

# TABLE OF CONTENTS

<b>1</b>	<b>HYDROLOGY AND WATER RESOURCES.....</b>	<b>1</b>
1.1	PRECIPITATION, THE ORIGIN OF ALL WATER RESOURCES .....	1
1.1.1	<i>The atmosphere .....</i>	<i>1</i>
1.1.2	<i>Formation of precipitation.....</i>	<i>3</i>
1.1.3	<i>Rainfall measurements .....</i>	<i>6</i>
1.1.4	<i>Intensity, duration and rainfall depth.....</i>	<i>8</i>
1.1.5	<i>Areal rainfall.....</i>	<i>10</i>
1.1.6	<i>Rainfall data screening.....</i>	<i>12</i>
1.2	ANALYSIS OF EXTREME RAINFALL EVENTS .....	15
1.2.1	<i>Frequency analysis.....</i>	<i>15</i>
1.2.2	<i>Mixed distributions.....</i>	<i>23</i>
1.2.3	<i>Probable maximum precipitation .....</i>	<i>25</i>
1.2.4	<i>Analysis of dry spells.....</i>	<i>26</i>
1.3	WATER RESOURCES.....	29
1.3.1	<i>Water scarcity and the rainbow of water.....</i>	<i>29</i>
1.3.2	<i>Groundwater resources .....</i>	<i>35</i>
1.3.3	<i>Surface water resources.....</i>	<i>40</i>
1.3.4	<i>Green water resources .....</i>	<i>41</i>
1.4	WATER BALANCES.....	43
1.4.1	<i>General water balance.....</i>	<i>43</i>
1.4.2	<i>Specific water balances .....</i>	<i>45</i>
1.4.3	<i>Water balance as a result of human interference.....</i>	<i>49</i>
<b>2</b>	<b>RAINFALL-RUNOFF ANALYSIS.....</b>	<b>51</b>
2.1	RUNOFF ANALYSIS .....	51
2.2	FLOOD SURVEYS .....	53
2.3	HYDROGRAPH ANALYSIS .....	58
2.4	FACTORS AFFECTING HYDROGRAPH SHAPE.....	61
2.5	RUNOFF DATA ANALYSIS .....	64
2.6	FLOOD FREQUENCY ANALYSIS.....	66
2.7	LACK OF DATA .....	71
2.8	RAINFALL RUNOFF RELATIONS .....	74
2.8.1	<i>Short duration peak runoff.....</i>	<i>74</i>
2.8.2	<i>Catchment yield.....</i>	<i>77</i>
2.8.3	<i>Deterministic catchment models.....</i>	<i>82</i>
<b>3</b>	<b>FLOOD PROPAGATION .....</b>	<b>85</b>
3.1	RESERVOIR ROUTING .....	85
3.2	FLOOD ROUTING IN NATURAL CHANNELS .....	90

<b>4</b>	<b>HYDROLOGY OF COASTAL AREAS.....</b>	<b>97</b>
4.1	INTRODUCTION.....	97
4.2	ASTRONOMICAL TIDE AND STORM SURGES.....	98
4.2.1	<i>The origin of astronomical tides</i> .....	98
4.2.2	<i>Storm surges</i> .....	99
4.3	PROPAGATION OF ASTRONOMICAL TIDES AND STORM SURGES INTO ESTUARIES.....	101
4.3.1	<i>Astronomical tides</i> .....	101
4.3.2	<i>Storm surges</i> .....	108
4.4	SALT WATER INTRUSION.....	109
4.4.1	<i>Introduction</i> .....	109
4.4.2	<i>Sea water intrusion into open estuaries</i> .....	109
4.4.3	<i>Seepage of brackish ground water</i> .....	119
4.4.4	<i>Sea water entering at navigation locks</i> .....	120
4.5	WATER CONTROL IN COASTAL AREAS.....	123
4.5.1	<i>Problems of quantity and quality</i> .....	123
4.5.2	<i>Coastal reservoirs</i> .....	124
4.5.3	<i>Effect of embanking on the hydrological conditions</i> .....	134
4.5.4	<i>Drainage of level areas</i> .....	138
	<b>References.....</b>	<b>141</b>