Instructor: Arturo Leon Name ___SOLUTION KEY_____

QUIZ 1

CE 412/512 Hydrology - Spring 2013

1. *(10 pts)* The table below lists the cumulative rainfall data for a storm event in a 350 acre basin.

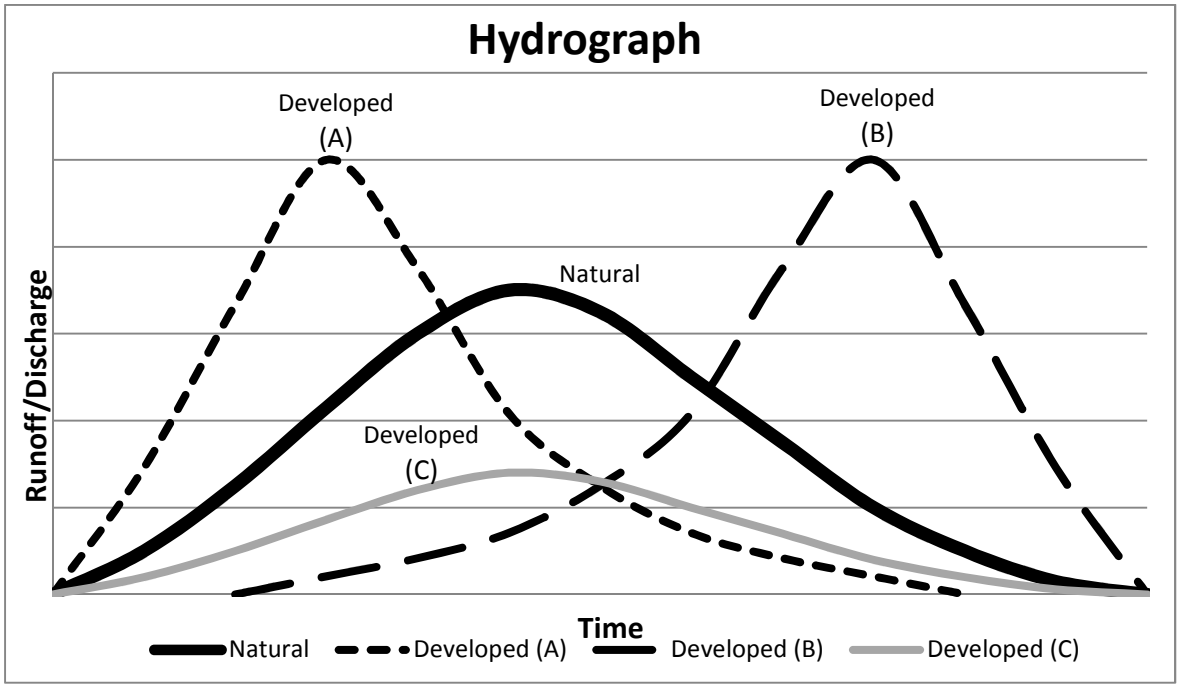
Time (min)	Accumulated Rainfall (in)
0	0
10	0.1
20	0.4
30	1.1
40	1.5
50	1.8
60	2.0

Time Interval	Incremental Rainfall (in)	Rainfall Intensity (in/hr)
0-10	0.1	0.6
10-20	0.3	1.8
20-30	***0.7***	***4.2***
30-40	0.4	2.4
40-50	0.3	1.8
50-60	0.2	1.2

Which time period has the highest intensity rainfall (in inches/hr.)?

a. 0-10 min
b. 20-30 min
c. 40-50 min
d. 50-60 min

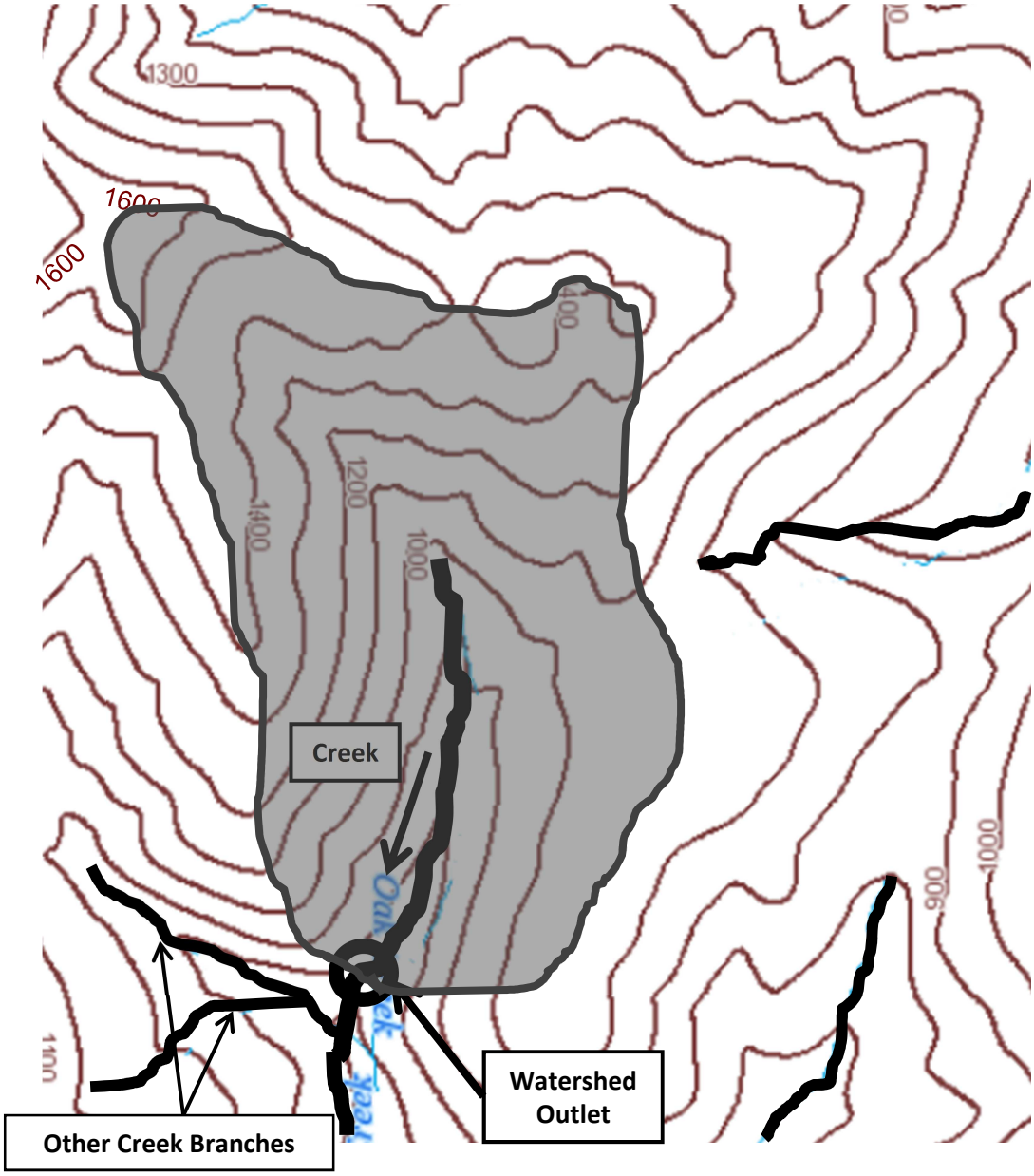
2. *(10 pts)* Urbanization changes the land use in a basin by creating more impervious areas, which can greatly affect stormwater runoff. Which graph below best shows the hydrograph change due to urbanization given the natural (before urbanization) hydrograph?



a. Developed (A)
b. Developed (B)
c. Developed (C)

3. *(10 pts)* Overland flow is defined as:
    a. All flows that contribute to runoff at the basin outlet
    b. Flow in the most upstream sub-basin of a watershed
    c. Sheet flow toward the nearest stream
    d. Measured flow at a stream gage

4. *(20 pts)* Complete the delineation of the watershed area that contributes to the Oak Creek outlet (circled location ○)



5. *(25 pts)* Elk Lake has a surface area of 500 ac. Over a 10-day period, the average inflow was 27,648 in^3/s and the average outflow was 20,736 in^3/s. The total precipitation was measured as 1.8 inches and the total evaporation loss was 1.1 inches. Over the 10-day period, a +2 inch storage change (or increase in lake level) was recorded. Estimate the amount of seepage (in inches) over the 10-day period for the lake. (Note: 1 ac = 43,560 ft^2 = 6,272,640 in^2).

Show your work/calculations and box your answer.

SOLUTION:

Storage Equation

$$\Delta S = Inflow - Outflow + Precip - Evap - Seepage$$

Convert Inflow and Outflow to depth (in.)

$$Inflow = 27648\frac{in^3}{s}\left(\frac{1}{500\ ac}\right)\left(\frac{1\ ac}{6{,}272{,}640\ in^2}\right)\left(\frac{3600s}{hr}\right)\left(\frac{24\ hr}{d}\right)(10\ d) = 7.6\ in$$

$$Outflow = 20736\frac{in^3}{s}\left(\frac{1}{500\ ac}\right)\left(\frac{1\ ac}{6{,}272{,}640\ in^2}\right)\left(\frac{3600s}{hr}\right)\left(\frac{24\ hr}{d}\right)(10\ d) = 5.7\ in$$

Calculate Seepage with Storage Equation

$$\Delta S = Inflow - Outflow + Precip - Evap - Seepage$$

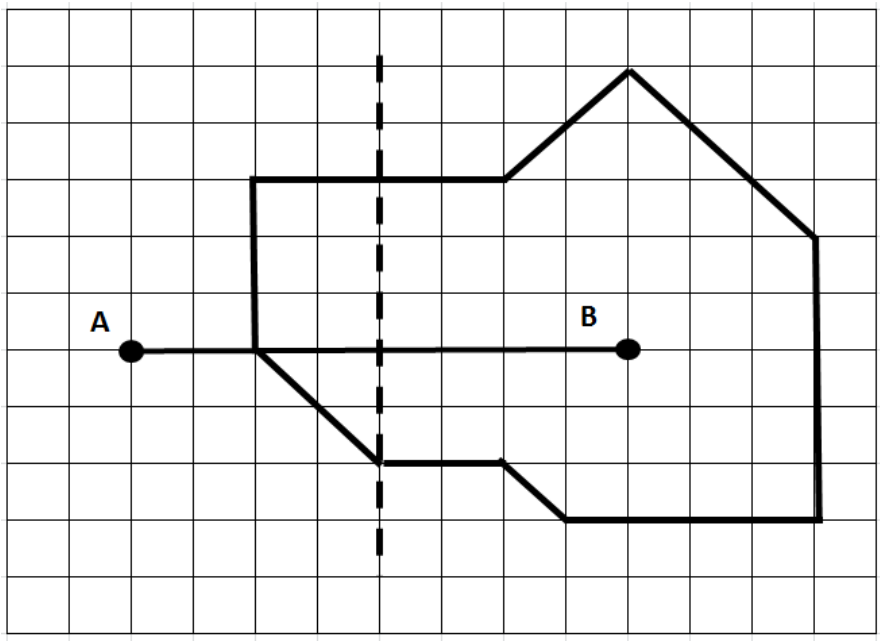
$$2\ in = 7.6\ in - 5.7\ in + 1.8\ in - 1.2\ in - S$$

$$\boxed{S = 0.6\ in}$$

6. *(25 pts)* A small urban watershed has two rainfall gages as located in the Figure below. One grid square = 1 sq. mile. Total rainfall recorded at each gage during a storm event is listed in the table below. Compute the mean areal rainfall for this storm using:

    a. arithmetic averaging, and
    b. the Thiessen method

Please box your answers.



NOTE: 1 grid square = 1 square mile

Gage	Rainfall (in)
A	4.5
B	3.7

SOLUTION:

a. *(5 pts)* To calculate the arithmetic average only the gages that are present in the watershed boundary need to be taken into account which in this case is just gage B.

Rainfall = 3.7 in

b. *(20 pts)* Thiessen Method

Gage	Area (mi^2)	Area %	Rainfall (in.)	Weighted Rainfall (in)
A	8	15.7	4.5	0.706
B	43	84.3	3.7	3.120
SUM	51	100		**3.825**

Rainfall = 3.825 in