Ventura County
Watershed Protection District
Planning & Regulatory Division
Hydrology Section

VCRat2.6 andTc Calculator

Training Class

December, 2008

VCWPD Tc Calculator Demonstration 1a

Objective: Learn to use Tc Calculator to do Tc calculations for undeveloped subareas

1) Launch Tc calculator (VenturaTc.exe).
2) Right click in the project explorer window (the white box on the left hand side of the window) and select *New Watershed.* Under project name, put Brown Barranca.
3) Right click on the watershed name in the project explorer and select *New Sub-Area for Watershed.* Select" Sub-Area" in the project explorer window – note that the sub-area data fields become active. Enter the following information in the subarea window:

Name – 1A	Rainfall Zone – K
Flood Zone – 2	Development Type – Undeveloped
Storm Frequency – 100	% Impervious – 0
Soil Type – 3	

On the date box, select the current date by clicking on the downward arrow. Otherwise, the output date will default to 12:00 AM.

4) Create a new flow-path by right-clicking on subarea "1A" in the project explorer and choosing *New Flow Path for Sub-area*. Repeat this step 2 more times to create a total of 3 flow-paths. All the necessary input information is in the provided maps. Select the first (top) flow-path in the project explorer window – note that the flow-path data fields become active. Enter the following info:

Name – 1A1	Type – Overland
Length – 775 ft	Top Elevation – 1,380 ft
Bottom Elevation – 1,140 ft	Contributing Area – 3.9
Development Type – Undeveloped	

See the figure below for what the data entry window should look like.

5) Enter the required information for flowpaths 1A2 and 1A3. The flowpath information is provided in the attached maps for subareas 1A and 2A. Please note that the flow path type should be changed from overland to natural channel for 1A2 and 1A3 respectively.
6) Save your project - Choose File | Save As and name your file "yourfilename.vtc" – put it in the desktop folder "VCRAT".
7) If you make any changes, save your input before moving on. Choose File | Save to save all the changes to the Tc input file.
8) Now that the data entry is complete, the Tc calculation can be performed. The calculator will check your input data to make sure it is complete and then run the calculations to find Tc. Click the *Compute* button on the toolbar. Calculator will run and creates an output text file. The Results screen appears and shows the detailed results of the calculation. You cannot print this output but a text file has been stored in your specified directory that you can print out.

VCWPD Tc Calculator Demonstration 1b – Multiple Subareas

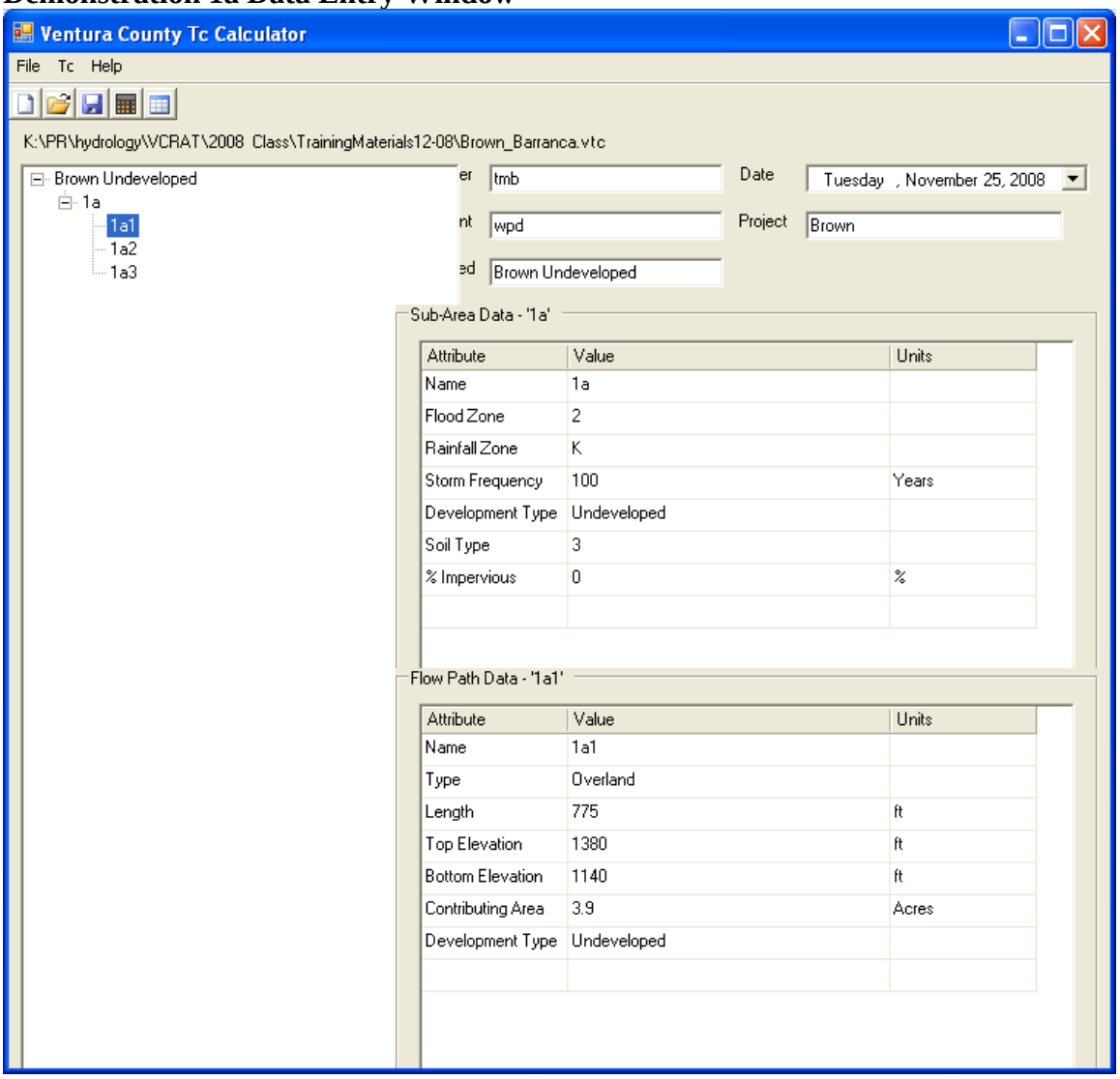
Objective: Learn to use Tc Calculator to do Tc calculations for multiple subareas

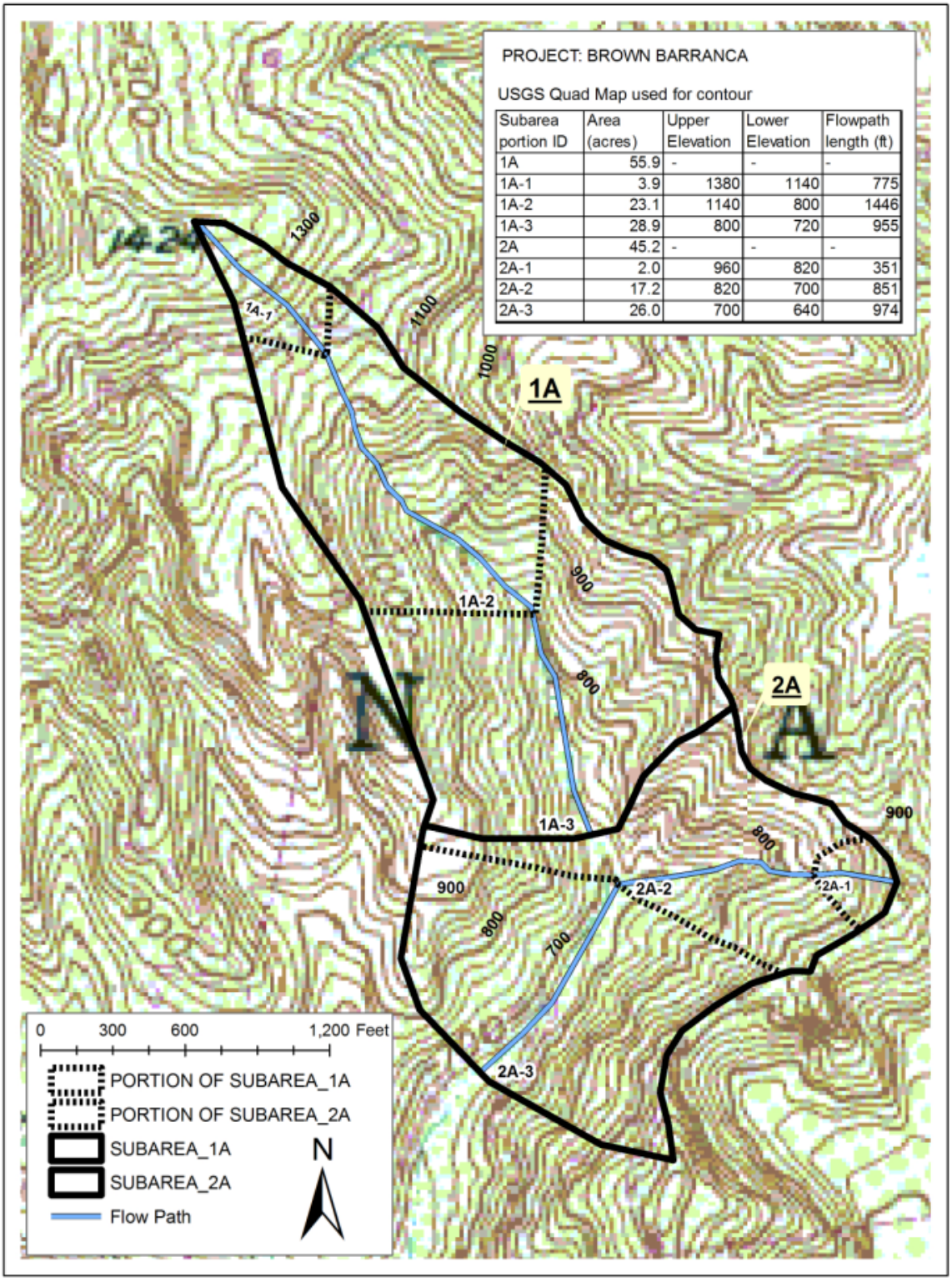
1) Right click on the watershed name and select “new subarea…”
2) Enter the following information for this subarea.

Name – 2A	
Flood Zone – 2	Rainfall Zone – K
Storm Frequency – 100	Development Type – Undeveloped
Soil Type – 3	% Impervious – 0

3) Add new flow paths to the subarea and enter the info from the map following the steps in Demonstration 1a above.
4) Save your file after entering the data and calculate the Tc for the new subarea.

Demonstration 1a Data Entry Window




PROJECT: BROWN BARRANCA
USGS Quad Map used for contour
Subarea portion ID | Area (acres) | Upper Elevation | Lower Elevation | Flowpath length (ft)
1A | 55.9 | - | - | -
1A-1 | 3.9 | 1380 | 1140 | 775
1A-2 | 23.1 | 1140 | 800 | 1446
1A-3 | 28.9 | 800 | 720 | 955
2A | 45.2 | - | - | -
2A-1 | 2.0 | 960 | 820 | 351
2A-2 | 17.2 | 820 | 700 | 851
2A-3 | 26.0 | 700 | 640 | 974
1A
2A
1A-1
1A-2
1A-3
2A-1
2A-2
2A-3
1300
1100
1000
900
800
700
0 300 600 1,200 Feet
PORTION OF SUBAREA_1A
PORTION OF SUBAREA_2A
SUBAREA_1A
SUBAREA_2A
Flow Path
N

VCWPD Tc Calculator Demonstration 2

Objective: Learn to use Tc Calculator to do Tc calculations for developed subarea

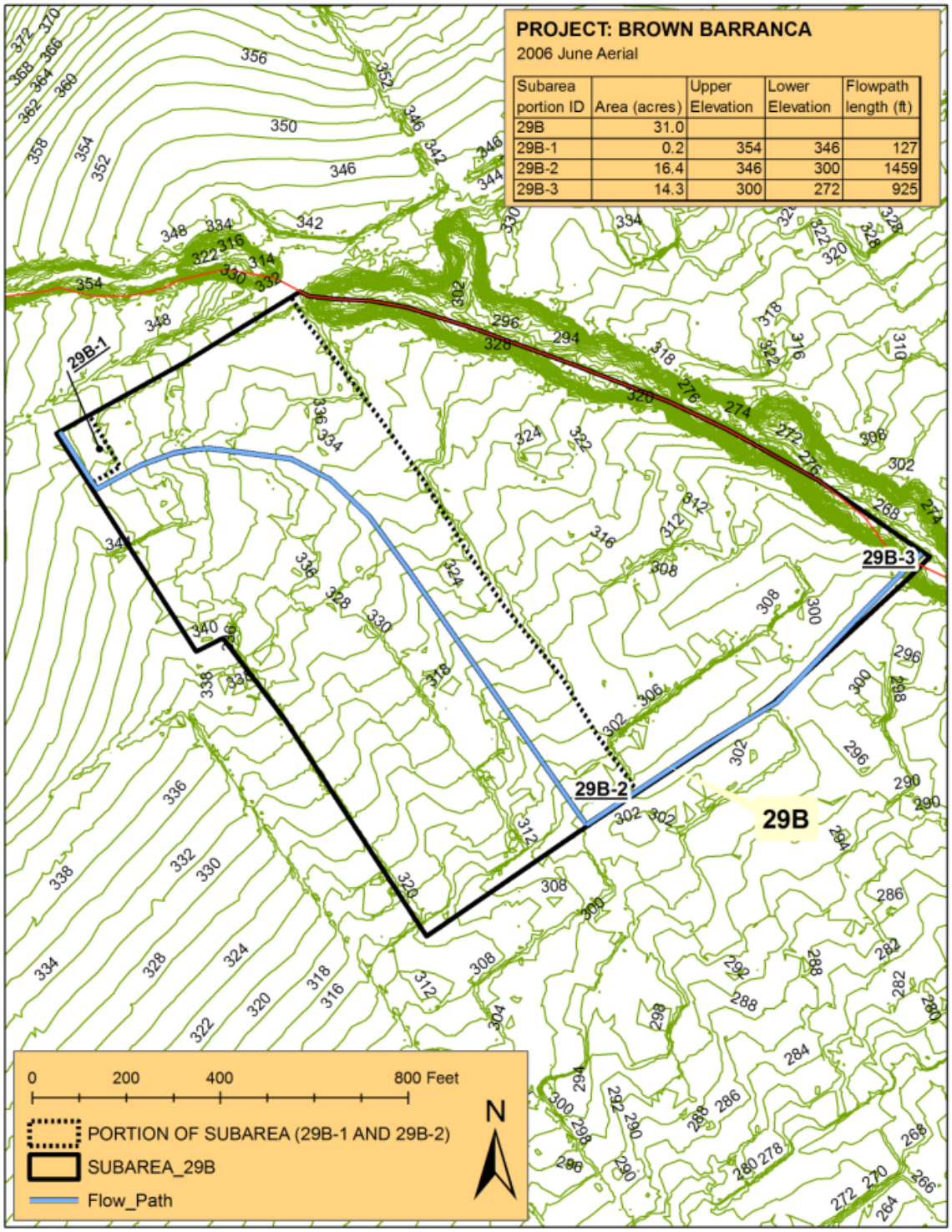
1) Launch Tc calculator (VenturaTc.exe). Another option is to add the subarea in your existing *.vtc file with the undeveloped subareas.
2) If you open a new file, right click in the project explorer (the white box on the left hand side of the window) and select *New Watershed.* Under project name, put Brown Residential.
3) Right click on the watershed name in the project window and select *New Sub-Area for Watershed.* Select" Sub-Area" in the project explorer – note that the sub-area data fields become active.
4) Enter the appropriate information. This information is obtained from the maps provided for subarea 29B. Enter the following information in the appropriate fields:

Name – 29B	
Flood Zone – 2	Rainfall Zone – K
Storm Frequency – 100	Development Type – Residential
Soil Type – 3	% Impervious – 23

5) Create a new flow-path by right-clicking on subarea "29B" in the project explorer and choosing *New Flow Path for Sub-area*. Repeat this step 2 more times to create a total of 3 flow-paths. All the necessary input information is in the provided maps.
6) Save your project before moving on to more data entry. For a new file, choose File | Save As and name your file "yourfilename.vtc" –put it in the desktop folder "VCRAT".
7) Select the first (top) flow-path in the project explorer window – note that the flow-path data fields become active.

Name – 29B-1	Type – Overland
Length – 127 ft	Top Elevation – 354 ft
Bottom Elevation – 346 ft	Contributing Area = 0.2 acres
Development Type – Residential	

8) Repeat the previous data entry procedure for flowpaths 29b2 and 29b3 and input the information shown in the maps. Please note that the flow path type changes. For 29B2, flow path type is street (32-ft wide, 6-in curbs) and for 29B3, the conveyance type is pipe (n=0.012). Enter an assumed diameter of 24-in for the pipe-the program will resize the pipe to provide for open-channel flow if necessary. If you enter a pipe size that provides for open channel flow, the program will use that size in the calculation.
9) Once finished, save your input before moving on. Choose File | Save to save all the changes to the Tc input file.
10) Now that the data entry is complete, the Tc calculation can be performed. The calculator will check your input data to make sure it is complete and then run the calculations to calculate a Tc. Click the *Compute* button on the toolbar. Calculator runs and creates an output file. The Results screen appears and shows the detailed results of the calculation.


PROJECT: BROWN BARRANCA
2006 June Aerial
Subarea portion ID | Area (acres) | Upper Elevation | Lower Elevation | Flowpath length (ft)
29B | 31.0
29B-1 | 0.2 | 354 | 346 | 127
29B-2 | 16.4 | 346 | 300 | 1459
29B-3 | 14.3 | 300 | 272 | 925
29B-1
29B-2
29B-3
29B
0 200 400 800 Feet
N
PORTION OF SUBAREA (29B-1 AND 29B-2)
SUBAREA_29B
Flow_Path


PROJECT: BROWN BARRANCA
2006 June Aerial
29B-1
29B-3
29B-2
29B
0
200
400
800 Feet
N
PORTION OF SUBAREA (29B-1 AND 29B-2)
SUBAREA_29B
Flow_Path

VCRat 2.6 Training Exercise- Example 1

Objective: Enter data in a new VCRat2.6 model input file and run it.

VCRat2.6 Starting From Scratch

1) Open VCRat2.6 program by double clicking on desktop shortcut or start →all programs → VCWPD Hydrology → VCRat 26 → VCRat26
2) Click on Project Info and in the window type the project name. If you do not provide a name, you cannot enter information in the model!
   >Job number, usually is a 5 digit project number, 1 is okay for this example.
   >Subarea Start number- can be higher than 1 but 1 is fine for this example.
   >Click on the folder and create the output file name and location, "start_from_scratch.out".
   If using relative pathways, output file and hydrographs will be stored in folder containing input file. If using absolute pathways, you can find hydrographs and store output files in different locations than the input file.
   If a hydrograph needs to be imported, click on the folder and locate .hyd file.
   >Click new if a new hydrograph will be created, "start_from_scratch_hydros_in.hyd".
3) Under storm frequency, scroll down to 100 year. Click on "Add" button to add as many single line project descriptions as you want. In this case, type "start from scratch tutorial" and click OK.
4) Add any other descriptions to the project including names, dates, assumptions, frequency. This will be printed on the title page.
5) Click the Ok button to close window. Now we can start adding model nodes.
6) Click on Add → Subarea (which should be 1A) →Ok, and type or select the parameters given below, then click OK.

Soil type 2	020
Area ac	54
Time of Concentration (min)	10
Percent Impervious	0
Rainfall zone	K zone

7) Click on Add → subarea (which should be 2A), and type in the parameters below.

Soil type	020
Area	47
Time of Concentration (min)	10
Percent Impervious	0
Rainfall zone	K zone

   You can also copy the info from Subarea 1 and then edit it in the appropriate places.
8) Under Main Channel Routing, click on add/edit and type in the parameters below, then click OK to close the routing window. OK again to close operation window.

Routing type	Natural mountain
Routing length	1750
Routing slope	0.04

9) Add PLACE HOLD node 3B (also called "dummy" nodes).

10) Add subarea 4B, and type in parameters given below.

Hydrograph Bank	B
Soil type	030
Area	67
Time of Concentration (min)	8
Percent Impervious	37
Rainfall zone	K zone

11) Add CONFLUENCE 5AB with hydrograph bank A, lateral bank B, and type in main channel routing parameters given below.

Routing type	40 Foot Road
Routing length	2525
Routing slope	0.01

Do not force flow to stay in the street by checking the box, which then adds a street width to the model input data.

12) Add subarea 6A and type in parameters given below. Ask for hydrograph printout.

Soil type	050
Area	18
Time of Concentration (min)	10
Percent Impervious	23
Rainfall zone	K zone

13) Under Reservoir routing, click on add/edit and type in the values below. Can enter SCS Curve Number and Centroid rainfall instead of runoff factor. Check the Route through Reservoir box. If you don't check this box, you can enter the reservoir information but the program will not route the hydrograph through the reservoir. AR factor is 1.0 due to total area less than 640 ac.

Hydrograph adjustment factor AR	1.0
Fatten Method	Runoff Factor
Runoff Yield in.	4.0
Emergency Spillway Elevation ft	100.0
Top of Dam Elevation ft	105.0

Stage - Storage - Discharge Curve for Reservoir at 6A

STAGE (ft)	STORAGE (ac-ft)	DISCHARGE (cfs)
80.00	0.00	0.00
85.00	40.00	100.00
87.50	80.00	150.00
90.00	120.00	200.00
95.00	160.00	250.00
100.00	300.00	300.00
105.00	400.00	5,000.00

For advanced users, do a couple of entries, export the file as a .csv file, do the remaining entries in Excel, and them import the final file.

14) Add PLACE HOLD node 7A. Ask for hydrograph printout.

15) Run the Model.

16) To view model hydrograph select Mode Menu → View Final Hydrographs

Click on model point to view hydrographs. Use Export button to export to another format for use in another model or to plot in Excel . Click the Close Button to close window.

17) Notice that because you did not force the program to keep the flow in the street, the program switched to a 6' pipe and marked the change with a "#" in the output file.
18) To check the peak flow without the reservoir, edit node 6a and in the reservoir edit window, uncheck the "Route through a Reservoir" box. Save file and rerun.

VCWPD VCRat 2.6 Training Example 2

Objective: Learn to use VCRat 2.6 to modify an existing file to add the following:

1. Missing subarea and routing information
2. Watershed yield, areal reduction, and detention basin routing

Problem Statement:

You work for the Watershed Protection District and are doing a review of a land development study. You notice that the consultant omitted two subareas from their hydrology model. They also designed a basin to attenuate their 100-yr developed flow back to the 10-yr undeveloped level, but neglected to include the basin in the model they submitted to show the peak flow reduction. In the interests of client service, you have volunteered to revise their VCRat 2.6 file to add these features and see if they met their mitigation goals.

Steps:

1. Launch VCRat 2.6
2. Open the file EXER2A.VIN
3. Revise with the provided information by editing PLACE HOLD nodes 2A and 40D by clicking on the node number and then the edit button. Don't forget to change the operation from dummy/place holder to subarea.
4. Edit subarea 70A to add a detention basin to mitigate the developed peak flow. Note- you need to add a placeholder node at 71A after the basin.
5. For advanced users, import the stage-storage-discharge file you created in the previous example in the reservoir edit window.

Missing Subarea Information

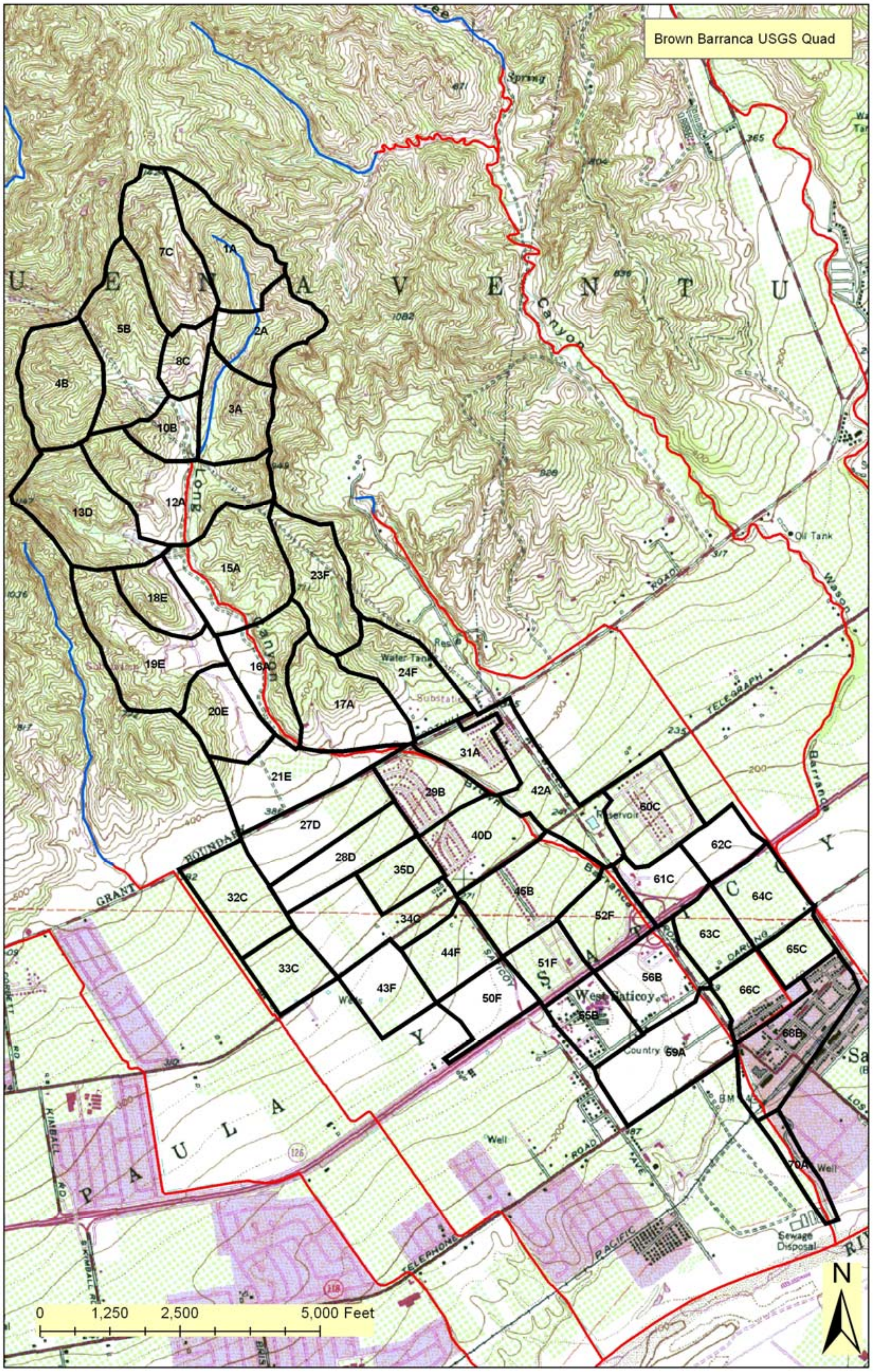
Node	Soil	Tc min	Area ac	% Eff Imp.	Routing Info
002A	030	10	47	0 Undev	Mountain Channel length = 1750' S=0.04 ft/ft
040D	030	9	50	23 Res	Machine Routing, length = 960' S=0.0111ft/ft

<u>Basin Information for Node 70A</u>
Hydrograph Adjustment Factor 0.85 Runoff ('fattening') Factor 4.0 inches
Basin Spillway Elevation 100 ft Top of Dam Elevation 105'

Stage - Storage - Discharge Curve for Reservoir at 70A

STAGE (ft)	STORAGE (ac-ft)	DISCHARGE (cfs)
80.00	0.00	0.00
85.00	40.00	100.00
87.50	80.00	150.00
90.00	120.00	200.00
95.00	160.00	250.00
100.00	300.00	300.00
105.00	400.00	5,000.00

If the Q10 undeveloped is 1,200 cfs, did the developer meet their mitigation requirements?


Brown Barranca USGS Quad
1A
2A
3A
4B
5B
7C
8C
10B
12A
13D
15A
16A
17A
18E
19E
20E
21E
23F
24F
27D
28D
29B
31A
32C
33C
34C
35D
40D
42A
43F
44F
45B
50F
51F
52F
55B
56B
59A
60C
61C
62C
63C
64C
65C
66C
68B
70A
0 1,250 2,500 5,000 Feet
N