

SUMMARY

A study of water quality and water column sediment loads was carried out in the period mid-December 1988 to mid-February 1989 on the south-east facing fringing reefs of Magnetic Island. The study aimed at providing a baseline before construction commenced on the marina/hotel development planned for the northern end of Nelly Bay. Although it was realized that a complete baseline, allowing for natural seasonal and meteorological variability, could not be produced in two months, as much data as was logistically possible to obtain was collected including data from periods of contrasting weather conditions. An associated benthic biota and sedimentation study provided a benthos baseline and measured sediment deposition in sediment traps in the same areas.

Parameters measured were determined after consideration of the possible contaminants from the development project, both in the construction and operation stages and included those which could be produced by sewage effluents (nutrients, turbidity, organic matter and bacteria), boating activities (anti-fouling coating residues, petroleum hydrocarbons) and construction and run-off (sediment and nutrients). Sampling sites were chosen on the basis of proposed water circulation patterns in the area and these were designated either as likely impact sites or control sites depending on whether they would be influenced by the development. Sites were sampled on five occasions in the water quality study and on seven occasions in the sediment/turbidity study. To gauge natural water column variability in Nelly Bay a spatial and temporal (up to one week) variability pilot study was carried out before the general baseline study commenced. To supplement chemical determination of low levels of the anti-fouling chemical tributyltin, a baseline for a possible biological monitoring programme on the susceptible gastropods Nassarius spp. was also carried out.

Pilot studies were done during the baseline study to assess the relative magnitudes of spatial and temporal variation at a range of scales within Nelly Bay. For most components of water quality sites and days do not constitute important sources of variation. Cost benefit analyses of the data from the study of spatial variability indicated, further, that the most efficient allocation of sampling effort was to dispense with sampling sites and concentrate on replicates. This strategy would be satisfactory provided that the replicates were well dispersed within locations and thus effectively integrated variation at the scales of 5-10 m and 50-75 m.

Although some components of water quality varied with time of day, none of the patterns of variation suggested that a particular time of day or tidal phase should be favoured when sampling, given that sampling will be logistically constrained to daylight hours.

The suggested programme for the estimation of environmental impacts during the construction phase of the Magnetic Quay development is necessarily a compromise between logistics and the need to cater to both small scale spatial and short term temporal variability. The results of calculations of the expected power of the proposed programme indicates that it should prove a powerful method of detecting moderate perturbations (50% change or greater) to water quality on any given day (Power > 0.8 for most variables, with Type I error = 0.1). Detection of much smaller effects (say 25% of means) with the same power is unlikely to be viable for most variables without the dedication of considerably more effort to sampling and analyses.

The bays are well mixed with uniform salinity and little thermal stratification except possibly during intense rainfall events. Dissolved inorganic nitrogen levels are high with anomalously high nitrite levels and above those considered desirable for healthy coral reefs by some authorities. Phosphorus and silicate levels are normal while although no tributyltin residues were detected elevated levels of copper, compared to uncontaminated waters, were found. Levels of aromatic hydrocarbons and coliform bacteria were also normal for this area. Few differences were noted between the bays except for phosphorus levels where Nelly Bay levels were consistently lower than in the more northern bays. Suspended solid values were low, particularly compared to values measured in the south-easterly trade wind season. No useable relationship between Secchi Disc readings and suspended solid values could be derived.