This pattern of mixing or transition from fluvial to marine has been described by Roy and Crawford (1977) in their attempt to explain a sediment deficiency at the coast.Because currently rivers are not supplying coarse loads to beaches, they claimed that there was a sediment budget deficiency and coastal degradation. They also thought that North Coast rivers could be seen to be in Stage 3 of a four-stage model proposed by Davies (1974). The final stage corrects this negative balance of coastal recession as rivers provide a more continuous load to the shore line.

This seems to be the case in this very small estuary. Only suspended fluvial loads reach the ocean. The coarser sands and gravels are held up some 7.2km channel distance from the training wall. So estuaries are slowly being filled in by various kinds of material. This is essentially the geological view of progressive sedimentation into the sink created by the transgression and the subsequent barriers. Apparent stability involves a shorter (engineering) span of time and this may be examined in three ways: the present, the immediate past and the future (without or with modifications).

Present-day stability seems to be indicated by a comparison of 1983 and 1988 cross-section surveys. This work has already been carried out by Webb McKeown. However, the stability noted in just two surveys six years apart may be more apparent than real. For instance, in a 12.5 month period 1970-71, just south of the north training wall in the Brunswick River, vertical variations were recorded along 5 traverses some 2000m long in five surveys. Maximum scour was up to 2.5m and, in some cases, the end survey was not greatly different from the first. Given the smaller estuary of Marshalls Creek and a more protected location with lower flows, the variations may well be much lower but they could still perhaps involve 1m or more. Much depends on duration and magnitudes of above threshold velocities, as well as the general state of the tides, in high runoff events leaving the flatter wetland environments west of New Brighton.

Immmediate-past stability is harder to understand without survey evidence. Three things have operated through the last 100 or so years to affect stability: changing catchment conditions, changing channel conditions and changing natural regimes.

Changing catchments conditions have probably increased runoff and suspended sediment loads, following deforestation, farming and the creation of some urban areas. Any bedload increases would have resulted mainly from channel erosion and reworking of coarse bank materials.

Changing channel conditions have resulted from human action and natural events. The addition of training walls, initially near the Heads in the late 19th Century and then in the north wall to improve navigation in the Brunswick River, has certainly altered the lower estuary (PWD charts).

The latter work has undoubtedly increased accretion with much sand having been added to the lower estuary since the late 1960s. Not all the PWD sources have yet been found and examined.

Channel changes may also have occurred as a result of variations in the natural regime. The late 19th Century is known to have been flood dominant; the first five decades of this century were much drier with few big floods and the period from 1949 onwards has again been flood dominant. Frequent floods of high magnitude in flood-dominated regimes (FDRs) have increased channel dimensions and have caused channel location changes. There is some evidence for this perhaps in the cutoff meanders in the wetlands area between the lake and New Brighton. For instance, at some earlier stage (probably not that long ago), the inclusion of the old meanders would have made the channel length from Site 20 to the Orana Bridge 5.8km. Sinuosity (channel length/valley length) was then very high at 2.3. Now the distance is 4.7km and the sinuosity has been reduced to 1.9. The loss of more than 1km has been effected by greater discharge (the former meanders are smaller in wavelength and channels were narrower) and some coarsening of the load. When this occurred is not evident as yet (may have been post-1949 but perhaps it was in the later half of the 19th Century). Below the Orana Bridge the channel length is 2.5km and sinuosity much lower at 1.2, indicating a coarser sand-perimeter channel and perhaps higher energy.

Future changes in stability may be of two kinds: those associated with no modification to the present channel and those with dredging for flood mitigation (or navigation as in PWD, 1984). In the former there would probably be a slow loss of capacity with the addition of lithics from the catchment and more marine material in the lower estuary. Some kind of channel would be maintained for the evacuation of water and fine sediments. Such slow changes might be accelerated by more catchment development and the maintenance of a flood-dominated regime.

The latter case cannot really be commented on in detail because data on location, size, shape and so on for the dredged channel are not available. The following speculations are apparent:-

(a) much of the lower part of any dredged channel will be cut in mobile sands, which are subject to reworking at fairly low velocities;

(b) west of New Brighton the tidal range will be increased, as will the prism volume (these are to be offset by increases in cross-section area);

(c) boundaries upstream and downstream of dredged reaches will need careful attention (NB PWD 1969 plan for western entrance through training wall);

(d) upstream there will be some potential for rejuvenation of more confined reaches of undredged channel.