

may be inferred from the topography of the water surface. Some examples of each are presented here.

### 13.2 COLORADO RIVER NEAR NEEDLES, CALIFORNIA

The first example is one in which the complications caused by heterogeneous bank materials, irregularities of bed material, and large variation of flood discharge are minimal. The example might be considered, in a sense, to be the perfect river, or perhaps more factually, the simple river.

The construction of Hoover Dam on the Colorado River resulted not only in complete control of discharges downstream but degradation of the channel bed by the water deprived of its natural debris load. Far downstream, in the vicinity of Needles and downstream of Davis Dam, the channel width is controlled by riprap of rock or by short groins without which bank erosion would take place



Fig. 13.1. Aerial photograph of the Colorado River near Needles, California. Controlled discharge and bank stabilization led to an unusual symmetry of moving bars on the bed. The direction of water flow is shown by arrows