CHAPTER 1

PHYSICAL GEOGRAPHY

LOCATION AND LIMIT OF THE METROPOLITAN AREA

Bangkok and Thonburi are two main adjoining cities which are shown in Figure 1 situated in the central part of Thailand, on the Chao Phraya Plain at the northern end of the Gulf of Thailand. The centre of Bangkok, the capital city is at latitude [1]13°45' North, longitude 100°31' East, and the distance along the river from the Memorial Bridge to the Gulf of Thailand is approximately [2]47 kilometres. The metropolitan area has been developed in almost all phases of business during the last decades or so, and consequently the central area of the city become increasingly crowded. Ways and means have been sought to extend the city limit to the outskirt, to the surrounding paddy fields. The government finds it necessary to enlarge this city by enveloping Nonthaburi, Samutprakarn and other adjacent districts to form a new Metropolitan area. Figure 2 shows the boundary of the proposed new metropolitan area. The 1990 Land Use

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[1]Husband & Co, Report on Sewerage and Sewage Disposal for the Central Area of Bangkok (Department of Public and Municipal Works, 1962), p. 12.

[2]ibid

MAP OF METROPOLITAN AREA

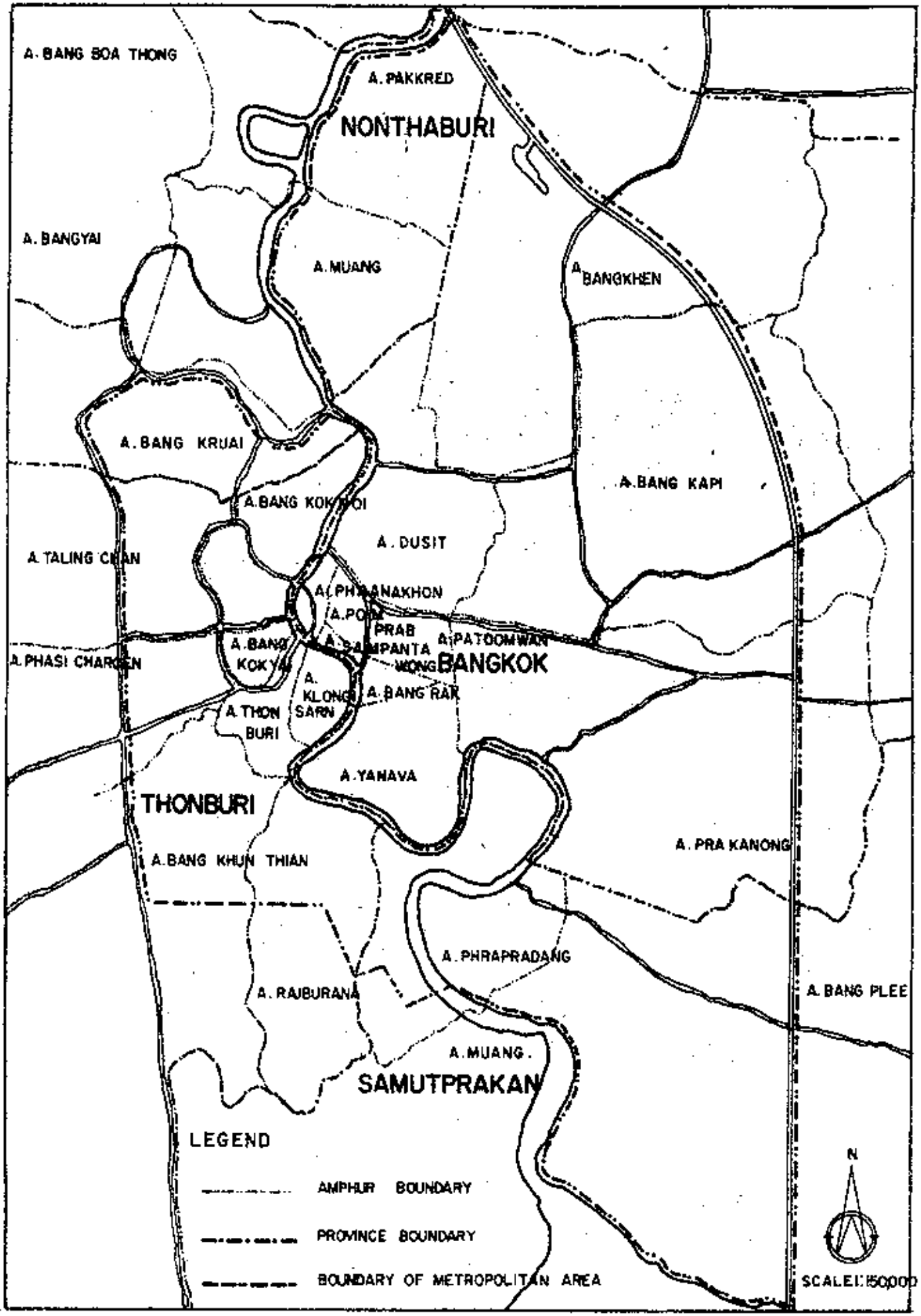

FIGURE 2

programme as prepared by Litchfield Whiting Bowne & Associates by the cooperation of Bangkok and Thonburi municipalities has included 4 adjoining provinces and this is quite reasonable. The metropolition area is expected to be [3]780 Km^2. It is rather difficult to rule out the limit of a developing country in the planning of its sewerage scheme, but smaller area would be more economic and in case of war, other areas would not be affected. For this reason, the area for the sewerage and drainage systems is chosen to be 33 Km^2 as illustrated in Figure 17.

TOPOGRAPHY

The topography of the metropolitan area is extremely flat with the ground elevation vary from [4]0.45 metres to 1.95 metres above mean sea level. The area is of poorly drained alluvial soil with heavy, low and mildly acid clays and being characterized by [5]Quaternary deposits including unconsolidated silt clay, sand and gravel, beach and estuarine clays and

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[3]Litchfield Whiting Bowne & Associates, Greater Bangkok Plan 2533 (Department of Town & Country Planning, 1960), p. 63.

[5]ibid p. 145.

[4]A.L. Tholin, A Study of Drainage and Sewerage for Bangkok (Bangkok Municipality, 1963), p. 1.

layers of laterite copping stabilized surfaces. [6]The soils have been divided into many more sub-groups as follows:-

(1) The natural level soils of Maenam Chao Phraya.

(2) Saline clays of The Gulf Coast.

(3) Low, darker bluish-gray with less salt near Bang Baw, Samutprakarn province.

(4) Dark gray to black Bang Chang Clay, along Klong Dannoen Saduak toward the south western corner of Bangkok plain.

(5) Bangkok clay proper, the dark surface of which is underlain by light bluish-gray clay.

(6) Bangkhen clay, which differs in having some occasional red and yellow spot variegations, streaks and mottling in the subsoil.

[7]Principal Topographic Features

In most localities the Quaternary deposits are less than 46 metre thick. An oil well drilled near Ayuthaya, 65

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[6]Ninth Pacific Science Congress of the Pacific Science Asecciation, Soil and Land Classification (Secretariat, Ninth Pacific Science Congress, Department of Science, Bangkok, Thailand, Vol. 18, 1957), pp. 15-20.

[7]Litchfield Whiting Bowne & Associates, Greater Bangkok Plan 2533 (Department of Town & Country Planning, 1960), p.145.

kilometres to the north of Bangkok reportedly encountered granite at a depth of 366 metres. Examination of the data from 40 wells drilled in the vicinity of Bangkok indicates that the region has good possibilities for the production of ground water. Artesian aquifers produce water of good Quality at depth of from 120 metres to 214 metres. Twenty wells which were dug under the Litchfield Whiting Bowne & Associates Emergency Water Project in 2502 B.E. yielded an average of 1,630 gallons per minute at an average depth of 171 metres. Typical well data in Bangkok-Thonburi are shown in Figure 3 and Figure 4.

Major Watershed

Chao Phraya River which originates from the northern part of the country flows through the metropolitan area to the Gulf of Thailand. There are about 50 main klongs in Bangkok and Thonbari into which most of the waste and stormwater are drained. These klongs are not properly drained thus causing nuisance and may be the principal lodging varioas diseases. Some klongs are used as commication lines and as a means to irregate water from the Chao Phraya River to the vast expansive paddy fields and plantation. Some klongs have been filled in to widen the roodway and to relieve the traffic congestion hence causing more drainage problems.

[8]Soil and Foundation Condition

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[8]ibid p. 145.

ASSOCIATED TUBE WELL (INTERNATIONAL) LIMITED

WELL RECORD

CONTRACT BANGKOK WELL NO.

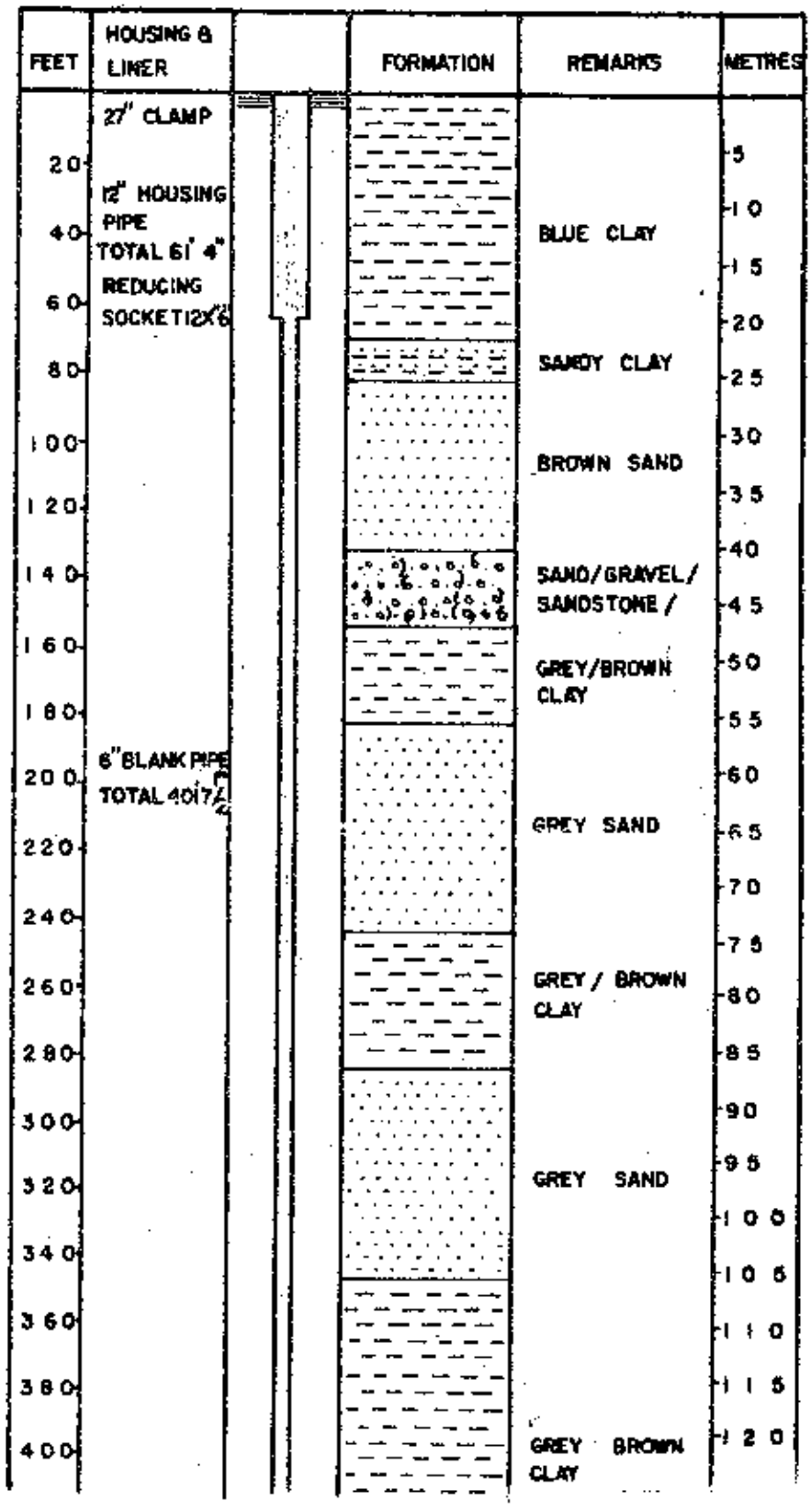

FIGURE 3

BANGKOK WATER-WORKS & ENGINEERING CO., LTD.

WELL LOG

CONTRACT THONBURI (Samrong) WELL NO.

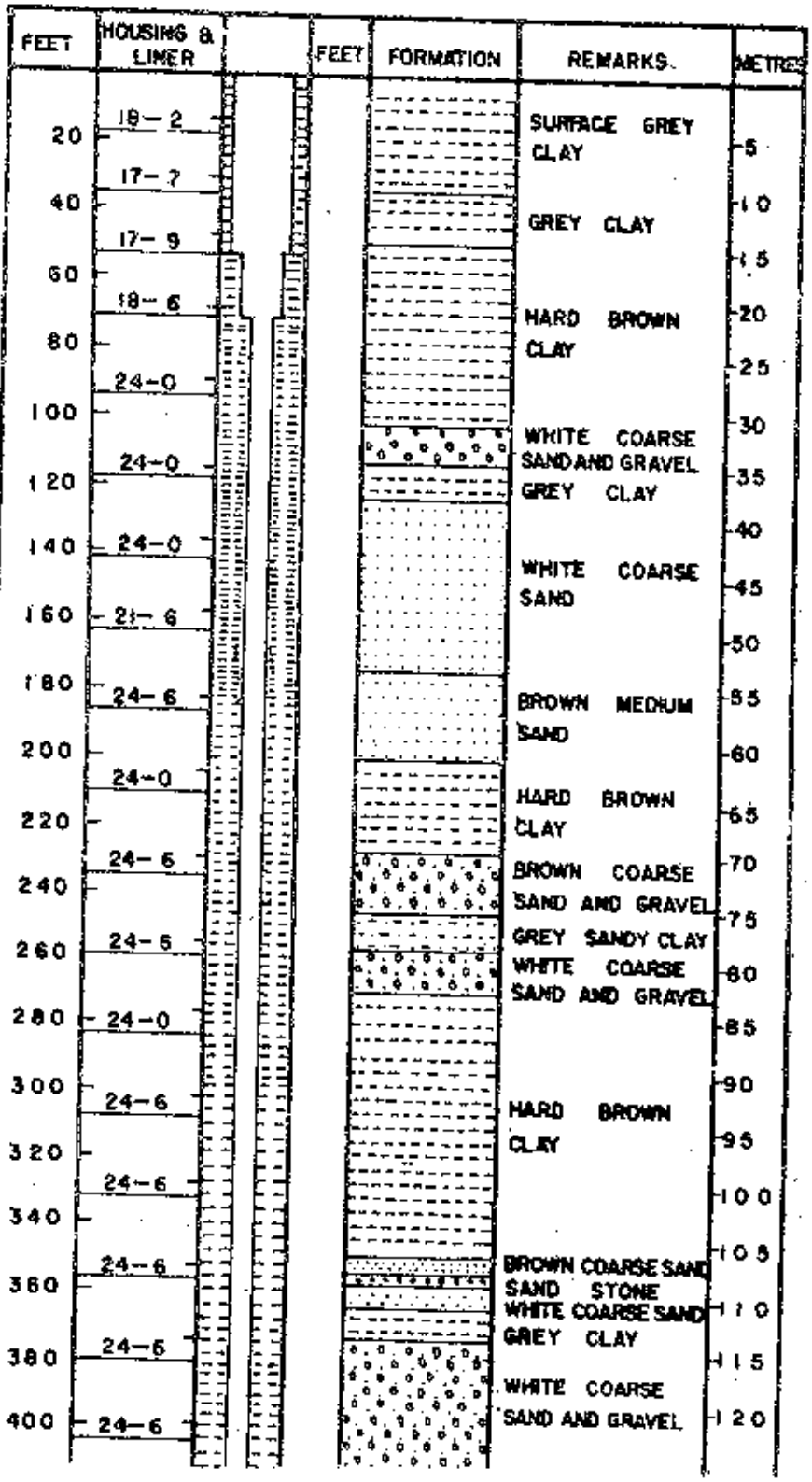

FIGURE 4

According to the available information the allowable soil bearing pressure on surface material in these city areas ranges from 2 to 3 tons per square metre. This necessitates the use of pilling under bridge piers, tall buildings or heavily loaded structures. A twelve inch pilling 25 metres long gives approximately 90 tons bearing capacity but only one-third of this value is generally used in the design of pillars. Short friction piling is frequently used for small structures and the loading is computed at 0.5 tons per square metre of surface.

Open trenches had been taken out for the water supply scheme to a depth of about 4.5 metres. The sides of these excavations were made vertical, walled only by light timbering. These excavated ditches were placed adjacent to drainage channel which is always full of water, a quantity of water always find its way into them which has to be pumped out.

CLIMATE

Sewerage and drainage systems can be affected by climatic factors such as temperature which accelerates biological activity, high humidity which tends to retard the drying of digested sewage sludge, evaporation which indicates that the sludge drying beds must have facilities for removal of excess water, and the wind which affects the rate of oxygen absorption. The 10-year climatic condition of this metropolitan area are summarized in Table 1.

TABLE 1.

CLIMATOLOGICAL DATA FOR THE PERIOD 1951 - 1960

Station: Bangkok

Latitude: 13°44' N.

Longitude: 100°30' E.

Elevation of Station above MSL. 2.30 metres

Height of barometer above MSL. 12.41 "

Height of thermometer above ground 1.5 "

Height of anemometer above ground 23.00 "

Height of raingauge above ground 0.70 "

Height of wind vane above ground 23.38 "

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (°C.)													
Mean	26.1	27.6	29.2	30.3	29.8	28.9	28.4	28.2	29.9	27.6	26.7	25.5	28.0
Mean Max	31.9	32.7	34.0	35.1	34.3	32.2	32.3	32.0	31.6	31.0	30.8	30.8	32.5
Mean Min	20.3	22.5	24.3	25.5	25.2	25.0	24.6	24.4	24.2	24.2	22.8	20.2	23.6
Ex. Max	36.0	36.4	39.8	39.0	39.4	36.8	35.5	35.2	34.6	33.8	34.4	34.8	39.8
Date	30/52	15/60	25/60	24/60	11.58	27/51	12.60	2days	3/60	5/53	3/57	31/51	25/60
Ex. Min	9.9	16.2	16.8	21.6	21.5	21.7	21.9	21.4	21.3	19.8	15.5	13.3	9.9
Date	12/55	6/57	3/59	16/52	12/51	27/58	28/54	17/58	16/55	31/58	30/56	3/55	12/55

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Relative Humidity %													
Mean	74.4	76.7	76.8	76.9	79.6	80.5	82.3	82.8	85.2	85.4	81.6	75.5	79.8
Lowest	29.0	17.0	25.0	28.0	30.0	47.0	47.0	54.0	49.0	53.0	42.0	34.0	17.0
Evaporation(m.m.)													
Mean	113.2	101.8	126.4	12.74	109.0	95.2	85.4	79.9	61.5	65.7	76.9	102.9	1145.3
Wind (Knots)													
Prevailing Direction	C,NE	S	S	S	S	S	C,S,SW	SW,S	C,SW	C,NE,N	C,N,NE	C,N,NE	
Mean Wind Speed	2.8	5.0	5.2	5.2	3.4	3.6	3.0	3.4	3.0	3.0	2.8	2.6	
Max. Wind Speed	24.0	37.0	30.0	60.0	52.0	44.0	44.0	44.0	44.0	37.0	44.0	30.0	
Rainfall(m.m.)													
Mean	8.9	17.7	29.8	70.6	144.8	158.9	215.8	212.4	343.8	270.3	55.7	1.9	1530.6
Mean rainy days	2.3	2.2	4.1	5.4	14.1	16.2	18.7	21.1	22.5	17.4	6.5	0.7	131.2

Average Annual Rainfall = 1530.6 millimetres

source: Meteological Department, Office of the Prime Minister.

Rainfall

Rainfall is by far the most significant of the climatic factors. It governs the required capacity of storm drainage facilities. An analysis of the relationship between its frequency, duration, and intensity by Prof. Aroon Sorathesn is shown in Figure 5, and this is used for designing storm sewers in this scheme. The annual average rainfall in Bangkok is [9]1530.6 millimetres.

[10]Seasons

The central plane of Thailand has 4 seasons:-

1. The Southwest Monsoon Season Begins in mid May and ends in September during which time an appreciable amout of rain falls throughout the city. This is caused by the intertropical convergence Zone moving up from the south cover the metropolitan area. Tropical storms also enter the city during this season about twice a year. These depressions

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[9]Meteorological Department, Climatoligical Data, 10 year Period 1951-1960 (Meteorological Department, Office of the Prime Minister, 1964), p. 16.

[10]United Nations, Water Resources Development in British Borneo, Federation of Malaya, Indonesia and Thailand (United Nations Publication, Flood Control Senies No. 14, 1959), pp. 100-103

INTENSITY — DURATION

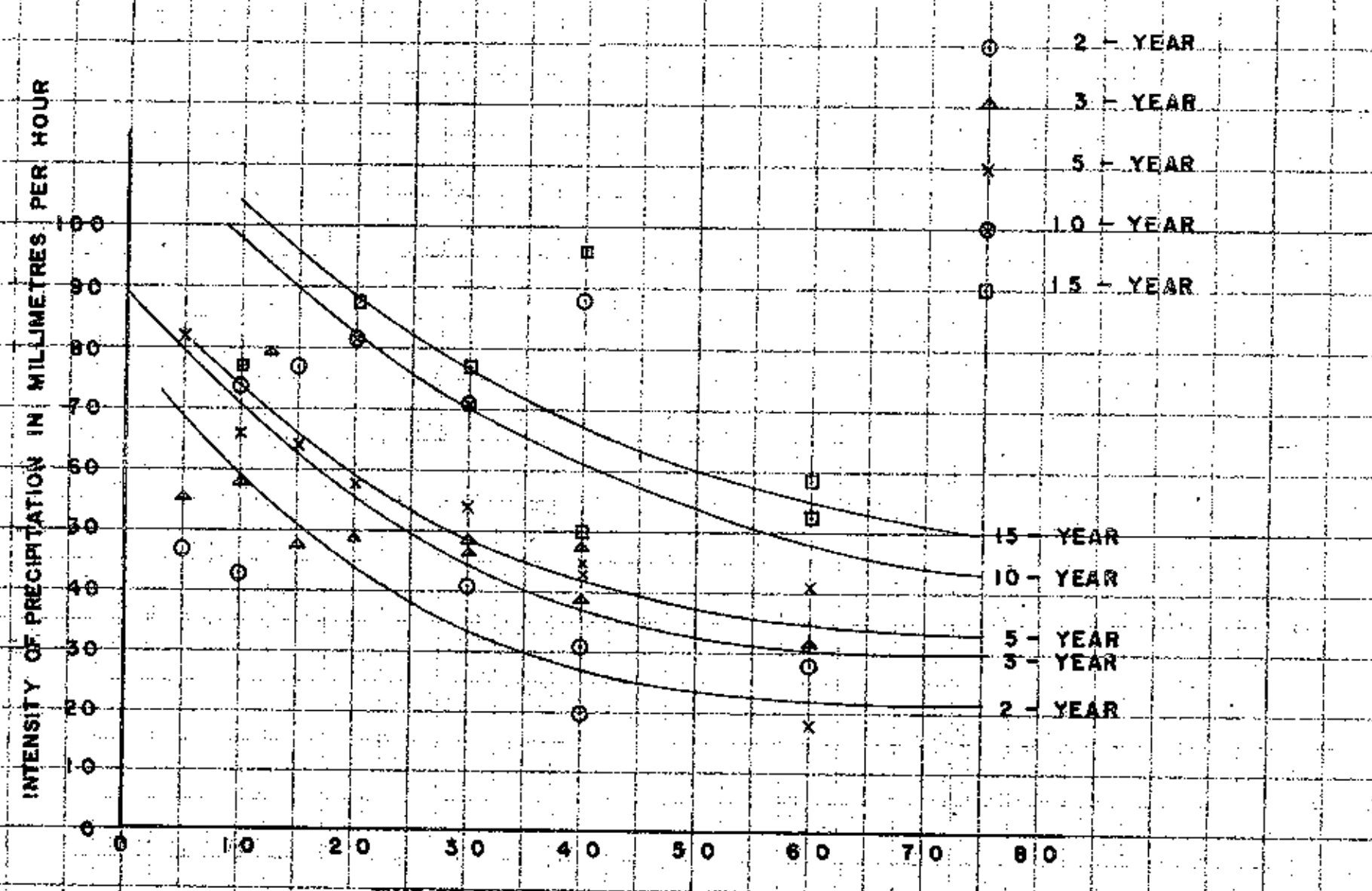

FIGURE 5

SOURCE : "ANALYSIS OF RAINFALL FOR BANGKOK AREA" BY PROF. AROON SORATHESN, 1957
COLLEGE OF ENGINEERING, CHULALONGKORN UNIVERSITY.

or storms not only cause torrential rainfall but also help to revive the activity of the monsoon.

2. The Retreating Southwest Monsoon This season commences sometime towards the end of September when the southwest monsoon retreats from North and Northeast of the city and it ends in about October. During this period rainfall usually decreases markedly.

3. The Northeast Monsoon Season. This season is comparatively dry and cool. Generally, the northeast monsoon passes through the city from the north or northeastern part of the country in November and it ends in February. However, during this season, the rain gradually eases up and is not as persistent as the southwest monsoon which occur in September, and the weather becomes dry and relatively cool in along the east coast of the south during this season.

4. The Retreating Northeast Monsoon Season. This season extends from March to mid-May.