CHAPTER FOUR

RUNNING WATERS: RIVERS, STREAMS AND TRICKLES

Running and standing waters may be differentiated as follows:

(a) A consistently unidirectional current is found in all running waters, but not to any degree in standing waters.
(b) Stratification rarely occurs in running waters (due to the current), but is a characteristic feature of many standing waters.
(c) In running waters, physical and chemical conditions change gradually from source to mouth, and the difference in many factors may be great between these. Conditions in standing waters are normally much more homogeneous.
(d) Running waters are normally shallow and have long, often complex, narrow channels. Standing waters may reach great depths, but mostly have simple broad basins.
(e) Constant erosion is characteristic of running waters, and materials so removed may be transported considerable distances, often right out of the catchment concerned. Erosion does occur in standing waters, but is rarely severe; eroded materials usually remain within the same basin.
(f) As a further consequence of erosion and deposition, most running waters increase the length of their channels with age, as cutting back to the source and meandering on the flood plain proceed; in standing waters, materials are constantly being deposited, tending to fill in the basin and eventually obliterate it completely.
(g) Currents in running waters are normally stronger than those in standing waters.

There are many kinds of running waters, sometimes several of them occurring, interconnected, with a single drainage system. This presents difficulties in classifying running waters into absolute categories. The range covered within the series includes small trickles and seepages (often

Table 4.1 Physical details of some of the world's largest rivers.

River	Discharge (100 cumecs)	Length (km)	Catchment (1000 km^2)
Amazon	1724	6274	6133
Zaire	396	4667	4015
Yangtze	218	5794	1943
Mississippi	176	6260	3222
Yenisey	174	4506	2590
Lena	155	4281	2424
Parana	149	4500	2305
Ob	125	5150	2484
Amur	96	4667	1844
Nile	28	6695	2979

temporary in nature), ditches, larger fast-flowing streams and rivers, large slow-flowing rivers and canals (Table 4.1).

The geology of the catchment underlying a running water has a strong influence on physical and chemical characteristics. Further, the nature of the bedrock and soils affects the character of the aquatic substrate and also relates to the rate of erosion, and hence succession, of that running water. The suspended solids present may also be determined by the degree of erosion, and they in turn affect light under water. The flow characteristics of running waters are also connected to geology, notably in the control exerted by rock and soil formations, and the relationship between ground water and surface waters. The flow pattern of running waters depends largely on the nature of this relationship. In addition to controlling the quantity of ground water, local geology also exerts a strong effect on its quality, notably in connection with the dissolved solids present.

Most water on earth is in circulation, within what is known as the hydrologic cycle (Figure 4.1). The energy utilised within this cycle comes mainly from the sun. Water evaporates from both land and sea to be reprecipitated, usually somewhere else. On most parts of the land, precipitation exceeds evaporation, and run-off towards the sea occurs.

4.1 Physical characteristics

4.1.1 *Current*

The velocity of currents in running waters depends on the nature of their gradients and substrates. In contrast to standing waters, wind has little

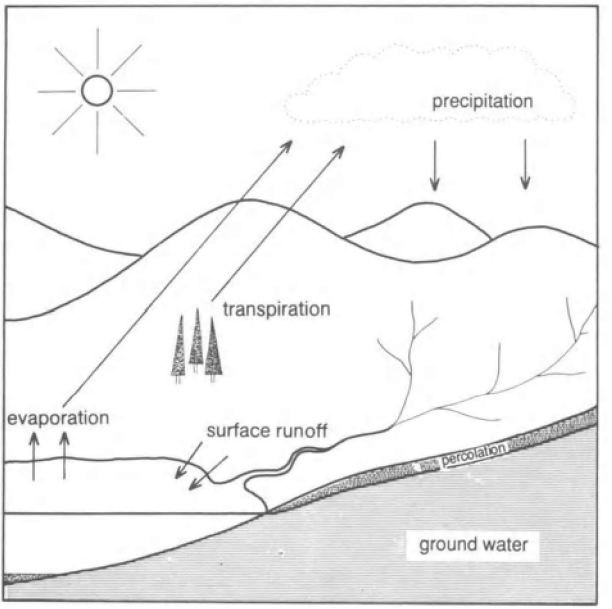

Figure 4.1 A diagrammatic representation of the hydrologic cycle.

influence on currents in running waters, except occasionally in large slow-flowing rivers. Current velocities in running waters are at their maximum in waterfalls and their minimum in pools; great extremes can occur within a single system, occasionally close together, though the fastest currents are normally found in the upper reaches and the slowest in the lower reaches.

Information on gradients, and thus on the current velocities, in a running water may be obtained by examining its profile. In most running waters the gradient is steep in the upper reaches for some distance below the source; in the middle reaches the gradient becomes much less severe, while in the lower reaches it tends to be very slight, especially near the mouth (Figure 4.2). Such a profile alone may give valuable information, not only on present conditions within the system, but also on the stage of development which the water has reached in relation to its succession (Figure 4.3).

Current velocity within any stretch of a running water depends also on the shape of the channel and has a regular pattern in a transverse section (Figure 4.4). Near the water surface, current velocity is reduced by surface