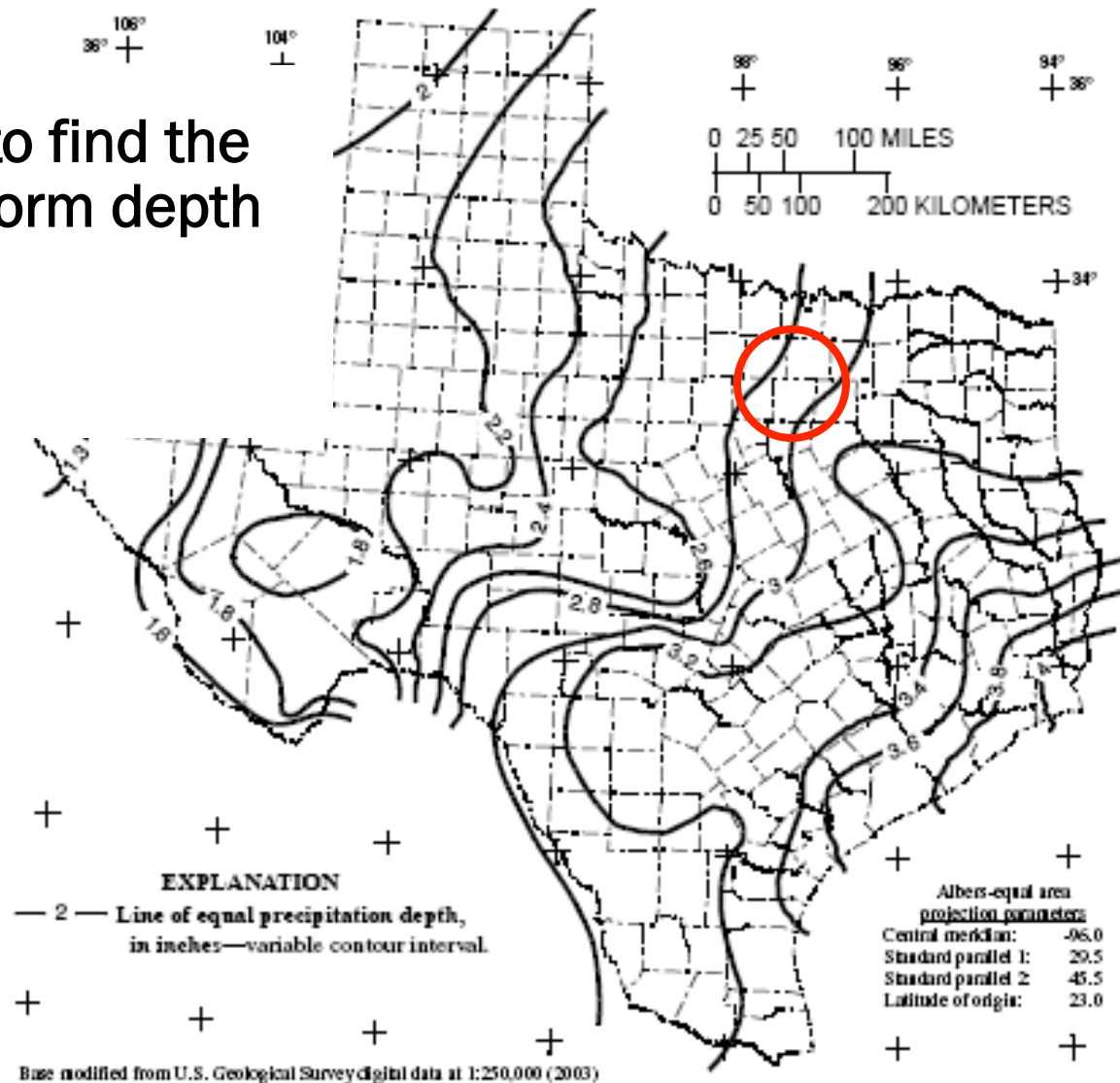


Figure 20. Depth of precipitation for 5-year storm for 3-hour duration in Texas.

# GENERATE A HYETOGRAPH – USE TXHYETO

TXHYETO-2015-PreRelease.xlsx

Search in Sheet

Home Layout Tables Charts SmartArt Formulas Data

B17

TxHYETO-2015 Pre-Release

## Texas Hyetographs for 50-th Percentile Storm

(Revised: July 30, 2015)

**1. Enter a Storm Duration**  
(from DDF Atlas, TP40, or equivalent)

hours

**2. Enter a Storm Depth**  
(from TxDOT Hydraulic Design Manual, EBDLKUP-NEW.xlsx, DDF Atlas, TP40, or equivalent)

inches

**3. Enter a desired Time Interval**  
(recommend intervals perfectly divisible by storm duration)

minutes

*Mixture Model Parameters (50th)*

w <sub>1</sub>	1.038977
a	0.795463
b	3.485892
w <sub>2</sub>	0.248833
m	0.471874
s	0.283391

Time (min)	Time (hrs)	Depth (in)
0	0	0.000
5	0.08	0.176
10	0.17	0.446
15	0.25	0.660
20	0.33	0.835
25	0.42	0.980
30	0.50	1.100
35	0.58	1.200
40	0.67	1.282
45	0.75	1.351
50	0.83	1.409
55	0.92	1.459
60	1.00	1.503
65	1.08	1.543
70	1.17	1.581
75	1.25	1.620
80	1.33	1.659
85	1.42	1.701
90	1.50	1.747
95	1.58	1.796
100	1.67	1.848
105	1.75	1.905
110	1.83	1.964
115	1.92	2.027
120	2.00	2.091
125	2.08	2.157
130	2.17	2.222
135	2.25	2.287
140	2.33	2.351
145	2.42	2.412

50th Percentile 90th Percentile



# DATA PREPARATION

HEC-HMS will require us to construct, external to HMS the following:

- *A Hyetograph (rainfall)*
- Loss model parameters
- Transform model parameters

In this example will use Excel to build some input data required by the program.

# LOSS MODEL PARAMETERS

## $I_aC_l$ model in TxDOT 0-4193-7

### Estimation of Initial Abstraction

The regression equation<sup>15</sup> for estimation of  $I_A$  has  $\phi^{[I_A]} = -0.9041$  and is

$$I_A = 2.045 - 0.5497L^{-0.9041} - 0.1943D + 0.2414R - 0.01354CN, \quad (23)$$

where  $I_A$  is initial abstraction in watershed inches,  $L$  is main-channel length of the watershed in miles,  $D = 0$  for undeveloped watersheds and  $D = 1$  for developed watersheds,  $R = 0$  for non-rocky watersheds and  $R = 1$  for rocky watersheds, and  $CN$  is the curve number.

# LOSS MODEL PARAMETERS

$I_a C_i$  model in TxDOT 0-4193-7

Microsoft Excel - Dimensionless2Dimen...

File Edit View Insert Format Tools Data  
Window Help

H9 fx

	A	B	C	D	E	F
1	Loss Model Parameter Estimation					
2	Initial Abstraction					
3	Input Values			Regression Coefficients		
4				2.045		
5	5.416	<=MCL (Miles)		-0.5497	-0.9041	
6	1	<=D (0 or 1)		-0.1943		
7	0	<=R (0 or 1)		0.2414		
8	86	<= CN		-0.01354		
9	Ia	0.567 inches				
10	Constant Loss					

Sheet1 Sheet2 Sl

Draw AutoShapes

R NUM

# LOSS MODEL PARAMETERS

## $I_aC_l$ model in TxDOT 0-4193-7

### Estimation of Constant Loss

The regression equation<sup>16</sup> for estimation of  $C_L$  has  $\phi^{[C_L]} = 0.2312$  and is

$$C_L = 2.535 - 0.4820L^{0.2312} + 0.2271R - 0.01676CN, \quad (29)$$

where  $C_L$  is constant loss in watershed inches per hour,  $L$  is main-channel length of the watershed in miles,  $R = 0$  for non-rocky watersheds and  $R = 1$  for rocky watersheds, and  $CN$  is curve number. The equation has

# LOSS MODEL PARAMETERS

$I_a C_i$  model in TxDOT 0-4193-7

Microsoft Excel - Dimensionless2Dimen...  
File Edit View Insert Format Tools Data  
Window Help  
H9 fx  
A B C D E F  
1 Loss Model Parameter Estimation  
2 Initial Abstraction  
3 Input Values Regression Coefficients  
4 2.045  
5 5.416 <=MCL (Miles) -0.5497 -0.9041  
6 1 <=D (0 or 1) -0.1943  
7 0 <=R (0 or 1) 0.2414  
8 86 <= CN -0.01354  
9 **Ia 0.567 inches**  
10 Constant Loss

Microsoft Excel - Dimensionless2Dimen...  
File Edit View Insert Format Tools Data  
Window Help  
H9 fx  
A B C D E F  
10 Constant Loss  
11 Input Values Regression Coefficients  
12 2.535  
13 5.416 <=MCL (Miles) -0.482 0.2312  
14 1 <=D (0 or 1) 0  
15 0 <=R (0 or 1) 0.2271  
16 86 <= CN -0.01676  
17  
18 **Ci 0.381 inches/hour**  
19

# DATA PREPARATION

HEC-HMS will require us to construct, external to HMS the following:

- *A Hyetograph (rainfall)*
- *Loss model parameters*
- Transform model parameters

In this example will use Excel to build some input data required by the program.

# UNIT HYDROGRAPH MODEL

## SCS Dimensionless Unit Hydrograph

- Related to a gamma distribution with shape  $K=3.77$
- HEC-HMS requires a time constant,  $T_{lag}$

For this example, will assume 0-4193-4 method is sufficient

# UNIT HYDROGRAPH MODEL

Estimate  $T_p$

$$T_p = 10^{(-1.41 - 0.313D)} L^{0.612} S^{-0.633},$$

Microsoft Excel - Dimensionless2Dimensi...

File Edit View Insert Format Tools Data Window Help

100%

07

	A	B	C	D	E	F
1	Time to Peak					
2	Input Values			Regression Coefficients		
3				0		
4	5.416	<=MCL (Miles)		2.812	0.612	
5	1	<=D (0 or 1)		0.0191		
6	0.005595	<=Slope		-0.633		
7						
8	<b> Tp </b>	<b> 1.428 hours </b>	<b> 85.665 minutes </b>			
9	Hydrograph Shape					

Draw AutoShapes

Reac NUM



# UNIT HYDROGRAPH MODEL

## Estimate K

$$K = 10^{(0.481 - 0.0782D)} L^{0.140},$$

Microsoft Excel - Dimensionless2Dimensi...

File Edit View Insert Format Tools Data Window Help

07 fx

	A	B	C	D	E	F
9	Hydrograph Shape					
10	Input Values			Regression Coefficients		
11				0		
12		5.416 <=MCL (Miles)		1.2668	0.14	
13		1 <=D (0 or 1)		2.5281		
14				1		
15				1		
16						
17	<b>K</b>	<b>3.203</b>				

Draw AutoShapes

Reac NUM

# UNIT HYDROGRAPH MODEL

## SCS Dimensionless Unit Hydrograph

- Related to a gamma distribution with shape  $K=3.77$

### For this example

- Assume that  $K=3.77$  is close enough in shape to  $K=3.2$  to use without modification.
- A later example will illustrate how to employ a user-specified hydrograph.
- Basin lag time is  $0.6 \cdot 80\text{min} = 48\text{ min}$

## (e) Relation between lag and time of concentration

Various researchers (Mockus 1957; Simas 1996) found that for average natural watershed conditions and an approximately uniform distribution of runoff:

$$L = 0.6T_c \quad (\text{eq. 15-3})$$

where:

$L$  = lag, h

$T_c$  = time of concentration, h

# DATA PREPARATION

HEC-HMS will require us to construct, external to HMS the following:

- *A Hyetograph (rainfall)*
- *Loss model parameters*
- *Transform model parameters*

Now ready to build the HEC-HMS model.

# HEC-HMS

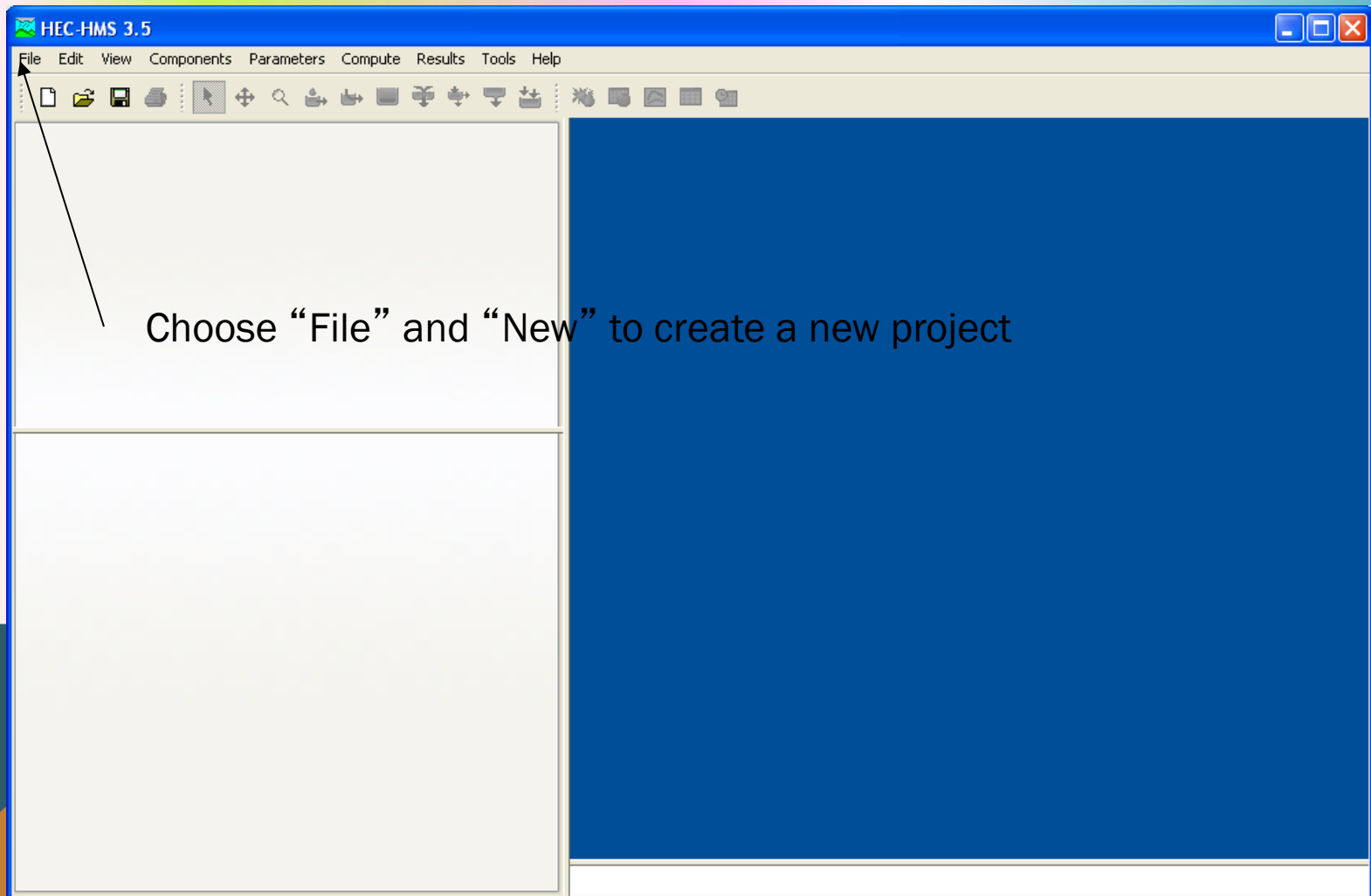
Start the program

Create a project

- Project is a directory where all data are stored for a particular model.
- Can share files between projects, but an advanced technique.

# HEC-HMS

## Start the program



# CREATE PROJECT

The screenshot displays the HEC-HMS 3.5 software interface. The main window is titled "HEC-HMS 3.5" and contains a menu bar (File, Edit, View, Components, Parameters, Compute, Results, Tools, Help) and a toolbar. A "Create a New Project" dialog box is open, showing the following fields:

- Name: Example 1
- Description: DES606 Example Problem Number 1
- Location: Documents and Settings\Administrator\My Documents
- Default Unit System: Metric

Annotations with arrows point to the following elements:

- "Name the Project" points to the Name field.
- "Description (optional)" points to the Description field.
- "Select Default Units (Metric or U.S. Customary)" points to the Default Unit System dropdown menu.

The Windows taskbar at the bottom shows the Start button and several open applications: DES606-Training, Microsoft PowerPoint, Microsoft Excel - Dim..., Adobe Acrobat Profe..., and HEC-HMS 3.5. The system clock shows 12:54 AM.

# CREATE PROJECT

The screenshot displays the HEC-HMS 3.5 software interface. The title bar shows the file path: `C:\...My Documents\Example_1\Example_1.hms`. The menu bar includes: File, Edit, View, Components, Parameters, Compute, Results, Tools, Help. The toolbar contains various icons for file operations and navigation. The main workspace is a large blue area. On the left, there is a project browser showing a folder named "Example-1". Below the browser are tabs for "Components", "Compute", and "Results". The "Project" tab is active, showing the following details:

- Name:** Example 1
- Description:** DES606 Example Problem Number 1
- DSS File:** C:\Documents and Settings\Administrator\My Documents\E...

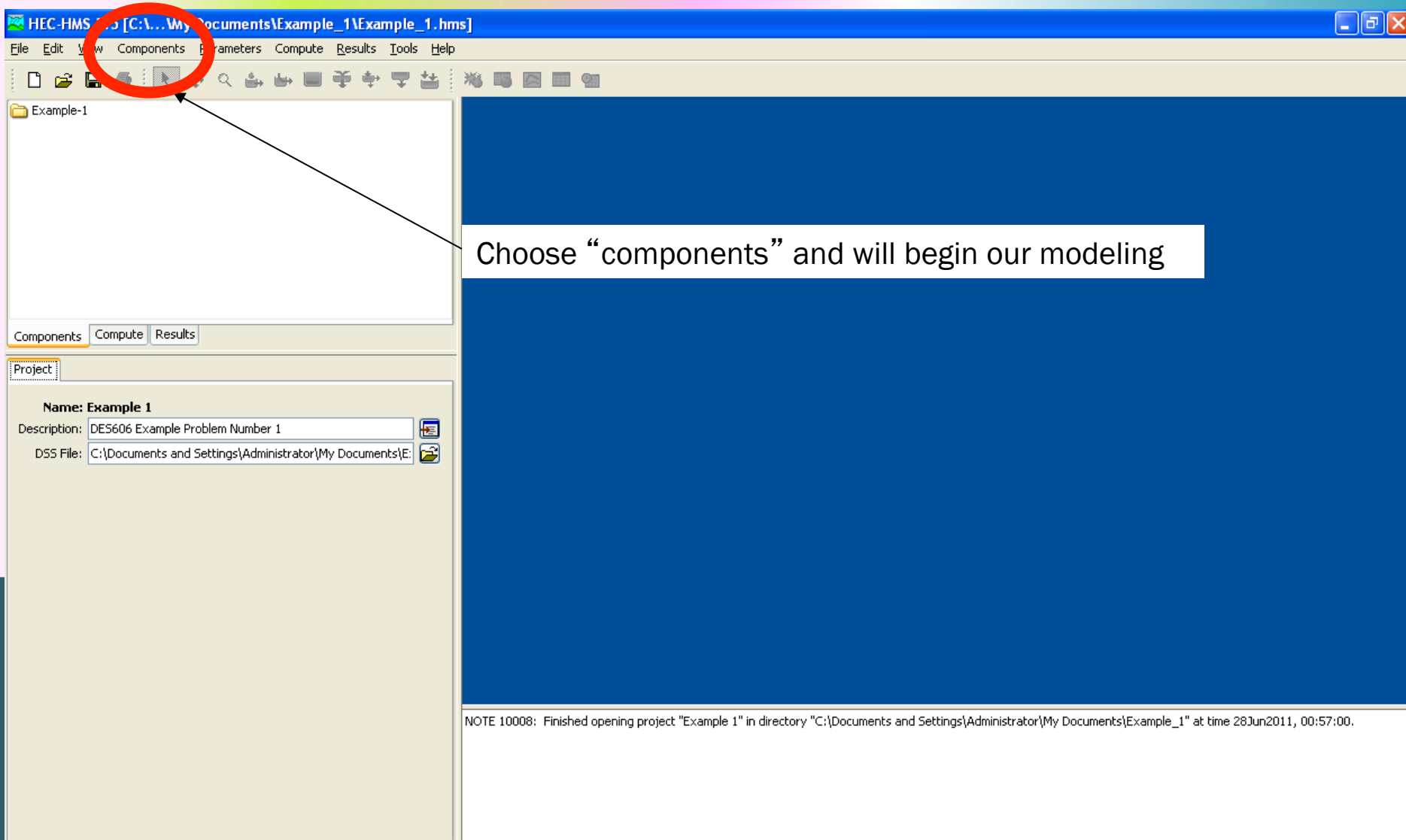
At the bottom of the interface, a message log displays the following note:

```
NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example_1" at time 28Jun2011, 00:57:00.
```

Annotations in the image include:

- A white box with the text "Name of the Project" and two arrows pointing to the "Example-1" folder in the project browser and the "Name: Example 1" field in the project details panel.
- A white box with the text "Note that project was created. This area is where notes, warnings, and error messages are presented to analyst." and an arrow pointing to the message log at the bottom.

# CREATE BASIN MODEL



The screenshot displays the HEC-HMS software interface. The title bar shows the file path: "C:\...My Documents\Example\_1\Example\_1.hms". The menu bar includes "File", "Edit", "View", "Components", "Parameters", "Compute", "Results", "Tools", and "Help". The "Components" menu is circled in red, and an arrow points from this circle to a white text box on the right. The main workspace is a large blue area. On the left, there is a "Project" panel with the following information:

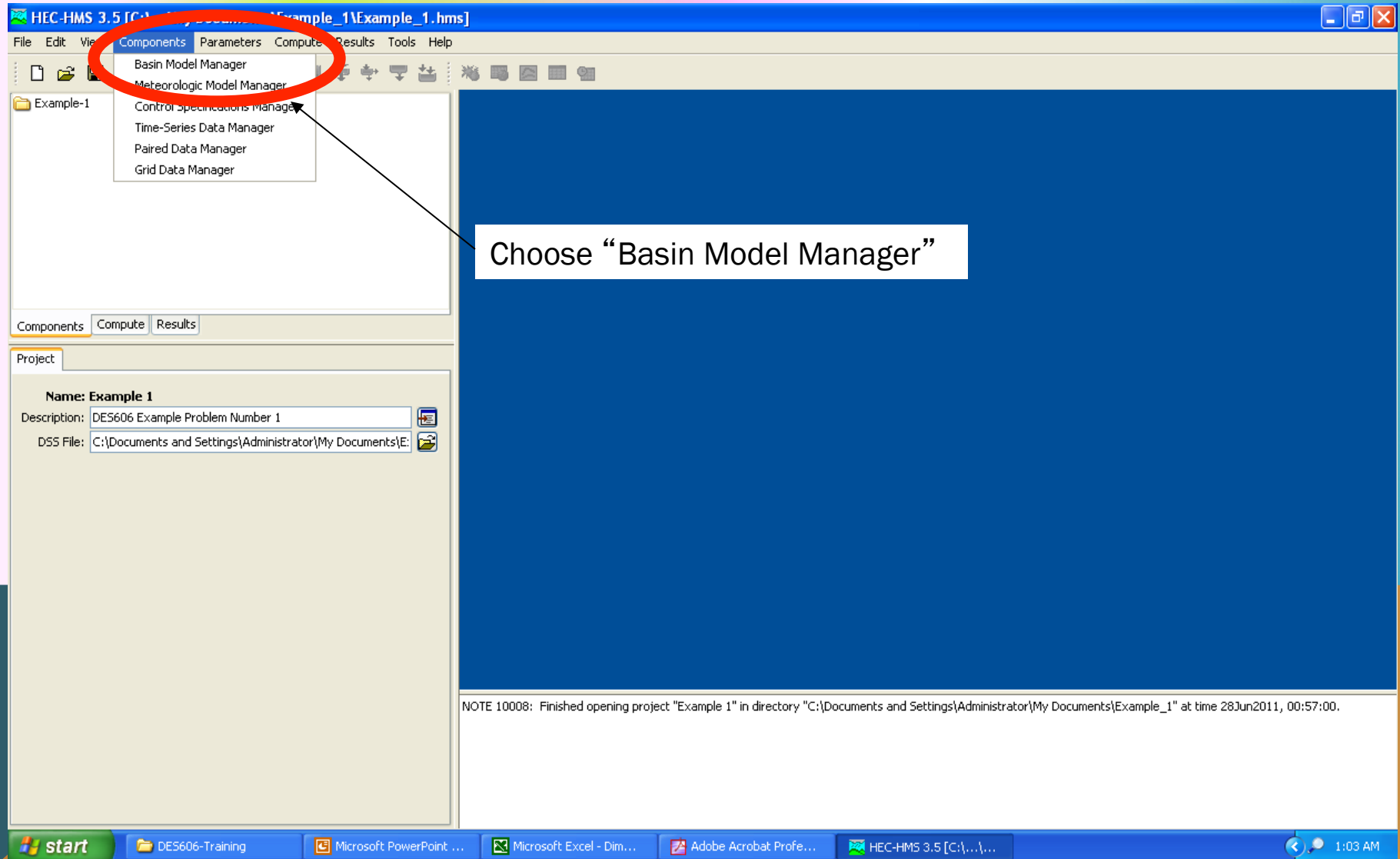
- Name:** Example 1
- Description:** DES606 Example Problem Number 1
- DSS File:** C:\Documents and Settings\Administrator\My Documents\E...

At the bottom of the interface, a status bar displays the message: "NOTE 10008: Finished opening project 'Example 1' in directory 'C:\Documents and Settings\Administrator\My Documents\Example\_1' at time 28Jun2011, 00:57:00."

Choose "components" and will begin our modeling



# CREATE BASIN MODEL



The screenshot displays the HEC-HMS 3.5 software interface. The 'Components' menu is open, and 'Basin Model Manager' is highlighted with a red circle. A white callout box with a black border contains the text 'Choose "Basin Model Manager"', with a black arrow pointing to the highlighted menu item. The software window title is 'HEC-HMS 3.5 [C:\Program Files\HEC\HMS3\Example\_1\Example\_1.hms]'. The menu items are: Basin Model Manager, Meteorologic Model Manager, Control Specifications Manager, Time-Series Data Manager, Paired Data Manager, and Grid Data Manager. The 'Project' section shows 'Name: Example 1', 'Description: DES606 Example Problem Number 1', and 'DSS File: C:\Documents and Settings\Administrator\My Documents\E...'. A status bar at the bottom contains the text: 'NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example\_1" at time 28Jun2011, 00:57:00.' The Windows taskbar at the bottom shows the Start button and several open applications: DES606-Training, Microsoft PowerPoint, Microsoft Excel - Dim..., Adobe Acrobat Profe..., and HEC-HMS 3.5 [C:\...]. The system clock shows 1:03 AM.

Choose "Basin Model Manager"

NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example\_1" at time 28Jun2011, 00:57:00.

# CREATE BASIN MODEL

The screenshot displays the HEC-HMS 3.5 interface. The main window shows a project named 'Example 1' with the following details:

- Name: Example 1
- Description: DES606 Example Problem Number 1
- DSS File: C:\Documents and Settings\Administrator\My Documents\E...

Two dialog boxes are overlaid on the main window:

- Basin Model Manager:** A window titled 'Basin Model Manager' with a 'Current basin models' list. The 'New...' button is circled in red. A callout box labeled 'Choose "New"' points to this button.
- Create A New Basin Model:** A dialog box with the following fields:
  - Name: Basin 1 (Callout: 'Name the Basin')
  - Description: Ash Creek Single Basin Model (Callout: 'Description')Buttons for 'Create' and 'Cancel' are at the bottom.

At the bottom of the window, a status bar contains the text: NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example\_1" at time 28Jun2011, 00:57:00.

The Windows taskbar at the bottom shows the Start button and several open applications: DES606-Training, Microsoft PowerPoint..., Microsoft Excel - Dim..., Adobe Acrobat Profe..., and HEC-HMS 3.5 [C:\...\...]. The system clock shows 1:05 AM.

# CREATE BASIN MODEL

2) "Sub Basin Creation Tool"

Select, then put a sub-basin into the hydrologic elements area

1) Select the Basin Name in the Component Manager Window

Basin Hydrologic Elements  
(Starts Empty – we will populate)

NOTE 10008: Finished opening project "E

time 28Jun2011, 00:57:00.

# CREATE BASIN MODEL

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Example-1  
Basin Models  
Ash Creek Basin

Basin Model

**Name: Ash Creek Basin**  
Description: Ash Creek Single Basin Model  
Grid Cell File:  
Local Flow: No  
Flow Ratios: No  
Replace Missing: No  
Unit System: U.S. Customary  
Sediment: No  
Water Quality: No

**Basin Model Manager**  
Current basin models  
Ash Creek Basin  
New...  
Copy...  
Rename...  
Delete  
Description...

**Create A New Subbasin Element**  
Name : SingleBasin  
Description : Ash Creek as a single basin  
Create Cancel

Sub-basin name

Description (optional)

NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example\_1" at time 28Jun2011, 00:57:00.

start DES606-Training Microsoft PowerPoint ... Microsoft Excel - Dim... Adobe Acrobat Profe... HEC-HMS 3.5 [C:\...],... 1:13 AM

# BASIN MODEL DATA INPUT

The screenshot shows the HEC-HMS 3.5 software interface. The main window displays a tree view of the project structure under 'Example-1', including 'Basin Models', 'Ash Creek Basin', and 'SingleBasin'. The 'SingleBasin' sub-basin is selected and highlighted. The 'Components' panel on the left shows the 'Loss' tab selected, with various parameters for the 'SingleBasin' element, such as 'Area (MI2)' set to 6.92, 'Canopy Method', 'Surface Method', 'Loss Method', 'Transform Method', and 'Baseflow Method'. The 'Loss' tab is also highlighted in the 'Components' panel. The 'SingleBasin' sub-basin is highlighted in the main window. The 'Loss' tab is highlighted in the 'Components' panel. The 'Loss' tab is highlighted in the 'Components' panel.

1) Select "cursor" tool

2) Select the sub-basin

3) Input hydrological and physical parameters

When you change from defaults, program will Ask you "are you sure?" For the example, answer yes and proceed.

4) When done, select the "Loss" tab.

28Jun2011, 00:57:00.

# BASIN MODEL DATA INPUT

The screenshot displays the HEC-HMS 3.5 software interface. The main window is titled 'Basin Model [Ash Creek Basin]'. On the left, a tree view shows the project structure: 'Example-1' > 'Basin Models' > 'Ash Creek Basin' > 'SingleBasin'. Below the tree view, the 'Components' tab is active, and the 'Transform' sub-tab is selected, which is circled in red. The 'Transform' sub-tab displays the following parameters for the 'SingleBasin' element:

Basin Name: Ash Creek Basin	
Element Name: SingleBasin	
*Initial Loss (IN)	0.567
*Constant Rate (IN/HR)	0.381
*Impervious (%)	0.0

Below the software interface, two numbered instructions are provided:

- 1) Input hydrological and physical parameters  
Use values from 0-4193-7  
Use 0% IC; 0-4193-7 accounted for IC
- 2) When complete, select "Transform" tab.

The Windows taskbar at the bottom shows the system tray with the time 1:23 AM and the date 28Jun2011. The taskbar also displays several open applications: start, DES606-Training, Microsoft PowerPoint, Microsoft Excel - Dim..., Adobe Acrobat Profe..., and HEC-HMS 3.5 [C:\...].

ings\Administrator\My Documents\Example\_1" at time 28Jun2011, 00:57:00.

# BASIN MODEL DATA INPUT

The screenshot displays the HEC-HMS 3.5 software interface. The main window is titled 'Basin Model [Ash Creek Basin]' and contains a 'SingleBasin' component. The 'Components' menu is highlighted with a red circle. The 'Basin Name' is 'Ash Creek Basin' and the 'Element Name' is 'SingleBasin'. The 'Graph Type' is set to 'Standard' and the '\*Lag Time (MIN)' is 85.6. The status bar at the bottom indicates the file path and time: 'Administrator\My Documents\Example\_1' at time 28Jun2011, 00:57:00.

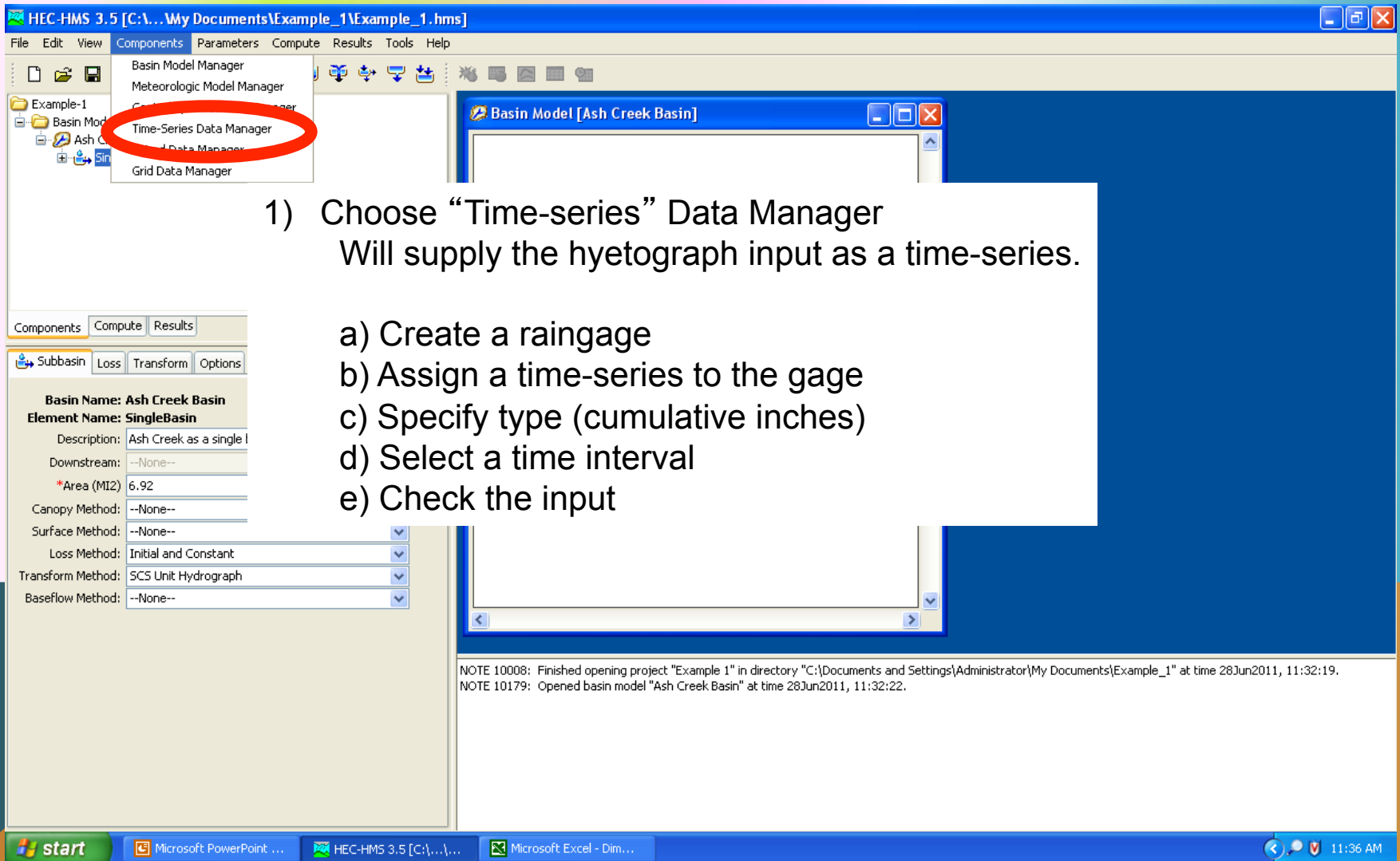
1) Input hydrological and physical parameters

Use values from 0-4193-3

Use the standard SCS-DUH.

2) When complete, select “Components” menu item

# CREATE RAINFALL INPUT



1) Choose “Time-series” Data Manager  
Will supply the hyetograph input as a time-series.

- Create a raingage
- Assign a time-series to the gage
- Specify type (cumulative inches)
- Select a time interval
- Check the input

NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example\_1" at time 28Jun2011, 11:32:19.  
NOTE 10179: Opened basin model "Ash Creek Basin" at time 28Jun2011, 11:32:22.



# CREATE RAINFALL INPUT

1) Data Type == Precipitation Gages

a) Select "New ..."  
b) Name the gage  
c) Description (optional)  
d) Select "Create"

Basin Model [Ash Creek Basin]

Time Series Data Manager

Data Type: Precipitation Gages

New...

Create A New Precipitation Gage

Name: OneAndOnlyGage

Description: A single gage that represents uniform precipitation

Create Cancel

NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example\_1" at time 28Jun2011, 11:32:19.  
NOTE 10179: Opened basin model "Ash Creek Basin" at time 28Jun2011, 11:32:22.

# CREATE RAINFALL INPUT

1) Select "Time Series/Precipitation Gages/Gage Name"

Data entry here:  
Units == Cumulative Inches  
Time Interval == 5 minutes (this example)

NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example\_1" at time 28Jun2011, 11:32:19.  
NOTE 10179: Opened basin model "Ash Creek Basin" at time 28Jun2011, 11:32:22.

The screenshot shows the HEC-HMS 3.5 interface. The 'Components' pane on the left shows a tree view with 'Example-1' expanded to 'Basin Models' > 'Ash Creek Basin' > 'SingleBasin' > 'Time-Series Gages' > 'Precipitation Gages'. The 'OneAndOnlyGage' option is selected and circled in red. The configuration window for 'OneAndOnlyGage' is open, showing fields for Name, Description, Data Source, Units, Time Interval, and Latitude/Longitude coordinates. The 'Units' field is set to 'Incremental Inches' and the 'Time Interval' is set to '15 Minutes'. A red circle highlights the 'OneAndOnlyGage' option and the configuration fields. A text box on the right provides instructions for data entry: 'Data entry here: Units == Cumulative Inches Time Interval == 5 minutes (this example)'. The status bar at the bottom shows the Windows taskbar with the Start button and several open applications: Microsoft PowerPoint, HEC-HMS 3.5, and Microsoft Excel. The system clock shows 1:00 PM on 28Jun2011.

# CREATE RAINFALL INPUT

The screenshot displays the HEC-HMS 3.5 software interface. The title bar reads "HEC-HMS 3.5 [C:\... My Documents\Example\_1\Example\_1.hms]". The menu bar includes "File", "Edit", "View", "Components", "Parameters", "Compute", "Results", "Tools", and "Help". The left-hand "Components" pane shows a tree view with "Example-1" expanded to "Precipitation Gages", where "OneAndOnlyGage" is selected. Below this, a "Time Window" tab is highlighted with a red circle. A callout box with a black border and white background points to the "Time Window" tab, containing the text: "Select 'Time Window' We will make a 3:15 -hour long input sequence." The main configuration area for "OneAndOnlyGage" is visible, with fields for "Name", "Description", "Data Source" (Manual Entry), "Units" (Cumulative Inches), and "Time Interval" (5 Minutes). The "SingleBasin" component is also visible in the main workspace. At the bottom, a log window displays several error messages (NOTE 10008, NOTE 10179, and multiple NOTE 10604 messages) related to missing or invalid values for the gage.

HEC-HMS 3.5 [C:\... My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Example-1

- Basin Models
  - Ash Creek Basin
    - SingleBasin
- Time-Series Data
  - Precipitation Gages
    - OneAndOnlyGage
      - 01Jan2000, 00:00 - 01Jan2000, 03:15

Components Compute Results

Time-Series Gage **Time Window** Table Graph

**Name:** OneAndOnlyGage

Description: A single gage that represents uniform precipitation

Data Source: Manual Entry

Units: Cumulative Inches

Time Interval: 5 Minutes

Latitude Degrees:

Latitude Minutes:

Latitude Seconds:

Longitude Degrees:

Longitude Minutes:

Longitude Seconds:

SingleBasin

NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example\_1" at time 28Jun2011, 11:32:19.  
NOTE 10179: Opened basin model "Ash Creek Basin" at time 28Jun2011, 11:32:22.  
NOTE 10604: 1441 missing or invalid values for gage "OneAndOnlyGage".  
NOTE 10604: 1621 missing or invalid values for gage "OneAndOnlyGage".  
NOTE 10604: 181 missing or invalid values for gage "OneAndOnlyGage".  
NOTE 10604: 141 missing or invalid values for gage "OneAndOnlyGage".  
NOTE 10604: 142 missing or invalid values for gage "OneAndOnlyGage".

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\... Microsoft Excel - Dim... 1:09 PM

# CREATE RAINFALL INPUT

The screenshot shows the HEC-HMS 3.5 software interface. The main window is titled "Basin Model [Ash Creek Basin]". On the left, a tree view shows the project structure, with "OneAndOnlyGage" selected under "Precipitation Gages". Below the tree, the "Components" tab is active, showing the configuration for "OneAndOnlyGage". The "Table" tab is selected, and a callout box points to it with the text: "Select 'Table' – we will cut-and-paste the time series from Excel". The configuration fields for "OneAndOnlyGage" are:

Name: OneAndOnlyGage	
*Start Date (ddMMYYYY)	01Jan2000
*Start Time (HH:mm)	00:00
*End Date (ddMMYYYY)	01Jan2000
*End Time (HH:mm)	03:15

At the bottom of the interface, a log window displays the following messages:

```
NOTE 10008: Finished opening project "Example 1" in directory "C:\Documents and Settings\Administrator\My Documents\Example_1" at time 28Jun2011, 11:32:19.  
NOTE 10179: Opened basin model "Ash Creek Basin" at time 28Jun2011, 11:32:22.  
NOTE 10604: 1441 missing or invalid values for gage "OneAndOnlyGage".  
NOTE 10604: 1621 missing or invalid values for gage "OneAndOnlyGage".  
NOTE 10604: 181 missing or invalid values for gage "OneAndOnlyGage".  
NOTE 10604: 141 missing or invalid values for gage "OneAndOnlyGage".  
NOTE 10604: 142 missing or invalid values for gage "OneAndOnlyGage".
```

The Windows taskbar at the bottom shows the Start button and several open applications: Microsoft PowerPoint, HEC-HMS 3.5, and Microsoft Excel.

# CREATE RAINFALL INPUT

Select "Table" – we will cut-and-paste the time series from Excel

- Cut and paste 00:05 to 03:10 from the spreadsheet.
- The first value at 00:00 is hand-entered as 0.00
- The last value at 03:15 is hand entered as 3.00

The screenshot displays the HEC-HMS 3.5 interface. On the left, the 'Time-Series Gage' table shows precipitation data for '01Jan2000, 00:00' to '01Jan2000, 01:25'. The value for '01Jan2000, 00:05' is 0.17, which is circled in red. An arrow points from this value to the 'depth(in)' column in the Excel spreadsheet. The Excel spreadsheet shows a table with columns for 'time(min)', 'time(hrs)', and 'depth(in)'. The value 0.17002 in the 'depth(in)' column at 5 minutes is circled in red. To the right, a 'Hyetograph' graph plots 'Depth (inches)' against time, showing a curve that starts at 0 and increases to approximately 1.7 inches at 100 minutes. The graph includes a trendline equation:  $y = 0.0823x^2 - 0.7932x + 1.71$ .

Time (ddMMYYYY, HH:mm)	Precipitation (IN)
01Jan2000, 00:00	0.00
01Jan2000, 00:05	0.17
01Jan2000, 00:10	0.44
01Jan2000, 00:15	0.66
01Jan2000, 00:20	0.85
01Jan2000, 00:25	0.99
01Jan2000, 00:30	1.11
01Jan2000, 00:35	1.20
01Jan2000, 00:40	1.28
01Jan2000, 00:45	1.35
01Jan2000, 00:50	1.40
01Jan2000, 00:55	1.45
01Jan2000, 01:00	1.49
01Jan2000, 01:05	1.53
01Jan2000, 01:10	1.57
01Jan2000, 01:15	1.62
01Jan2000, 01:20	1.66
01Jan2000, 01:25	1.71

time(min)	time(hrs)	depth(in)	b0	b1	b2	b3
5	0.083333	0.17002	-0.1602	4.3496	-4.879	2
10	0.166667	0.44199	-0.1602	0.362467	-0.03388	0.00
15	0.25	0.664421	-0.1602	1.0874	-0.30494	0.00
20	0.333333	0.845187	-0.1602	1.449867	-0.54211	0.10
25	0.416667	0.991361	-0.1602	1.812333	-0.84705	0.20
30	0.5	1.109259	-0.1602	2.1748	-1.21975	0.30
35	0.583333	1.204476	-0.1602	2.5373	-1.60005	0.40
40	0.666667	1.281927	-0.1602	2.9000	-1.98000	0.50
45	0.75	1.345886	-0.1602	3.2627	-2.36000	0.60
50	0.833333	1.40003	-0.1602	3.6254	-2.74000	0.70
55	0.916667	1.44747	-0.1602	3.9881	-3.12000	0.80
60	1	1.4908	-0.1602	4.3508	-3.50000	0.90
65	1.083333	1.532131	-0.1602	4.7135	-3.88000	1.00
70	1.166667	1.573131	-0.1602	5.0762	-4.26000	1.10
75	1.25	1.615069	-0.1602	5.4389	-4.64000	1.20
80	1.333333	1.658849	-0.1602	5.8016	-5.02000	1.30
85	1.416667	1.705052	-0.1602	6.1643	-5.40000	1.40
90	1.5	1.753978	-0.1602	6.5270	-5.78000	1.50
95	1.583333	1.805683	-0.1602	6.8897	-6.16000	1.60
100	1.666667	1.860018	-0.1602	7.2524	-6.54000	1.70

# CREATE RAINFALL INPUT

Select "Table" – we will cut-and-paste the time series from Excel

- Cut and paste 00:05 to 03:00 from the spreadsheet.
- The first value at 00:00 is hand-entered as 0.00

The screenshot displays the HEC-HMS 3.5 interface. On the left, a tree view shows the project structure, with '01Jan2000, 00:00 - 01Jan2000, 03:15' selected under 'Precipitation Gages'. The main window shows a 'Table' view for a 'SingleBasin' gage. The table lists precipitation values in inches for various times. A red circle highlights the first row (00:00, 0.00) and the second row (00:05, 0.17). To the right, an Excel spreadsheet is open, showing a hyetograph graph. The graph plots 'Depth (inches)' on the y-axis (0 to 3) against 'time(min)' on the x-axis (0 to 100). The data points from the table are plotted, and a curve is fitted to the data. A red circle highlights the value 0.17002 in the Excel spreadsheet, which corresponds to the 0.17 in the HEC-HMS table. The Excel spreadsheet also shows a table with columns for 'time(min)', 'time(hrs)', 'depth(in)', and coefficients 'b0', 'b1', 'b2', 'b3'.

Time (ddMMYYYY, HH:mm)	Precipitation (IN)
01Jan2000, 00:00	0.00
01Jan2000, 00:05	0.17
01Jan2000, 00:10	0.44
01Jan2000, 00:15	0.66
01Jan2000, 00:20	0.85
01Jan2000, 00:25	0.99
01Jan2000, 00:30	1.11
01Jan2000, 00:35	1.20
01Jan2000, 00:40	1.28
01Jan2000, 00:45	1.35
01Jan2000, 00:50	1.40
01Jan2000, 00:55	1.45
01Jan2000, 01:00	1.49
01Jan2000, 01:05	1.53
01Jan2000, 01:10	1.57
01Jan2000, 01:15	1.62
01Jan2000, 01:20	1.66
01Jan2000, 01:25	1.71

time(min)	time(hrs)	depth(in)	b0	b1	b2	b3
5	0.083333	0.17002	-0.1602	4.3496	-4.879	2
10	0.166667	0.44199	-0.1602	0.362467	-0.03388	0.00
15	0.25	0.664421	-0.1602	0.724933	-0.13553	0.00
20	0.333333	0.845187	-0.1602	1.0874	-0.30494	0.00
25	0.416667	0.991361	-0.1602	1.449867	-0.54211	0.10
30	0.5	1.109259	-0.1602	1.812333	-0.84705	0.20
35	0.583333	1.204476	-0.1602	2.1748	-1.21975	0.30
40	0.666667	1.281927	-0.1602	2.5373	-1.60222	0.40
45	0.75	1.345886	-0.1602	2.9000	-1.98470	0.50
50	0.833333	1.40003	-0.1602	3.2627	-2.36718	0.60
55	0.916667	1.44747	-0.1602	3.6254	-2.74966	0.70
60	1	1.4908	-0.1602	3.9881	-3.13214	0.80
65	1.083333	1.532131	-0.1602	4.3508	-3.51462	0.90
70	1.166667	1.573131	-0.1602	4.7135	-3.89710	1.00
75	1.25	1.615069	-0.1602	5.0762	-4.27958	1.10
80	1.333333	1.658849	-0.1602	5.4389	-4.66206	1.20
85	1.416667	1.705052	-0.1602	5.8016	-5.04454	1.30
90	1.5	1.753978	-0.1602	6.1643	-5.42702	1.40
95	1.583333	1.805683	-0.1602	6.5270	-5.80950	1.50
100	1.666667	1.860018	-0.1602	6.8897	-6.19198	1.60

# CREATE RAINFALL INPUT

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

Basin Model [Ash Creek Basin]

SingleBasin

Total depth == 2.8 inches

Precipitation (IN)

0.0 0.5 1.0 1.5 2.0 2.5 3.0

00:00 00:30 01:00 01:30 02:00 02:30 03:01

01Jan2000

Slide 49 of 50 Default Design

Duration == 3.0 hours

5075.pdf

90th percentile

50th percentile

10th percentile

90th percentile

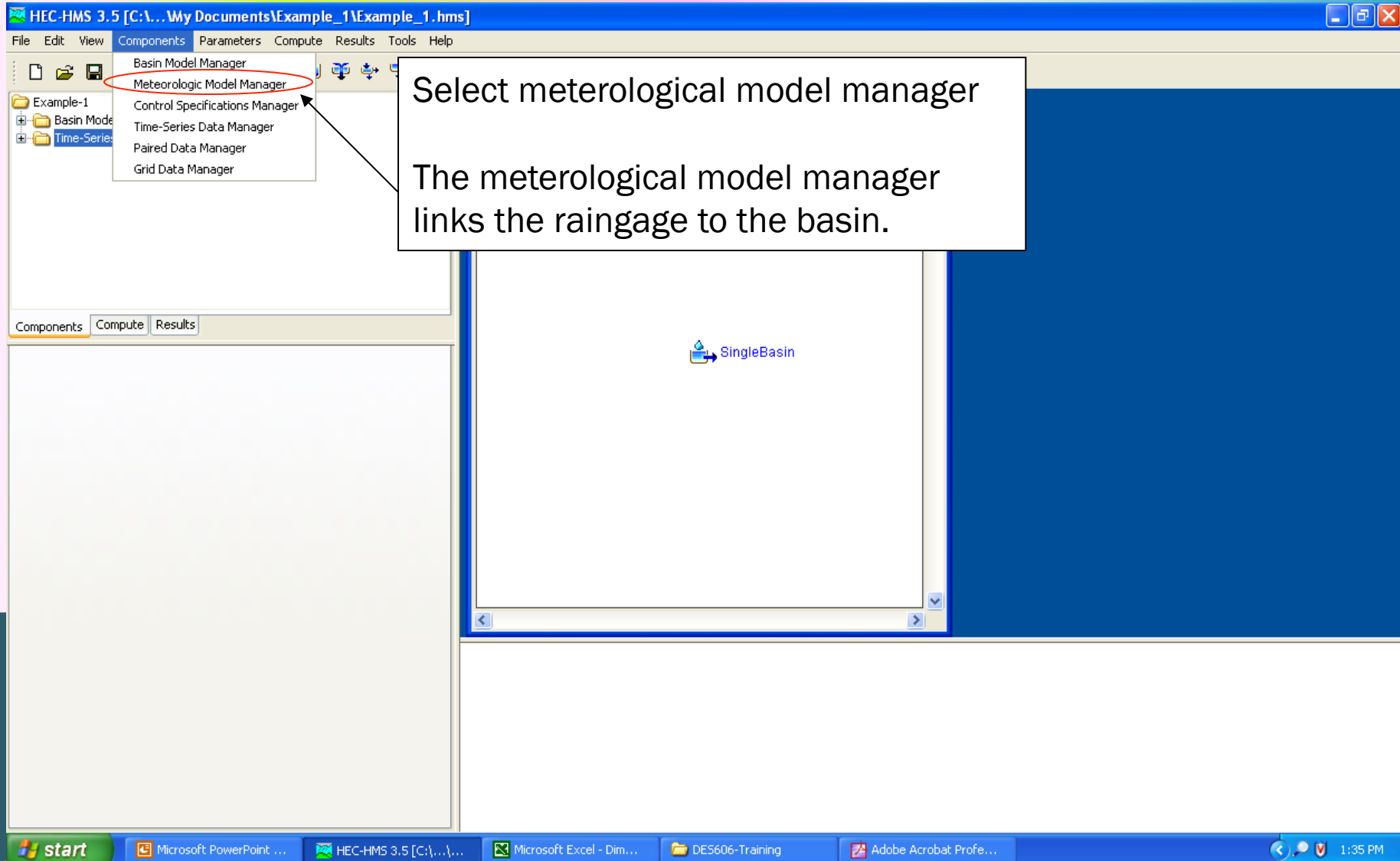
50th percentile

10th percentile

First- through fourth-quartile storms combined (trimmed and smoothed data group)

Verify that plot looks like the dimensionless hyetograph  
Graphs should have similar shape

# CREATE METEROLOGICAL MODEL



The screenshot displays the HEC-HMS 3.5 software interface. The title bar shows the file path: [C:\...My Documents\Example\_1\Example\_1.hms]. The menu bar includes File, Edit, View, Components, Parameters, Compute, Results, Tools, and Help. The Components menu is open, listing several options: Basin Model Manager, Meteorologic Model Manager (circled in red), Control Specifications Manager, Time-Series Data Manager, Paired Data Manager, and Grid Data Manager. A white callout box with a black border points to the 'Meteorologic Model Manager' option. The callout contains the text: 'Select meterological model manager' and 'The meterological model manager links the raingage to the basin.' The main workspace area shows a 'SingleBasin' icon with a blue arrow pointing to it. The Windows taskbar at the bottom shows the Start button and several open applications: Microsoft PowerPoint, HEC-HMS 3.5, Microsoft Excel, DE5606-Training, and Adobe Acrobat Professional. The system clock in the bottom right corner shows 1:35 PM.

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Basin Model Manager  
Meteorologic Model Manager  
Control Specifications Manager  
Time-Series Data Manager  
Paired Data Manager  
Grid Data Manager

Example-1  
Basin Mode  
Time-Series

Components Compute Results

SingleBasin

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\...)... Microsoft Excel - Dim... DE5606-Training Adobe Acrobat Profe... 1:35 PM

Select meterological model manager

The meterological model manager links the raingage to the basin.



# CREATE METEOROLOGICAL MODEL

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Example-1  
Basin Models  
Time-Series Data

Components Compute Results

Basin Model [Ash Creek Basin]

Meteorologic Model Manager

Current meteorologic models

New...  
Copy...  
Rename...

Create A New Meteorologic Model

Name : MetModel1  
Description : Link single gage to single basin

Create Cancel

- 1) Select "New ..."
- 2) Name the model
- 3) Description (optional)
- 4) Select "Create"

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\... Microsoft Excel - Dim... DES606-Training Adobe Acrobat Profe... 1:37 PM

# CREATE METEOROLOGICAL MODEL

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Example-1

- Basin-Models
- Meteorologic Models
  - MetModel1
  - Specified Hyetograph
- Time-Series Data

Components Compute Results

Meteorology Model Basins Options

**Met Name: MetModel1**

Description: Link single gage to single basin

Precipitation: Specified Hyetograph

Evapotranspiration: --None--

Snowmelt: --None--

Unit System: U.S. Customary

Basin Model [Ash Creek Basin]

- 1) Select "MetModel1"
- 2) Verify "Specified Hyetograph"
- 3) Select "Basins"
  - a) Basins we will link the subbasin to the time series

SingleBasin

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\... Microsoft Excel - Dim... DES606-Training Adobe Acrobat Profe... 1:41 PM

# CREATE METEROLOGICAL MODEL

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Example-1

- Basin Models
- Meteorologic Models
  - MetModel1**
  - Specified Hyetograph
- Time-Series Data

Components Compute Results

Meteorology Model Basins Options

Met Name: MetModel1

Basin Model	Include Subbasins
Ash Creek Basin	Yes

Basin Model [Ash Creek Basin]

SingleBasin

1) Select "Specified Hyetograph"  
2) Select "Yes" in Include Subbasin

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\...]\... Microsoft Excel - Dim... DES606-Training Adobe Acrobat Profe... 1:45 PM

# CREATE METEROLOGICAL MODEL

The screenshot displays the HEC-HMS 3.5 software interface. The main window is titled "Basin Model [Ash Creek Basin]". On the left, a tree view shows the project structure: "Example-1" containing "Basin Models", "Meteorologic Models" (with "MetModel1" selected), "Specified Hyetograph", and "Time-Series Data". Below the tree view, the "Components" tab is active, showing the "Subbasins" section. The "Met Name" is "MetModel1". A table with columns "Subbasin Name" and "Gage" is visible. The "Gage" column contains the option "OneAndOnlyGage", which is circled in red. A callout box with an arrow pointing to this option contains the following text:

1) Select "OneAndOnlyGage"  
This action links the gage name,  
Time-series, and the basin models.

The Windows taskbar at the bottom shows several open applications: Microsoft PowerPoint, HEC-HMS 3.5, Microsoft Excel, DE5606-Training, and Adobe Acrobat Professional. The system clock indicates 1:47 PM.

# CREATE CONTROL SPECIFICATIONS

The screenshot displays the HEC-HMS 3.5 software interface. The title bar reads "HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]". The menu bar includes "File", "Edit", "View", "Components", "Parameters", "Compute", "Results", "Tools", and "Help". The "Components" menu is open, showing a list of options: "Basin Model Manager", "Meteorologic Model Manager", "Control Specifications Manager", "Time-Series Data Manager", "Paired Data Manager", and "Grid Data Manager". The "Control Specifications Manager" option is circled in red. A white callout box with a black border and an arrow pointing to the red circle contains the text: "Close to a working model! Select 'Control Specifications'". The main workspace area shows a "SingleBasin" icon. The Windows taskbar at the bottom includes the "start" button and several open applications: "Microsoft PowerPoint ...", "HEC-HMS 3.5 [C:\...]", "Microsoft Excel - Dim...", "DES606-Training", and "Adobe Acrobat Profe...". The system clock shows "1:48 PM".

# CREATE CONTROL SPECIFICATIONS

The screenshot displays the HEC-HMS 3.5 interface. The main window is titled 'Basin Model [Ash Creek Basin]'. A 'Control Specifications Manager' dialog is open, showing a 'New...' button circled in red. A second dialog, 'Create A New Control Specifications', is open over it, with the 'Name' field containing 'Control 1' and the 'Description' field containing 'ControlSpecsForFirstRun'. The 'Create' button in this dialog is also circled in red. A callout box on the right contains the following list:

- 1) "New ..."
- 2) Name and Description
- 3) "Create"

The Windows taskbar at the bottom shows the Start button and several open applications: Microsoft PowerPoint, HEC-HMS 3.5, Microsoft Excel, DES606-Training, and Adobe Acrobat Professional. The system clock indicates 1:50 PM.

# CREATE CONTROL SPECIFICATIONS

The screenshot displays the HEC-HMS 3.5 software interface. The main window is titled "Basin Model [Ash Creek Basin]". On the left, a tree view shows the project structure, including "Control Specifications" and "Control 1". The "Control Specifications" panel is active, showing the following details for "Control 1":

Name:	Control 1
Description:	ControlSpecsForFirstRun
*Start Date (ddMMYYYY):	01Jan2000
*Start Time (HH:mm):	00:00
*End Date (ddMMYYYY):	01Jan2000
*End Time (HH:mm):	23:00
Time Interval:	15 Minutes

A red oval highlights the start and end date and time fields. A callout box with three numbered points is positioned to the right of the oval:

- 1) Provide simulation start and end dates/ time
- 2) Should cover the rainfall input time, but can be longer
- 3) Time step should be appropriate.

At the bottom of the interface, a log window displays the following messages:

```
NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 13:53:10.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 74 missing precipitation values that were set to zero.  
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 13:53:10.
```

The Windows taskbar at the bottom shows the Start button and several open applications: Microsoft PowerPoint, HEC-HMS 3.5, Microsoft Excel, DES606-Training, and Adobe Acrobat Professional. The system clock indicates the time is 5:16 PM.

# CREATE SIMULATION

The screenshot displays the HEC-HMS 3.5 software interface. The main window is titled "Basin Model [Ash Creek Basin]". The "Compute" menu is open, showing options like "Create Simulation Run", "Run Manager", "Create Optimization Trial", "Select Trial", "Trial Manager", "Create Analysis", "Select Analysis", "Analysis Manager", "Multiple Compute...", "Check Parameters", and "Compute". A callout box with the text "1) Create simulation run" points to the "Create Simulation Run" option in the menu.

In the "Control Specifications" panel, the following details are visible for "Control 1":

- Name: Control 1
- Description: ControlSpecsForFirstRun
- \*Start Date (ddMMYYYY): 01Jan2000
- \*Start Time (HH:mm): 00:00
- \*End Date (ddMMYYYY): 01Jan2000
- \*End Time (HH:mm): 23:00
- Time Interval: 5 Minutes

The "Control Specifications" panel is circled in red. The "SingleBasin" icon is also visible in the main window.

Log output at the bottom of the window:

```
NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 13:53:10.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 74 missing precipitation values that were set to zero.  
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 13:53:10.
```

The Windows taskbar at the bottom shows the Start button and several open applications: Microsoft PowerPoint, HEC-HMS 3.5, Microsoft Excel, DES606-Training, and Adobe Acrobat Professional. The system clock shows 5:18 PM.



# CREATE SIMULATION

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Example-1

- Basin Models
  - Ash Creek Basin
  - SingleBasin
- Meteorologic Models
- Control Specifications
  - Control 1
- Time-Series Data
- Precipitation Gages
  - OneAndOnlyGage
  - 01Jan2000, 00:00 - 01Jan2000, 03:00

Basin Model [Ash Creek Basin]

1) Name the run (default is Run #)  
2) Choose next

Create a Simulation Run [Step 1 of 4]

A simulation run must have a name. You can give it a description after it has been created.

Name

To continue, enter a name and click Next.

< Back Next > Cancel

NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 13:53:10.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 74 missing precipitation values that were set to zero.  
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 13:53:10.

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\... Microsoft Excel - Dim... DES606-Training Adobe Acrobat Profe... 5:19 PM

# CREATE SIMULATION

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Example-1

- Basin Models
  - Ash Creek Basin
  - SingleBasin
- Meteorologic Models
- Control Specifications
  - Control 1
- Time-Series Data
- Precipitation Gages
  - OneAndOnlyGage

01Jan2000, 00:00 - 01Jan2000, 03:00

Components Compute Results

Control Specifications

**Name: Control 1**

Description: ControlSpecsForFirstRun

\*Start Date (ddMMYYYY) 01Jan2000

\*Start Time (HH:mm) 00:00

\*End Date (ddMMYYYY) 01Jan2000

\*End Time (HH:mm) 23:00

Time Interval: 5 Minutes

**Create a Simulation Run [Step 2 of 4]**

A simulation run includes a basin model. Select one from the list below.

Name	Description
Ash Creek Basin	Ash Creek Single Basin Model

To continue, select a basin model and click Next.

< Back Next > Cancel

NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 13:53:10.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 74 missing precipitation values that were set to zero.  
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 13:53:10.

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\... Microsoft Excel - Dim... DES606-Training Adobe Acrobat Profe... 5:20 PM

# CREATE SIMULATION

The screenshot displays the HEC-HMS 3.5 software interface. The main window is titled "Basin Model [Ash Creek Basin]". A "Create a Simulation Run [Step 3 of 4]" dialog box is open, showing a list of meteorologic models. The "MetModel1" model is selected and highlighted with a red oval. A white callout box with a black border contains the text "1) Verify model selections" and "2) Choose next", with an arrow pointing to the "MetModel1" entry. The dialog box also contains the text "Selected basin model 'Ash Creek Basin'. A simulation run includes a meteorologic model. Select one from the list below." and "To continue, select a meteorologic model and click Next." Below the list are buttons for "< Back", "Next >", and "Cancel".

Example-1

- Basin Models
  - Ash Creek Basin
  - SingleBasin
- Meteorologic Models
- Control Specifications
  - Control 1
- Time-Series Data
- Precipitation Gages
  - OneAndOnlyGage

01Jan2000, 00:00 - 01Jan2000, 03:00

Components Compute Results

Control Specifications

Name: Control 1

Description: ControlSpecsForFirstRun

\*Start Date (ddMMYYYY) 01Jan2000

\*Start Time (HH:mm) 00:00

\*End Date (ddMMYYYY) 01Jan2000

\*End Time (HH:mm) 23:00

Time Interval: 5 Minutes

Basin Model [Ash Creek Basin]

Create a Simulation Run [Step 3 of 4]

Selected basin model "Ash Creek Basin". A simulation run includes a meteorologic model. Select one from the list below.

Name	Description
MetModel1	Link single gage to single basin

To continue, select a meteorologic model and click Next.

< Back Next > Cancel

NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 13:53:10.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 74 missing precipitation values that were set to zero.  
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 13:53:10.

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\... Microsoft Excel - Dim... DES606-Training Adobe Acrobat Profe... 5:21 PM

# CREATE SIMULATION

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Example-1

- Basin Models
  - Ash Creek Basin
  - SingleBasin
- Meteorologic Models
- Control Specifications
  - Control 1
- Time-Series Data
- Precipitation Gages
  - OneAndOnlyGage

01Jan2000, 00:00 - 01Jan2000, 03:00

Components Compute Results

Control Specifications

**Name: Control 1**

Description: ControlSpecsForFirstRun

\*Start Date (ddMMYYYY) 01Jan2000

\*Start Time (HH:mm) 00:00

\*End Date (ddMMYYYY) 01Jan2000

\*End Time (HH:mm) 23:00

Time Interval: 5 Minutes

Basin Model [Ash Creek Basin]

Create a Simulation Run [Step 4 of 4]

Selected basin model "Ash Creek Basin" and meteorologic model "MetModel1". A simulation run includes a control specifications. Select one from the list below.

Name	Description
Control 1	ControlSpecsForFirstRun

Select a control specifications and click Finish.

< Back Finish Cancel

NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 13:53:10.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 74 missing precipitation values that were set to zero.  
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 13:53:10.

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\...]\... Microsoft Excel - Dim... DES606-Training Adobe Acrobat Profe... 5:22 PM

# RUN SIMULATION

The screenshot displays the HEC-HMS 3.5 software interface. The main window shows a project tree on the left with folders for Basin Models, Meteorologic Models, Control Specifications, Time-Series Data, and Precipitation Gages. The 'Control Specifications' window is open, showing the following details:

Field	Value
Name	Control 1
Description	ControlSpecsForFirstRun
*Start Date (ddMMYYYY)	01Jan2000
*Start Time (HH:mm)	00:00
*End Date (ddMMYYYY)	01Jan2000
*End Time (HH:mm)	23:00
Time Interval	5 Minutes

The 'Compute' menu item and the 'flaming water drop' icon in the toolbar are circled in red. A text box explains: "Run simulation from the compute menu item, or The 'flaming water drop' icon." The 'Basin Model [Ash Creek Basin] Current Run [Run 1]' window shows a 'SingleBasin' icon and a log of simulation results:

```
NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 13:53:10.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 74 missing precipitation values that were set to zero.  
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 13:53:10.  
NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 17:22:47.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 221 missing precipitation values that were set to zero.  
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 17:22:47.
```

The Windows taskbar at the bottom shows the Start button and several open applications: Microsoft PowerPoint, HEC-HMS 3.5, Microsoft Excel, DES606-Training, and Adobe Acrobat Professional. The system clock shows 5:22 PM.

# RUN SIMULATION

HEC-HMS 3.5 [C:\...My Documents\Example\_1\Example\_1.hms]

File Edit View Components Parameters Compute Results Tools Help

Example-1

- Basin Models
  - Ash Creek Basin
  - SingleBasin
- Meteorologic Models
- Control Specifications
  - Control 1
- Time-Series Data
- Precipitation Gages
  - OneAndOnlyGage

01Jan2000, 00:00 - 01Jan2000, 03:00

Components Compute Results

Control Specifications

Name: Control 1

Description: ControlSpecsForFirstRun

\*Start Date (ddMMMYYYY): 01Jan2000

\*Start Time (HH:mm):

\*End Date (ddMMMYYYY):

\*End Time (HH:mm): 23:00

Time Interval: 5 Minutes

Successful run:

Basin Model [Ash Creek Basin] Current Run [Run 1]

Finished Computing "Run 1"

Basin: Ash Creek Basin Met: MetModel1 Control: Control 1

100%

Close

NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 13:53:10.  
NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 17:22:47.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 221 missing precipitation values that were set to zero.  
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 17:22:47.  
NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 17:24:46.  
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".  
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 221 missing precipitation values that were set to zero.  
~~NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".~~  
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 17:24:47.

start Microsoft PowerPoint ... HEC-HMS 3.5 [C:\...]\... Microsoft Excel - Dim... DES606-Training Adobe Acrobat Profe... 5:24 PM

# RUN SIMULATION

Right-Click on the sub-basin  
to obtain “results”

For this example choose :  
View results/Graph

The screenshot displays the HEC-HMS 3.5 software interface. The main window is titled "Basin Model [Ash Creek Basin] Current Run [Run 1]". On the left, the "Element Name: SingleBasin" panel shows the following configuration:

- Description: Ash Creek as a single basin
- Downstream: --None--
- \*Area (MI2): 6.92
- Canopy Method: --None--
- Surface Method: --None--
- Loss Method: Initial and Constant
- Transform Method: SCS Unit Hydrograph
- Baseflow Method: --None--

The main workspace shows a basin model diagram with a context menu open over a sub-basin. The menu options are:

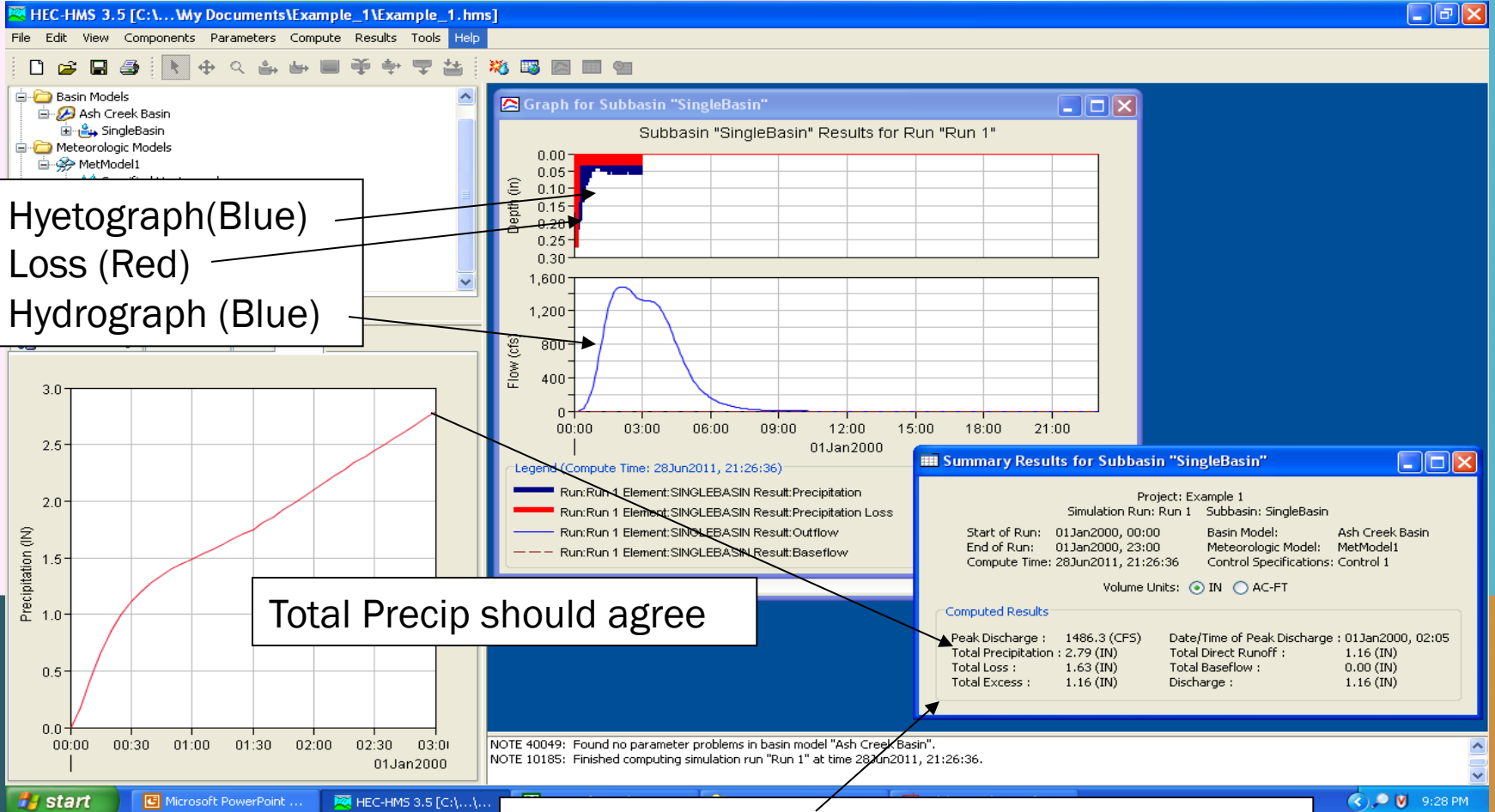
- Create Basin
- Edit
- View Results [Run 1]
- Connect Downstream
- Select Computation Point
- Cut Element
- Copy Element
- Paste Element
- Delete Element

The bottom status bar displays the following log messages:

```
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 13:53:10.
NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 17:22:47.
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 221 missing precipitation values that were set to zero.
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 17:22:47.
NOTE 10184: Began computing simulation run "Run 1" at time 28Jun2011, 17:24:46.
NOTE 20364: Found no parameter problems in meteorologic model "MetModel1".
WARNING 20657: Hyetograph gage "OneAndOnlyGage" for subbasin "SingleBasin" contains 221 missing precipitation values that were set to zero.
NOTE 40049: Found no parameter problems in basin model "Ash Creek Basin".
NOTE 10185: Finished computing simulation run "Run 1" at time 28Jun2011, 17:24:47.
```

The Windows taskbar at the bottom shows the Start button and several open applications: Microsoft PowerPoint, HEC-HMS 3.5, Microsoft Excel, DES606-Training, and Adobe Acrobat Professional. The system clock indicates 9:13 PM on 28 Jun 2011.

# VIEW RESULTS



Hyetograph (Blue)  
Loss (Red)  
Hydrograph (Blue)

Total Precip should agree

Summary Table (Separate Window Query)



# ADD OBSERVATIONS

Intentional input basin lag as 80 minutes

Use a historical storm and see how well (or poorly) we did

Use Time-Series-Manager to add these new gages

Use Control-Specifications to build control conditions for this different run.

# NEXT TIME

- ES7 Solution Sketch
- Unit Hydrographs – HMS Workshop
  - Multiple sub-basins