

# Chapter 8

## Hydrogeology

### Introduction

The Hydrogeological Research Group of the British Geological Survey was commissioned to describe the hydrogeological regime in the district and predict the hydrogeological and engineering implications of continued groundwater extraction (Gale & Cook, 1989). The Yuen Long-Shan Pui River Catchment was selected as a typical area (Figure 23) for collection of hydrogeological data.

The mean annual rainfall of Yuen Long is approximately 1 800 mm, and falls mainly in the summer months. It varies from 2 200 mm on the high ground along the southern watershed to 1 600 mm near the coast. Mean annual potential evapotranspiration was calculated to be about 1 300 mm and is at a maximum in the summer months. Recharge to groundwater is only likely to occur between April and September (Gale & Cook, 1989). Parts of the low-lying areas are liable to flood, particularly after typhoon rains, but the surface water usually disperses after a few hours.

The influence of man upon the hydrological cycle in the Yuen Long district is considerable. There are vast areas of fill, natural slopes are protected by shotcrete, streams and rivers are canalised and there has been recent general urbanisation. All these factors have increased the speed with which rainwater is discharged to the sea. The aquifers do not receive their full natural recharge. In addition, pumping of the groundwater, which is practised in Yuen Long, disturbs the hydrogeological cycle and may result in saline intrusion into the aquifer and possibly reverse the flow of water between aquifers.

### Groundwater Characteristics

Monitoring of piezometers has confirmed the expected fall of the piezometric surface from above sea level on the plain south of Yuen Long, to close to sea level from the urban area northwards. The piezometric level is locally depressed under central Yuen Long because of pumping (Figure 24). The effect of this local depression is to induce a recharge of polluted urban water, usually from faulty sewage and drainage pipes, as well as through the cracked base of nullahs. Annual fluctuations of the water levels is relatively small ( $\pm 2$  m). Siu & Wong (1984b) noted a daily correlation between water levels and tidal fluctuations near the Shan Pui River in the alluvial aquifer. Siu (1990) confirmed the presence of two aquifers below the Yuen Long Industrial Estate, one in the alluvium and the other in fractured bedrock.

The variations in water levels in the bedrock and the superficial deposits are, in places, closely linked. This would imply numerous connections between the two, although there are local areas where an aquitard present above the bedrock results in a confined aquifer in rock. Thirty five samples of water were collected from the Yuen Long area. Most were taken from wells or boreholes but a few from other sources were used as controls. Samples were taken from boreholes by balers and by pumping from piezometer tubes.

### Water Quality

The quality of water in the Yuen Long area is very variable, with chloride contents ranging from 5 mg/l (tap water) to over 11 000 mg/l. The maximum chloride concentrations were obtained from boreholes BGS 9 and 15. The former is adjacent to the tidal Shan Pui River and the latter near to Deep Bay. Chloride concentrations are high in the majority of other samples. This contamination is a common factor and is either found as a natural residual chloride concentration or is induced by pumping.

The purest groundwater, least affected by saline contamination, comes from the marble aquifer, for example from boreholes BGS 2, 3, 5 and 8, all of which are sited beyond the urban and old industrial limits of Yuen Long. In the Industrial Estate area to the north of the town, the pure marble water lies below a saline alluvial aquifer with chloride values in excess of 7 000 mg/litre. Beneath the urban areas both alluvial and bedrock aquifers show varying degrees of saline contamination. This is attributable to the proximity of the Shan Pui River or one of its tributaries. Conductivity measurements (related to chloride concentrations) in borehole samples show a steady increase downstream. The contamination in these urban areas has been induced in both the aquifers, which shows hydraulic continuity between them. On-site analysis of Eh (oxidation potential) and dissolved oxygen was limited but showed that the latter was low in the bedrock aquifers and that the groundwater was of a reducing nature.

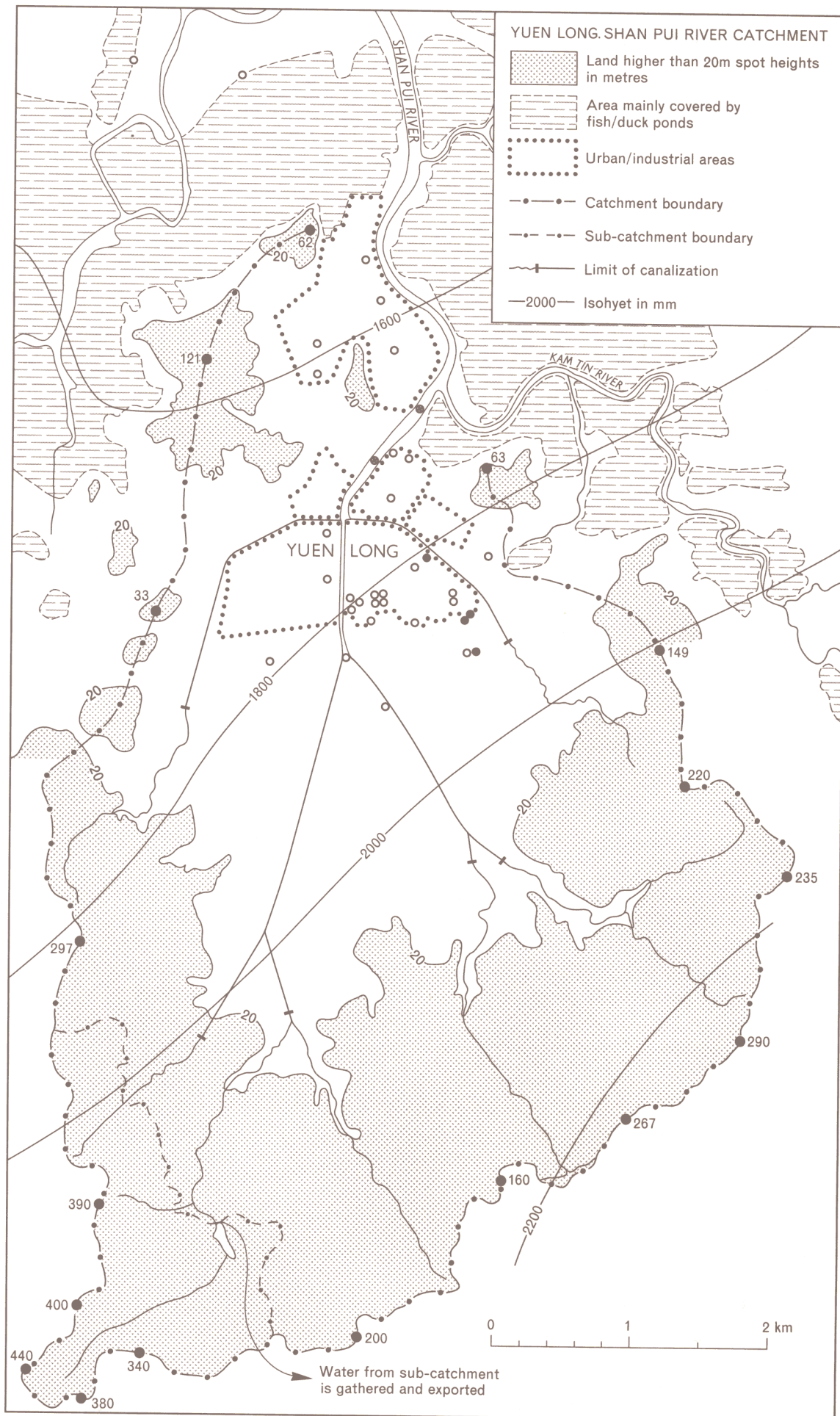


Figure 23 - The Shan Pui River Catchment, Yuen Long

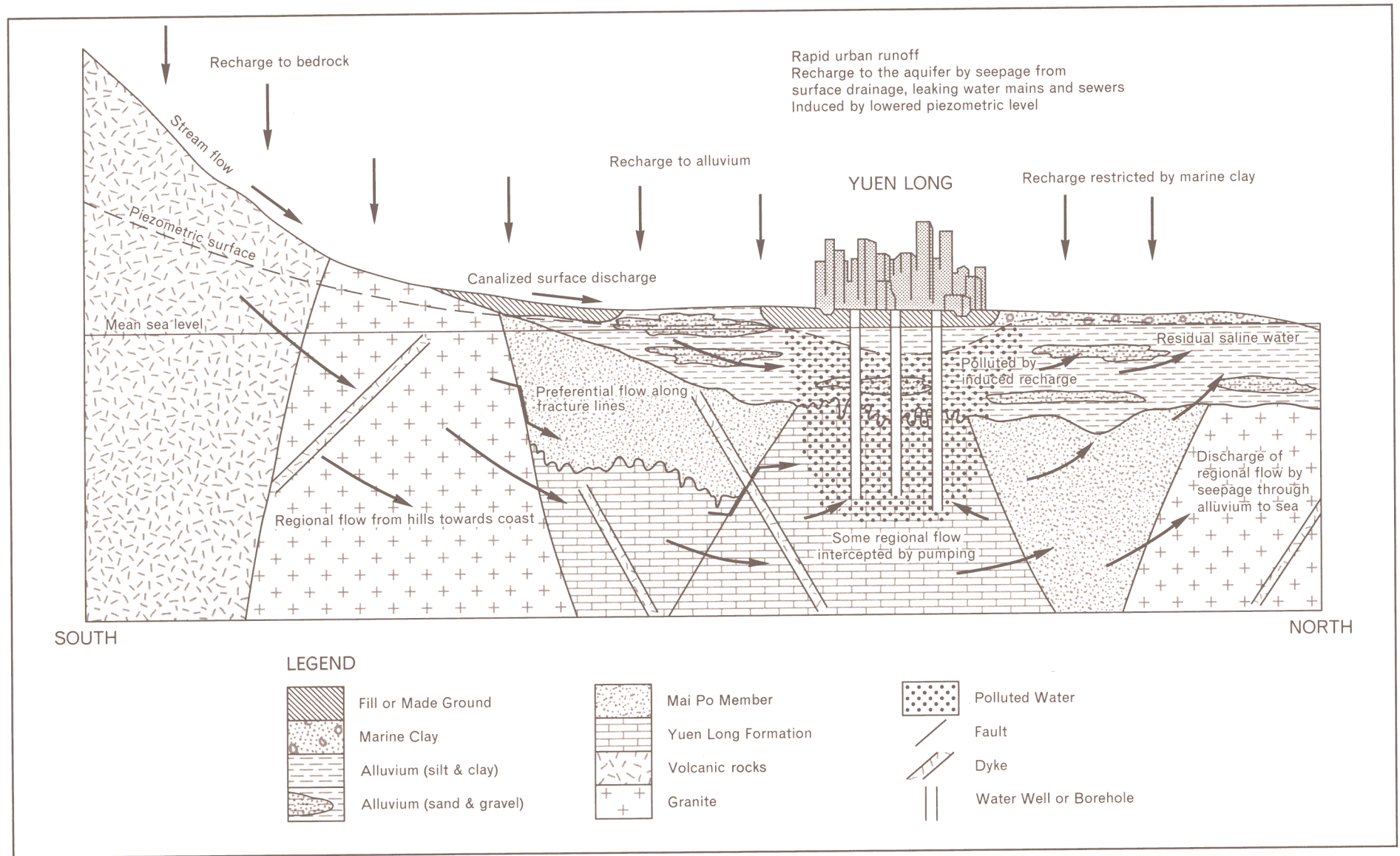


Figure 24 - Schematic Model of Groundwater Flow Beneath Yuen Long