EXECUTIVE SUMMARY

A pilot study was undertaken at Green Island in June 1989 to assess the spatial and temporal variation of a range of water quality parameters. It was a precursor to the implementation of a proposed baseline study of water quality around Green Island to ensure the optimum allocation of sampling in a cost effective manner.

Water quality parameters were measured over a range of nested spatial and temporal scales within the framework of three separate studies. Spatial variability was assessed with respect to **depth** and **habitat** (reef flat and slope) and over a range of nested horizontal scales; **Locations** (ca. 500 m); **Sites**, nested within locations (ca. 50 m), and **replicates** nested within all of the above factors (ca. 1-5m). Significant differences in concentration between **locations** (i.e. > 500 m) around Green Island were found for most inorganic nutrients (NO_2 + NO_3, NH_4, DIN, PO_4). Differences between **habitats** (reef flat and slope) were important for DIN and for PO_4. **Depth** and **site** were not important sources of variation for any of the parameters examined.

Higher values of DIN were recorded at locations (D & F) on the windward side of Green Island, whilst the mean DIN concentration at location E on the north-eastern side of the reef was significantly lower than other locations. Differences due to habitat were considered potentially significant. It was considered that the potential for nutrients to be modified as the water mass is advected across the reef should be addressed in the design of the baseline study.

Short term temporal variation was assessed over a 24 hour period sampling every 3 hours at two location on the reef **flat** and **slope**. Diel comparisons were made at the same time over 3 days at the same locations. The temporal study demonstrated that apart from DIN, **time of day** was not an important source of variation for most parameters of water quality. Multivariate analysis suggested there were changes in dissolved nutrient change consistent with tidal and diurnal cycles. Time periods sampled around low tides had higher concentrations of DIN than those around high tides. Sampling on different **days** was a significant source of variability for nitrogen species.

Differences in nutrient flux between days and over larger time frames (i.e. seasons) should be accounted for in the proposed sampling programme. Although diurnal variation is not a potential source of variability, sampling should be conducted at a

similar time on every sampling occasion. Sampling is preferable around the high tide for logistical reasons (i.e. boat handling).

Cost benefit analysis indicated that the most efficient allocation of sampling was to dispense with sampling sites or depth and to concentrate on replicates well dispersed within locations thus effectively integrating spatial variation at scales of 5-10 m and 50-70 meters.

It is proposed that the baseline water programme should sample surface waters at a number of sites (defined by habitat type) along transacts running across the reef from offshore. To account for temporal variability sampling would be carried out on two field trips during the Winter and Summer with sampling on two alternate days on each field trip. Sampling would be conducted around the diurnal high tide of every occasion.

No significant change in ambient water quality could be attributed to sewage discharge, although phosphate levels were higher in the vicinity. Explicit studies are needed to address this problem.

Values of the parameters measured were in the range of values reported from other studies on the GBR.

The results of the pilot study cannot be interpolated to studies on high island fringing reefs. For instance, factors such as bottom sediment type, resuspension, sediment nutrient pool are likely to be different for a turbid fringing reef.

It was considered analytical problems and prohibitive costs made particulate nitrogen and BOD_5 unsuitable parameters to measure in the baseline study.

Standardisation of sampling methods between workers is recommended if results are to be usefully compared. For example the use of filtration and filter type can have a substantial effect on nutrient concentrations.

Techniques of multivariate analysis provide a useful way for examining patterns which may not be apparent using univariate techniques.