

STANDARD CITY SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION
OF STORM SEWER

City of Kentwood Engineer's Office

I. Introduction (Rational Method and Assumption)

- A. Local storm sewer design in the City of Kentwood shall be based on the Rational Method.
- B. Rational Method is based on 3 assumptions:
 - 1. Peak runoff at any design location is a function of the average rainfall intensity during the time of concentration to that location.
 - 2. The frequency of peak discharge is the same as the frequency of the average rainfall intensity.
 - 3. Time of concentration is the time required for the runoff from the most remote part of the drainage area to become established and flow to the point under design.
(Most remote refers to most remote in time not necessarily distance.)
- C. The Rational Method is limited to a design area of 5 square miles.

II. Rational Method Equation

A. $Q = CIA$

- Q = Peak runoff rate in cfs
- C = Runoff coefficient dependent upon the characteristics of the drainage area
- I = Average rainfall intensity in inches/hour
- A = Drainage area in acres

1. Drainage Area

- a. Tributary area can be determined by field surveys, maps and aerial photographs.
- b. Important considerations
 - 1. Land use - present and future
 - 2. Character of soil and cover
 - 3. Ground slopes

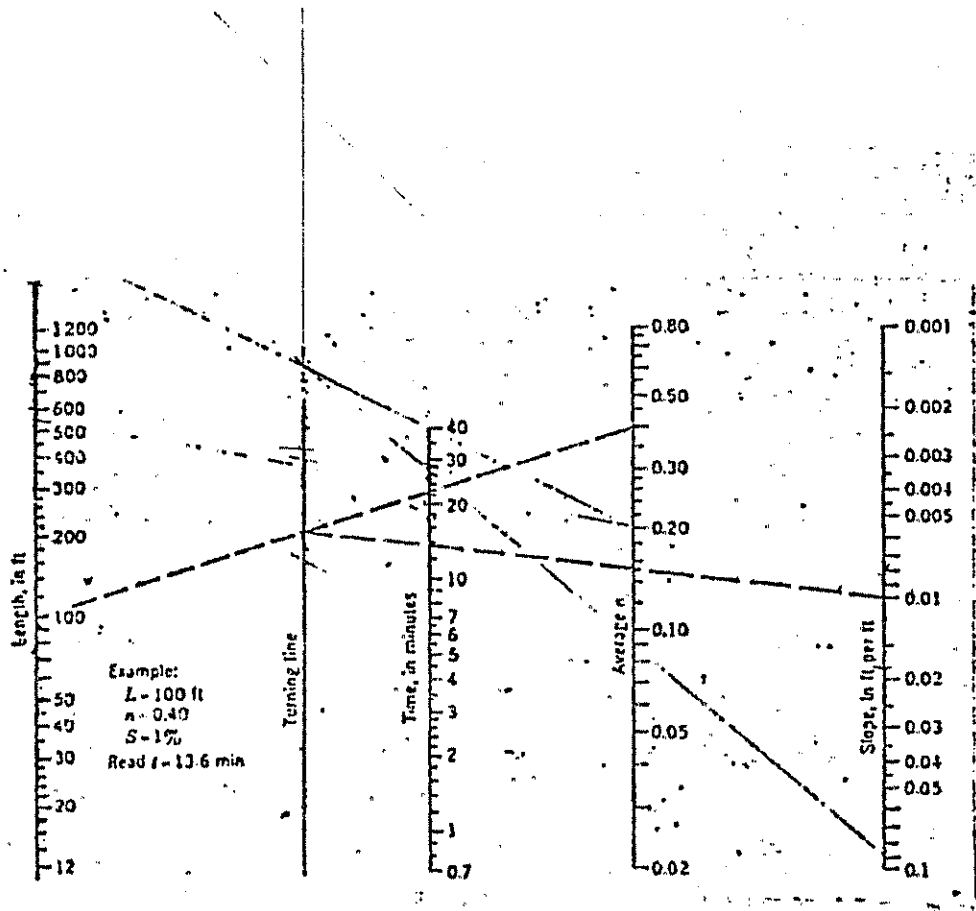
2. Rainfall Intensity

- a. Determined by the following factors

1. Average frequency of occurrence.
 2. Intensity-duration characteristics of rainfall for selected average frequency of occurrences.
 3. Time of concentration.
- b. Frequency of occurrence design parameters
1. Residential, multi-family, industrial 5 year frequency.
 2. Commercial and high value - 10 year frequency.
 3. Flood protection - 100 year.
 4. The City Engineer reserves the right to change the design frequency of occurrence where he deems it necessary for the protection of the public.
- c. Intensity-Duration characteristics
1. Graph of rainfall intensity versus storm duration is included in this report.
 2. The graph shall be used for all storm sewer design in the City of Kentwood.
- d. Time of concentration
1. Consists of inlet time plus time of flow in the sewer from the most remote point to the point under construction.
 - a. inlet time is overland flow time for stormwater to reach a proposed drainage structure.
 1. inlet time varies with:
 - a. Slope of land - S
 - b. Surface retardance coefficient - n
 - c. Length of overland flow - L
 2. Following chart shall be used for the determination of n

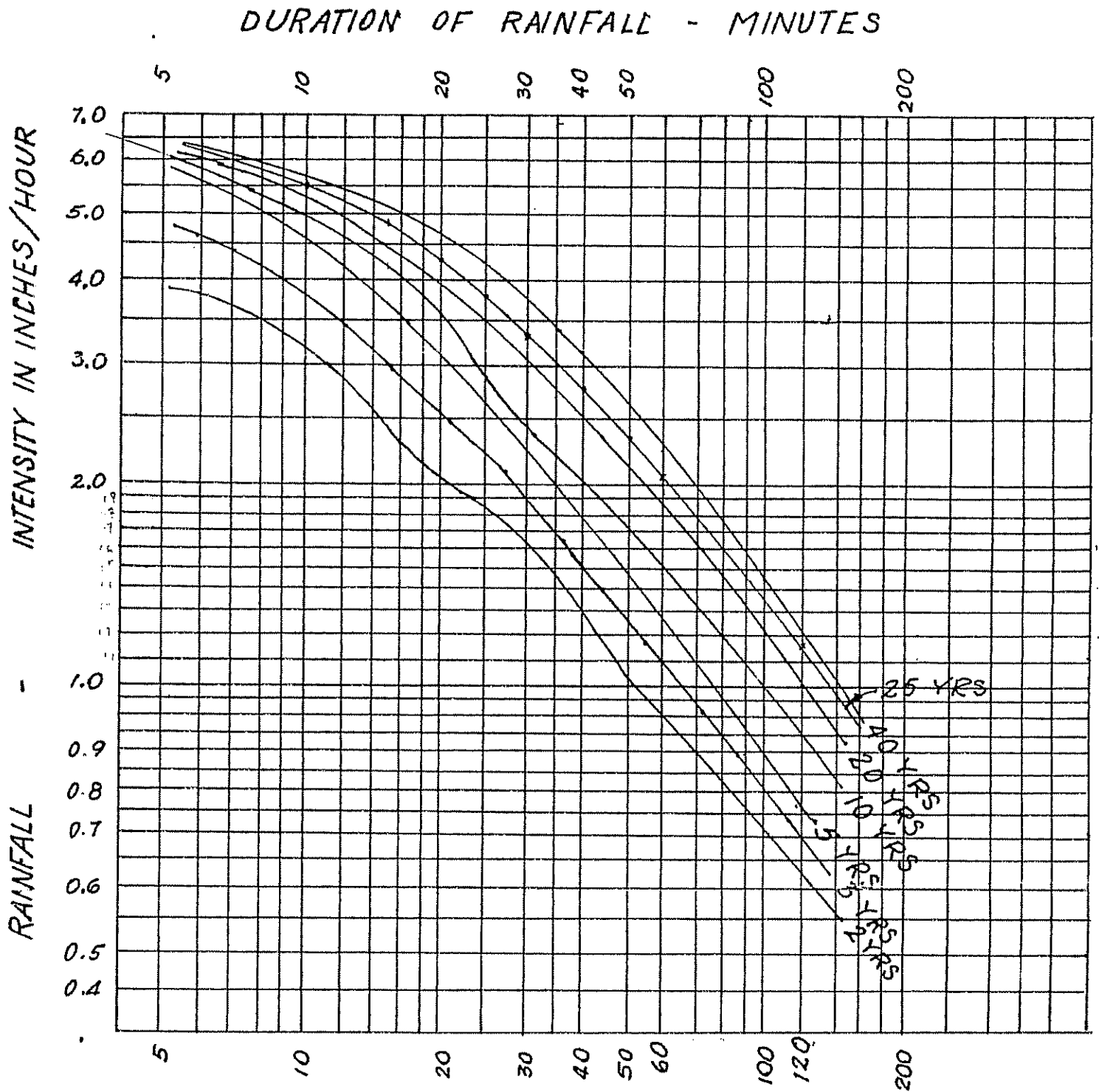
<u>TYPE OF SURFACE</u>	<u>n VALUE</u>
Smooth impervious surface	0.02
Smooth bare packed soil	0.10
Poor grass, cultivated row crops or moderately rough bare surface	0.20
Pasture or average grass	0.40
Deciduous Timberland	0.60
Conifer timberland, deciduous timberland with deep forest litter or dense grass	0.80

3. Following nomograph shall be used for determining the time of concentration within the City of Kentwood.



OVERLAND FLOW

REC W 3/9/83



RAINFALL CURVES FOR STORMS
IN THE VICINITY OF GRAND RAPIDS

