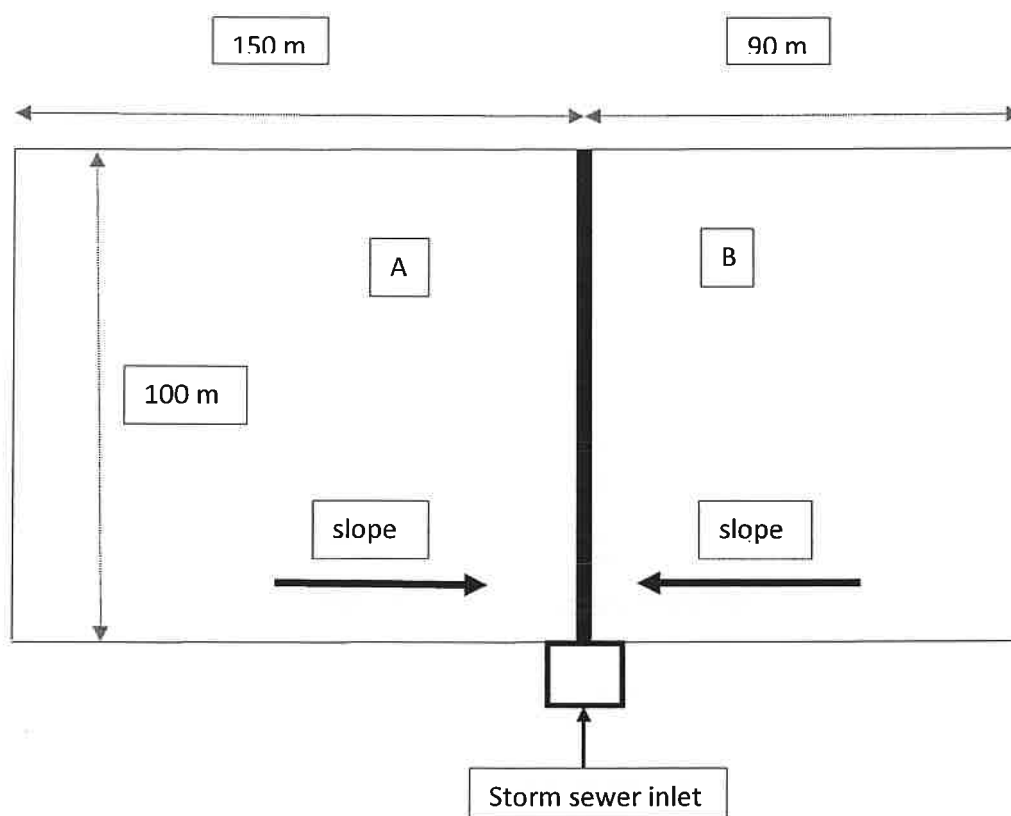


PROBLEM 1.-

City parking lots A and B slope to join at a common gutter that discharges to a storm sewer inlet located at one end of the lots, as shown. Both lots are 100 m wide, with lot A being 150 m deep and lot B being 90 m deep. Lot A slopes at 0.001 and lot B slopes at 0.0006. Both lots are newly paved with smooth asphalt.

For a rainfall intensity of      cm/hr over a 1 hr period. WHATS IS THE TIME OF CONCENTRATION ( $T_c$ ) FOR FLOW TO THE GUTTER of both lots?



$$T_c = \frac{1.8 (1.1 - C) \sqrt{3.28 * D}}{S^{1/3}}$$

Where:

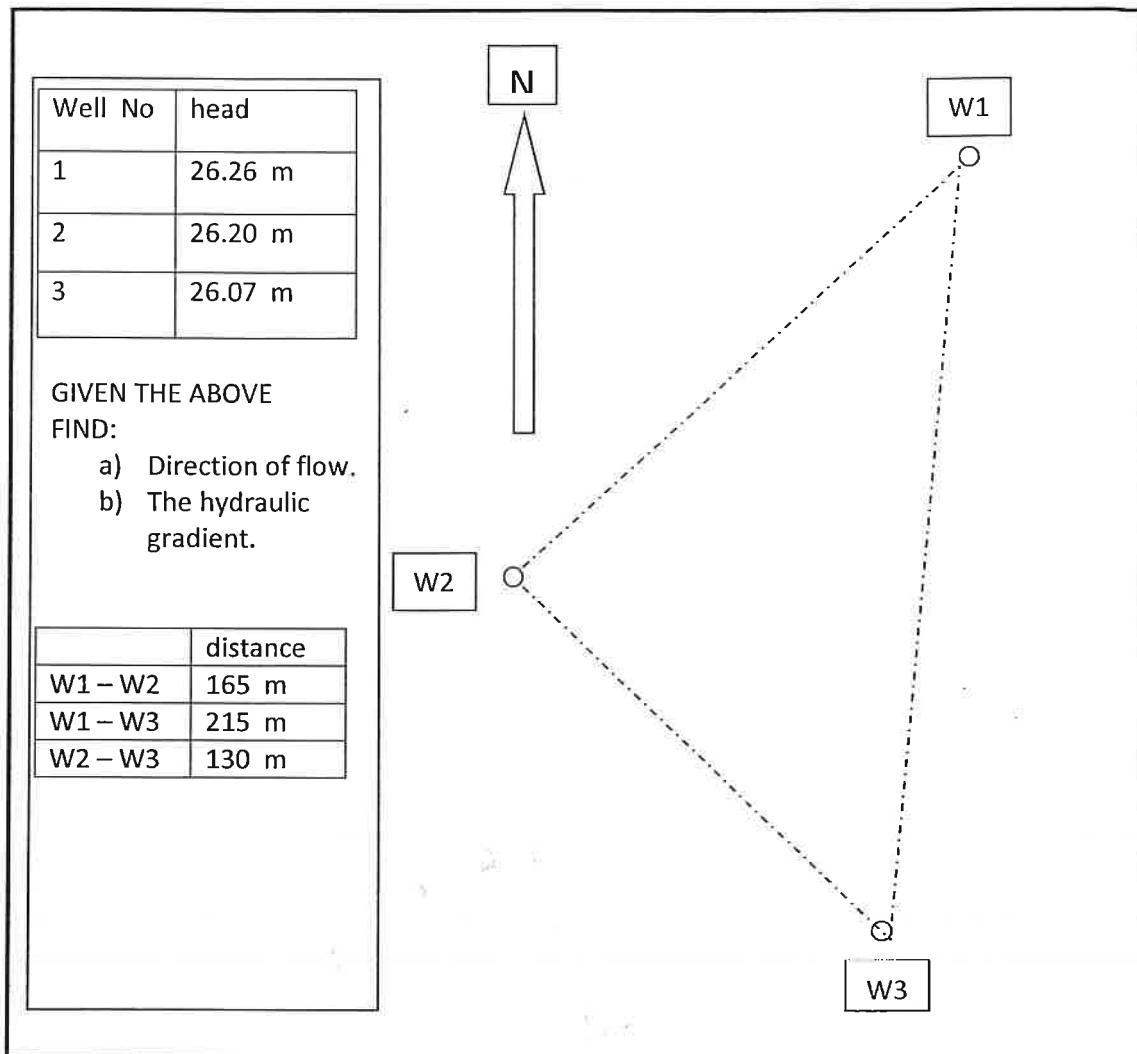
C= Run Off Coefficient      D= Overland distance (m)      S=% slope

## Values of Runoff Coefficient (C) for Rational Formula

| Land Use                                                                                                 | C                                                        | Land Use                  | C           |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------|-------------|
| <b>Business:</b><br>Downtown areas<br>Neighborhood areas                                                 | 0.70 - 0.95<br>0.50 - 0.70                               | <b>Lawns:</b>             |             |
|                                                                                                          |                                                          | Sandy soil, flat, 2%      | 0.05 - 0.10 |
|                                                                                                          |                                                          | Sandy soil, avg., 2-7%    | 0.10 - 0.15 |
|                                                                                                          |                                                          | Sandy soil, steep, 7%     | 0.15 - 0.20 |
|                                                                                                          |                                                          | Heavy soil, flat, 2%      | 0.13 - 0.17 |
|                                                                                                          |                                                          | Heavy soil, avg., 2-7%    | 0.18 - 0.22 |
|                                                                                                          |                                                          | Heavy soil, steep, 7%     | 0.25 - 0.35 |
| <b>Residential:</b><br>Single-family areas<br>Multi units, detached<br>Multi units, attached<br>Suburban | 0.30 - 0.50<br>0.40 - 0.60<br>0.60 - 0.75<br>0.25 - 0.40 | <b>Agricultural land:</b> |             |
|                                                                                                          |                                                          | <i>Bare packed soil</i>   |             |
|                                                                                                          |                                                          | *Smooth                   | 0.30 - 0.60 |
|                                                                                                          |                                                          | *Rough                    | 0.20 - 0.50 |
|                                                                                                          |                                                          | <i>Cultivated rows</i>    |             |
|                                                                                                          |                                                          | *Heavy soil, no crop      | 0.30 - 0.60 |
|                                                                                                          |                                                          | *Heavy soil, with crop    | 0.20 - 0.50 |
|                                                                                                          |                                                          | *Sandy soil, no crop      | 0.20 - 0.40 |
|                                                                                                          |                                                          | *Sandy soil, with crop    | 0.10 - 0.25 |
|                                                                                                          |                                                          | <i>Pasture</i>            |             |
|                                                                                                          |                                                          | *Heavy soil               | 0.15 - 0.45 |
| <b>Industrial:</b><br>Light areas<br>Heavy areas                                                         | 0.50 - 0.80<br>0.60 - 0.90                               | <b>Streets:</b>           |             |
|                                                                                                          |                                                          | Asphaltic                 | 0.70 - 0.95 |
|                                                                                                          |                                                          | Concrete                  | 0.80 - 0.95 |
|                                                                                                          |                                                          | Brick                     | 0.70 - 0.85 |
| Parks, cemeteries                                                                                        | 0.10 - 0.25                                              | Unimproved areas          | 0.10 - 0.30 |
| Playgrounds                                                                                              | 0.20 - 0.35                                              | Drives and walks          | 0.75 - 0.85 |
| Railroad yard areas                                                                                      | 0.20 - 0.40                                              | Roofs                     | 0.75 - 0.95 |

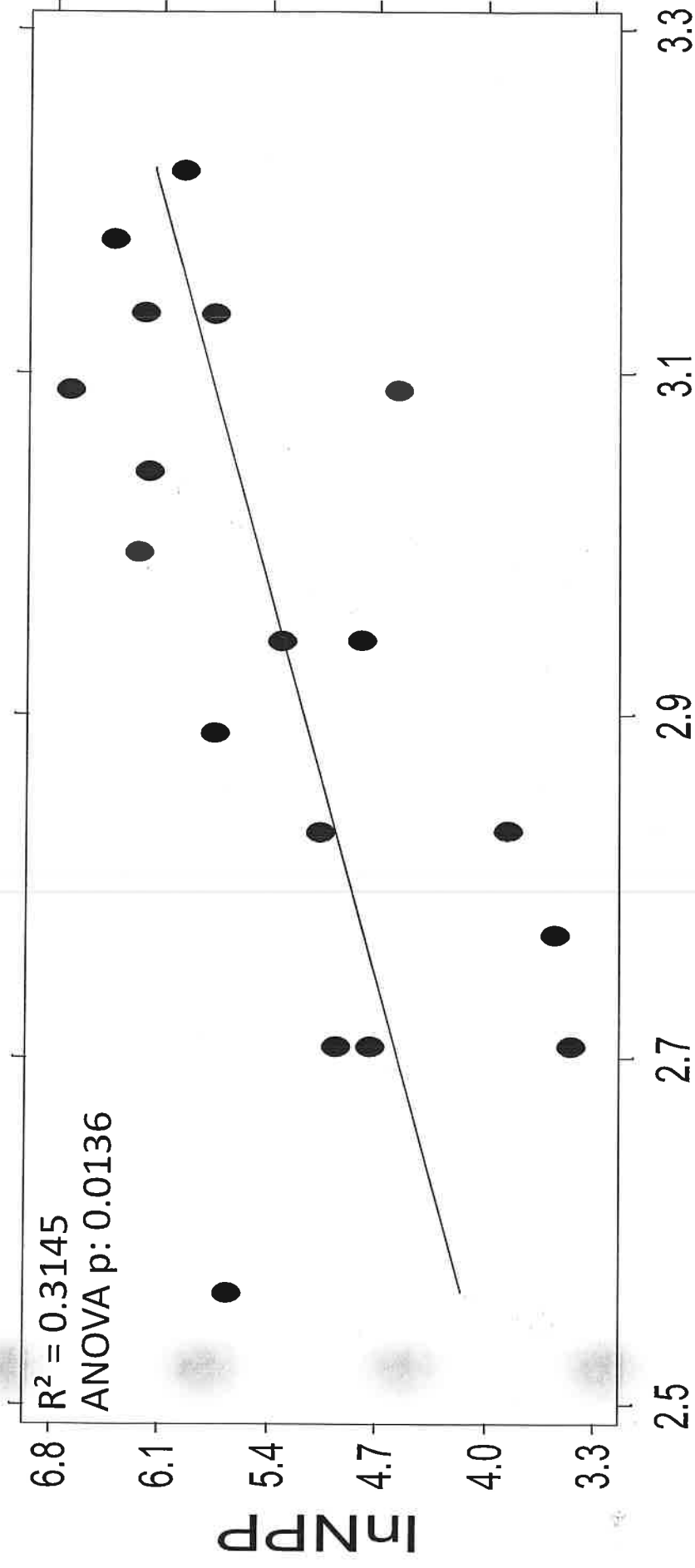
**\*Note:** The designer must use judgement to select the appropriate "C" value within the range. Generally, larger areas with permeable soils, flat slopes and dense vegetation should have the lowest "C" values. Smaller areas with dense soils, moderate to steep slopes, and sparse vegetation should assigned the highest "C" values.

**A runoff coefficient is a number that relates the rainfall rate and runoff rate. Using the runoff coefficient, scientists and hydrologists can calculate how much water passes over a given area per second.**



## OBJECTIVE 4: COMPARE WATER TRANSPARENCY AND NPP

### Net Primary Production vs Secchi Depth



lnSecchi

$$\ln NPP = -3.7106 + 3.0648 * \ln \text{Secchi}$$