Tropical cyclone Joy
December 1990
BPA 29

Coastal Management Branch

Cyclone technical report no. 2

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Preface

This report on tropical cyclone Joy report is one of a series. It contains data collected by the Beach Protection Authority over the period prior to, during and after the passage of tropical cyclone Joy in December 1990. Other reports in the series are:

- Tropical cyclone Winifred
- Tropical cyclone Charlie
- Tropical cyclone Aivu (in preparation)
- Tropical cyclone Mark (in preparation)
- Tropical cyclone Betsy (in preparation)
- Tropical cyclone Fran (in preparation)

Contents

Introduction 2

Storm surge recording 2

Wave recording 2

Coastal Observation Program — Engineering 2

Field inspections 3

References 3

List of figures

1 Track of tropical cyclone Joy
2 Locations of water level recorders
3 Locations of water level recorders
4 Cooktown storm surge tide data and predictions
5 Mossman storm surge tide data and predictions
6 Cairns storm surge tide data and predictions
7 Mourilyan storm surge tide data and predictions
8 Clump Point storm surge tide data and predictions
9 Cardwell storm surge tide data and predictions
10 Lucinda storm surge tide data and predictions
11 Townsville storm surge tide data and predictions
12 Cape Ferguson storm surge tide data and predictions
13 Bowen storm surge tide data and predictions
14 Shute Harbour storm surge tide data and predictions
15 Mackay storm surge tide data and predictions
16 Hay Point storm surge tide data and predictions
17 Port Douglas tide data and predictions
18 Abbot Point tide data and predictions
19 Location of wave recording station — Cairns
20. Location of wave recording station — Townsville
21 Location of wave recording station — Abbot Point
22 Location of wave recording station — Mackay
23 Cairns wave recording station, wave height and period parameters
24 Trinity wave recording station, wave height and period parameters
25 Townsville wave recording station, wave height and period parameters
26 Abbot Point wave recording station, wave height and period parameters
27 Mackay wave recording station, wave height and period parameters
28 Location of COPE stations
29 Location of COPE stations
30 Beach profiles — Clifton Beach and Trinity Beach
31 Beach profiles — Bramstom Beach North and Bramston Beach
32 Beach profiles — Cowley Beach and Hull Beach
33 Beach profiles — Tully Heads and Tully Heads No.2
34 Beach profiles — Forrest Beach and Saunders Beach
35 Beach profiles — East Queens Beach and Kings Beach
36 Beach profiles — Midge Point and Seaforth Beach
37 Beach profiles — Harbour Beach and Lamberts Beach
38 Beach profiles — Sarina Beach and East Farnborough
39 Beach profiles — Barwell Creek and Lammermoor Beach
40 Beach profiles — Keppel Sands and Tannum Sands
41 Beach profiles — Moore Park and Bargara
42 Beach profiles — Kelly's Beach and Theodolite Creek
43 Field inspections — Trinity Beach and Bramston Beach
44 Field inspections — Tully Heads and Cardwell Beach
45 Field inspections — Midge Point and Ball Bay
46 Field inspections — Bucasia and Shoal Point
47 Field inspections — Far Beach and Louisa Creek
48 Field inspections — Yeppoon and Bangalee
49 Field inspections — Kinka Beach

Introduction

On 19 December 1990, tropical cyclone Joy formed out of a tropical depression in the north Coral Sea approximately 940km east-north-east of Cooktown. Over the next three days Joy moved on a generally west-south-westerly track and slowly intensified to Category 3 (on a scale of 1 to 5) at 1600h (AEST) on 21 December 1990. At this time the system was 420km north-east of Cooktown and had an estimated central pressure of 970HPa. Figure 1 indicates the cyclone track.

On the morning of 23 December 1990, Joy was located approximately 135km north-east of Cairns and was further upgraded to Category 4, with an estimated central pressure of 940HPa and wind gusts near the centre reaching 230km/h. Over the following 24 hours Joy remained almost stationary in a position approximately 120km north-east of Cairns until moving slightly offshore and decreasing in intensity to be downgraded to Category 3 in the morning of 24 December 1990. Following this change, Joy proceeded to follow a south to south-westerly path during the period 24–26 December 1990, further decreasing in intensity to a Category 1 cyclone and crossing the Queensland coast at 1800h (AEST) on 26 December 1990 at Upstart Bay near Ayr. At landfall, Joy had a central pressure of approximately 985HPa with estimated wind gusts to 110km/h. The system further degenerated into a tropical depression later in the evening of 26 December 1990, south-west of Ayr.

Tropical cyclone Joy posed one of the most extreme threats to Queensland coastal populations in recent times. During the period 22–25 December 1990, destructive winds were experienced on the coast between Cape Tribulation and Innisfail, with gales and high winds impacting as far south as Gladstone. Only three other recorded cyclone events rated as Category 4 have impacted the Queensland coastline this century. Fortunately Joy weakened significantly to a Category 1 before making landfall, although extensive damage was reported due to the high winds and major flooding.

Storm surge recording

Water level data were obtained from the Beach Protection Authority's storm surge tide recorders at Cooktown, Mossman, Cairns, Mourilyan, Clump Point, Cardwell, Lucinda, Townsville, Cape Ferguson, Bowen, Shute Harbour, Mackay and Hay Point. Figures 2 and 3 show the locations of these recorders. The water level data were recorded at ten-minute intervals on non-volatile memory devices and transferred to the Principal Tides Officer, Department of Transport for analysis and verification. Figures 4 to 16 present measured water levels, predicted tides and the residual levels for each site. It should be noted that the measured water level data are represented as hourly values which have been determined from the ten-minute records.

The storm surge tide recording system also allows interrogation via the Public Switched Telephone Network for real time access during cyclone events. This facility was used during the passage of tropical cyclone Joy to monitor any storm surge. Several storm tide warnings were issued for Joy advising of potential coastal inundation hazards due to an estimated storm surge of up to two metres between Port Douglas and Cardwell.

Water level data from Department of Transport tide recorders at Port Douglas and Abbot Point have also been obtained to examine the storm surge at these sites. Figures 2 and 3 show the locations and Figures 17 and 18 present the measured water levels, predicted tides and residual levels for these sites.

From the data obtained, a peak storm surge of 0.45 metres was recorded at Port Douglas at 0000h (AEST) 24 December 1990. High waters at Port Douglas were predicted for 0232h and 1428h on 24 December 1990. The passage of tropical cyclone Joy coincided with neap tides throughout the region and the resulting storm tide levels were therefore below predicted highest astronomical tide (HAT). Note that the HAT values used in this report are taken from the 1990 Official Tide Tables, published by the Department of Harbours and Marine, Queensland. Refer to Reference 2 for further detail.

Wave recording

Wave data were obtained from the Beach Protection Authority's wave recording stations at Cairns, Townsville, Abbot Point and Mackay. Figures 19 to 22 show the locations of these stations.

Each wave recording station consists of a Waverider buoy moored in an offshore location which transmits a continuous 27MHz FM signal to an onshore receiving station. Throughout the course of the cyclone event, the wave recording equipment was switched to record data in bursts of twenty minutes at intervals of three hours. The Trinity wave recording station (trialling the Authority's upgraded wave recording system) was configured to record data at intervals of one hour and the software enabled real time access to the recorded data via the Public Switched Telephone Network. This facility was used during tropical cyclone Joy to monitor the incidence of heavy wave conditions along the exposed sections of the coastline.

Wave height and period data for the period 20–30 December 1990 are shown in Figures 23 to 27 for the wave recording stations from Cairns to Mackay. The wave parameters, derived from a zero upcrossing time domain analysis and spectral analysis, are as follows:

- Hsig: the average height of the highest one third waves in a record.
- Hmax: the highest individual wave in a record.
- Tz: the average period of all waves in a record.
- Tpeak: the wave period corresponding to the peak of the wave energy spectrum.

During tropical cyclone Joy, a peak Hsig of 3.43 metres and Hmax of 5.54 metres, shown in Figure 26, were measured at the Abbot Point wave recording station at 1453h (AEST) on 26 December 1990.

Coastal Observation Program — Engineering

Volunteer observers involved with the Beach Protection Authority's Coastal Observation Program — Engineering (COPE) were asked to carry out beach profile measurements directly following the passage of the cyclone, where possible. These profiles were then plotted and compared with previous data to assess the extent of beach change. Additional information obtained from the COPE observers in the aftermath of tropical cyclone Joy relating to beach conditions proved invaluable to Authority officers in the assessment of local conditions.

Figures 28 and 29 show the locations of COPE stations between Clifton Beach and Theodolite Creek. Profiles from these stations have been plotted in Figures 30 to 42.

Field inspections

Engineers and Dune Conservation Officers from the Beach Protection Authority undertook field inspections of coastal areas between Cairns northern beaches and the Yeppoon area in early January 1991. In a number of areas, substantial beach erosion was reported although threat to property from erosion was minimal. The following is a brief description of the condition of the beaches inspected.

Mulgrave Shire
Very little erosion was apparent in this region with most beaches in good condition. Some minor erosion was observed at the northern end of Trinity Beach and at Bramston Beach. See photographs in Figure 43.

Johnstone Shire
The majority of beaches inspected in this region showed very little effects from events experienced during the passage of tropical cyclone Joy although some erosion was evident in the vicinity of the beach fronting the caravan park at Kurrimine.

Cardwell and Hinchinbrook Shires
A small number of cases of beach erosion were reported including some minor slumping of a rock wall at Tully Heads and some re-shaping of a re-nourished beach at Cardwell. See photographs in Figure 44.

Thuringowa City
At Toolakea Beach, in the vicinity of a creek mouth re-alignment project undertaken in 1989, the effects of the cyclone were mainly beneficial with sand from offshore banks being fed onshore. Some slight erosion was reported at Saunders Beach and Cungulla.

Townsville City
Due to the passage of tropical cyclone Joy, a slight acceleration of the continuing erosion and coastline recession was observed in the Rowes Bay area. No other problems were reported.

Bowen and Whitsunday Shires
No inspections of sites in these Shires were undertaken. However, reports were received of wave damage to marina pontoons at Daydream Island.

Pioneer Shire
Substantial beach erosion was reported in this region; some is shown in Figures 45 and 46. Moderate erosion and tree losses were reported at Midge Point, Halliday Bay, Seaforth, St Helens Beach and Ball Bay. Due to coastline recession, the erosion scarp at Ball Bay was reported to be approximately two metres from the road in one location. At Shoal Point, erosion scarps of three metres and extensive destruction of fencing and walkways were reported. Lesser erosion occurred at Eimeo and scarps of two to three metres were observed at Bucasia and Lamberts Beach.

Mackay City
Along the dune system of Town Beach a number of breakthroughs were reported and damage occurred to the rock wall fronting the park. At Far Beach the storm wave conditions overtopped and damaged the rock wall. See photographs in Figure 47.

Sarina Shire
Some moderate erosion was reported in this region along with a number of problems associated with stormwater run-off at Louisa Creek, Grasstree, Salonika, Sarina and Armstrong Beaches. See photographs in Figure 47.

Broadsound
Some coastline recession which threatened property boundaries was reported at Clairview.

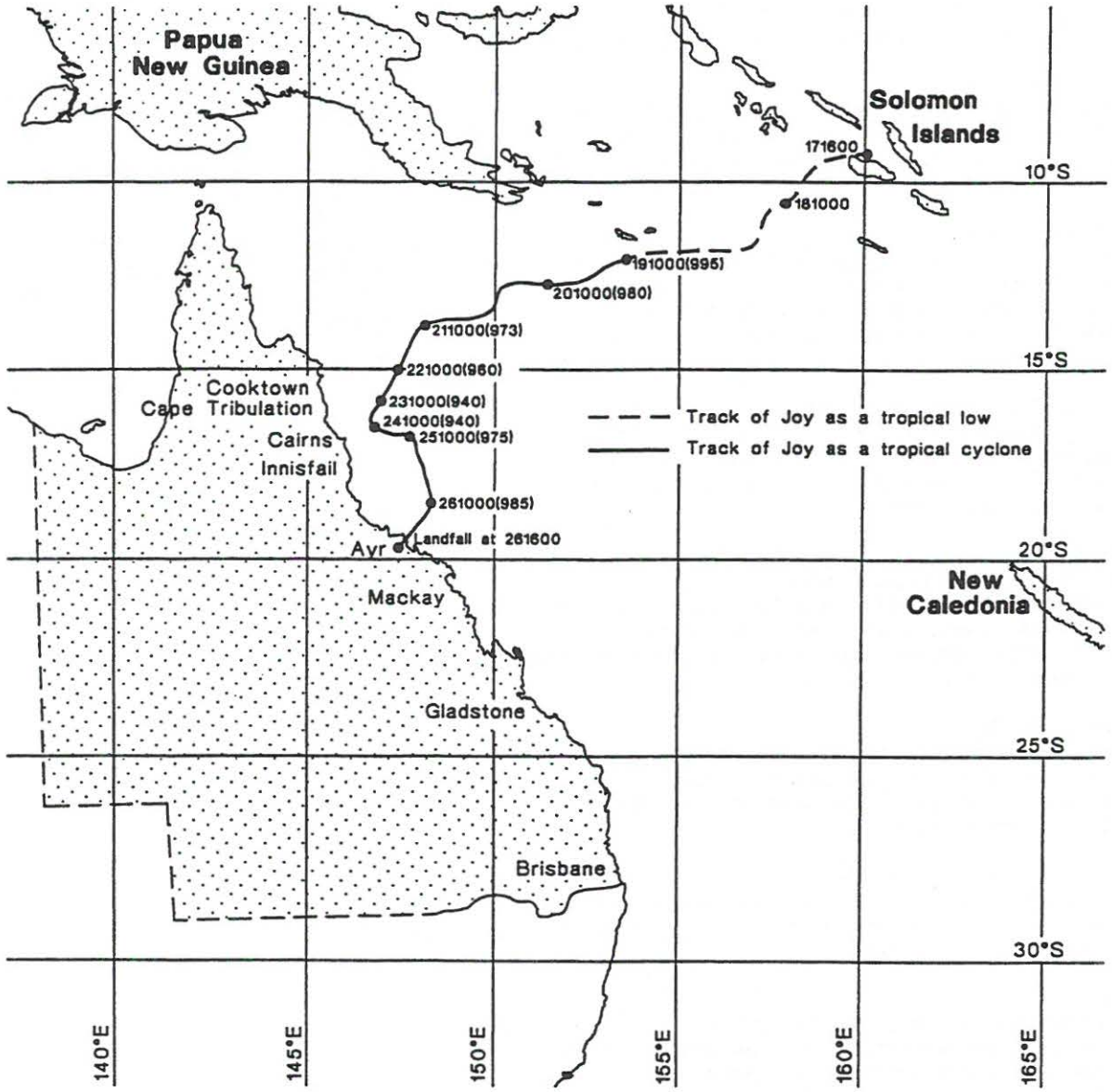
Livingstone Shire
Moderate localised erosion was reported to have occurred at Bangalee, Yeppoon and Kemp Beach. See photographs in Figure 48. Some damage to the rock wall and extensive erosion and overtopping of the bund wall at Kinka Beach were also reported. See photographs in Figure 49.

References

1. Monthly Weather Review Queensland December 1990, Bureau of Meteorology.

2. Queensland Official Tide Tables 1990, Department of Harbours and Marine

Note: Department of Harbours and Marine subsequently merged to Queensland Transport between the time of publication of these Tide Tables and the passage of Tropical Cyclone 'Joy'.



Track of Tropical Cyclone Joy
1600 AEST 17/12/90 to 1600 AEST 26/12/90

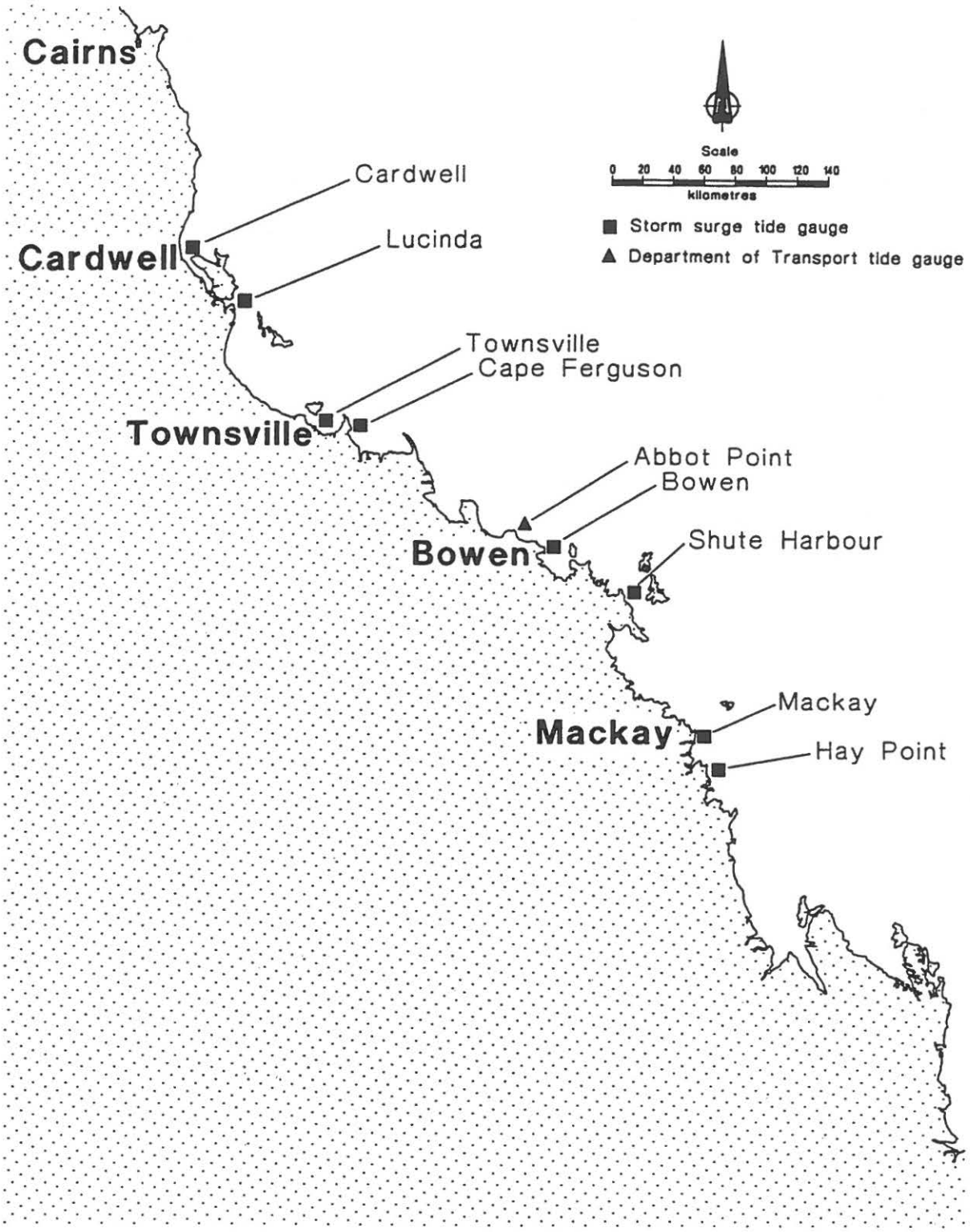
0 100 200 300 400 500 Kilometres
Approximate scale

Track of Tropical Cyclone Joy

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

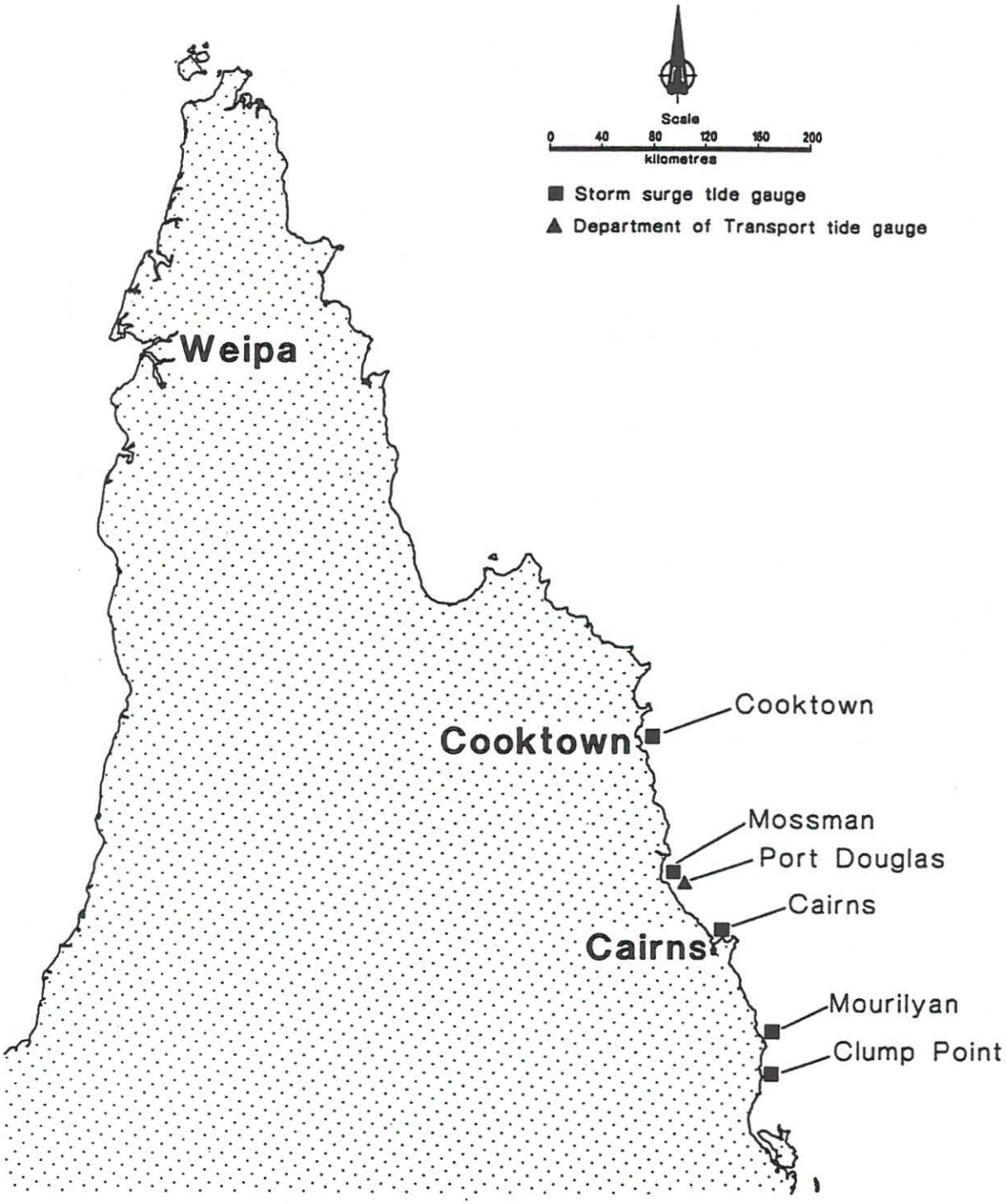
Tropical Cyclone Joy

Figure 1



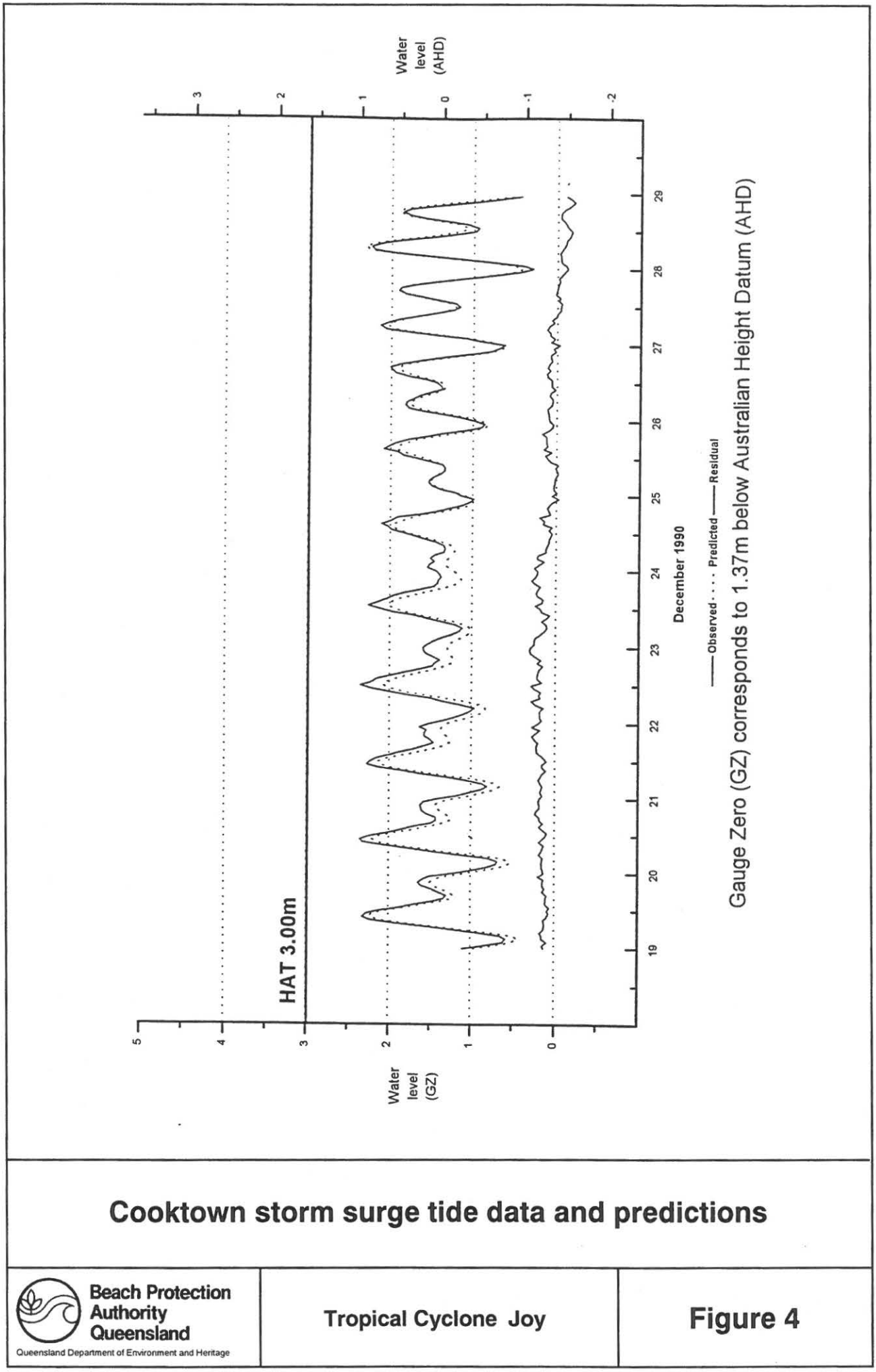
Location of water level recorders

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 2



Location of water level recorders

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 3

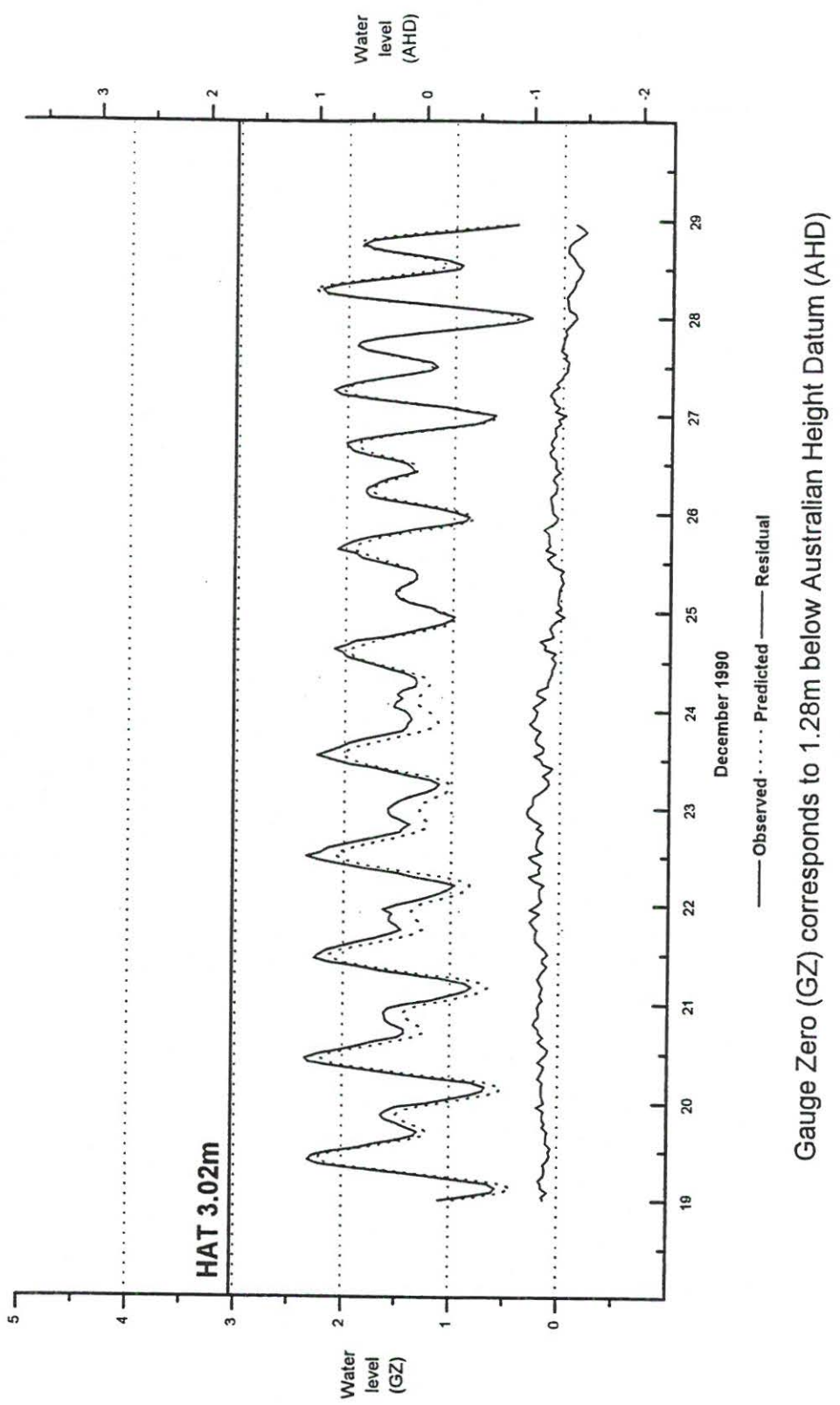


Cooktown storm surge tide data and predictions

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 4

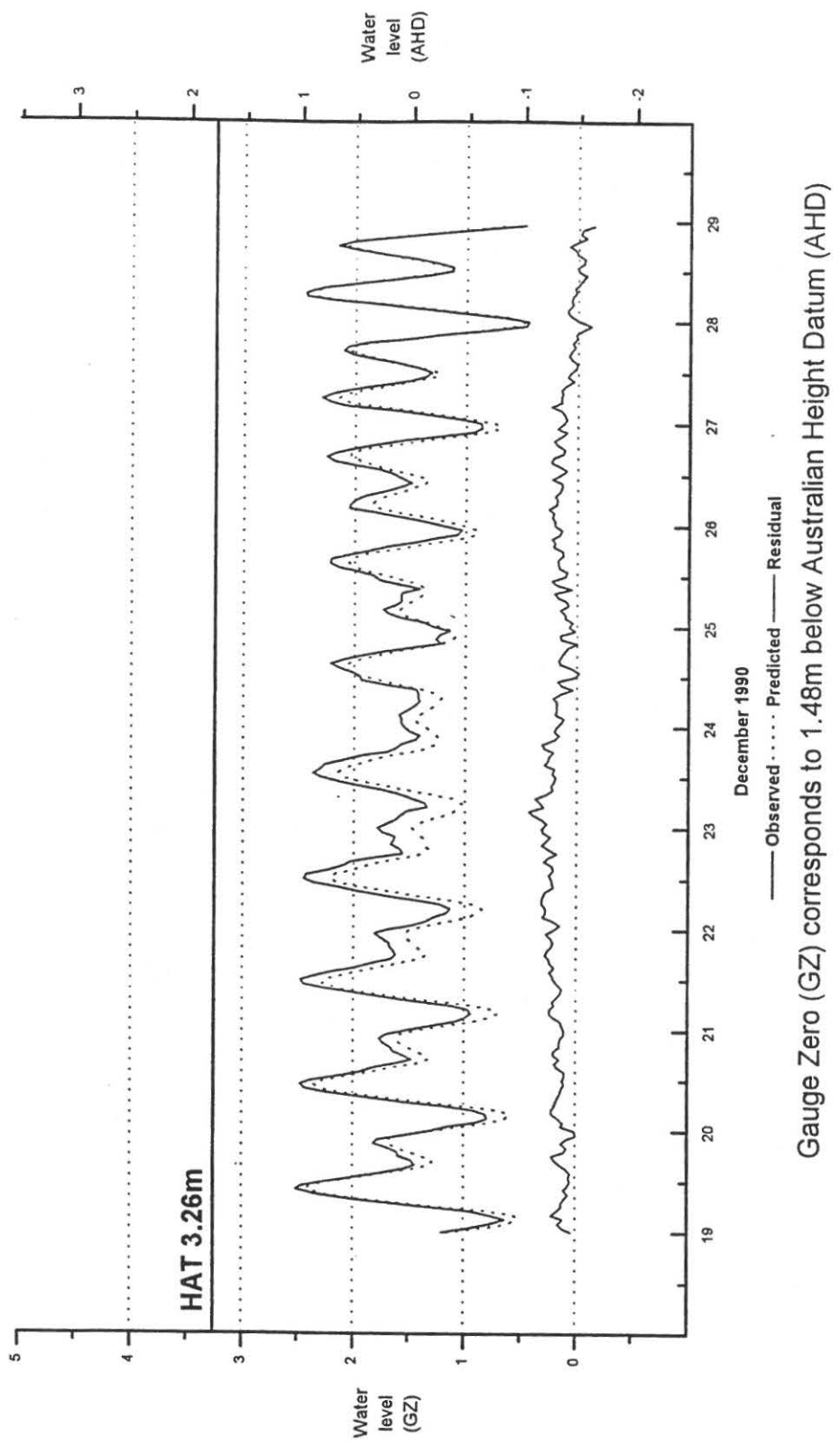


Mossman storm surge tide data and predictions

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 5

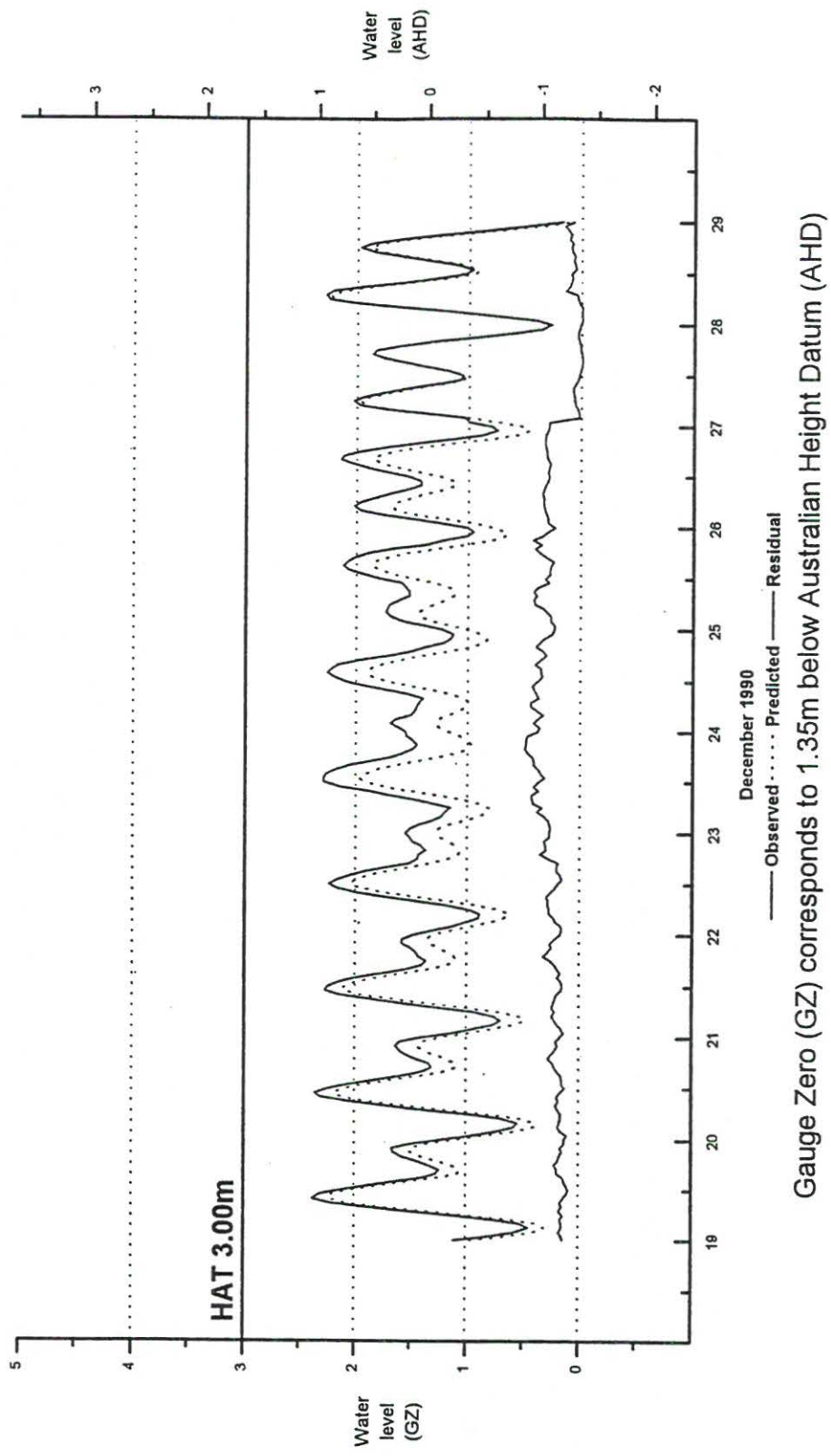


Cairns storm surge tide data and predictions

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 6

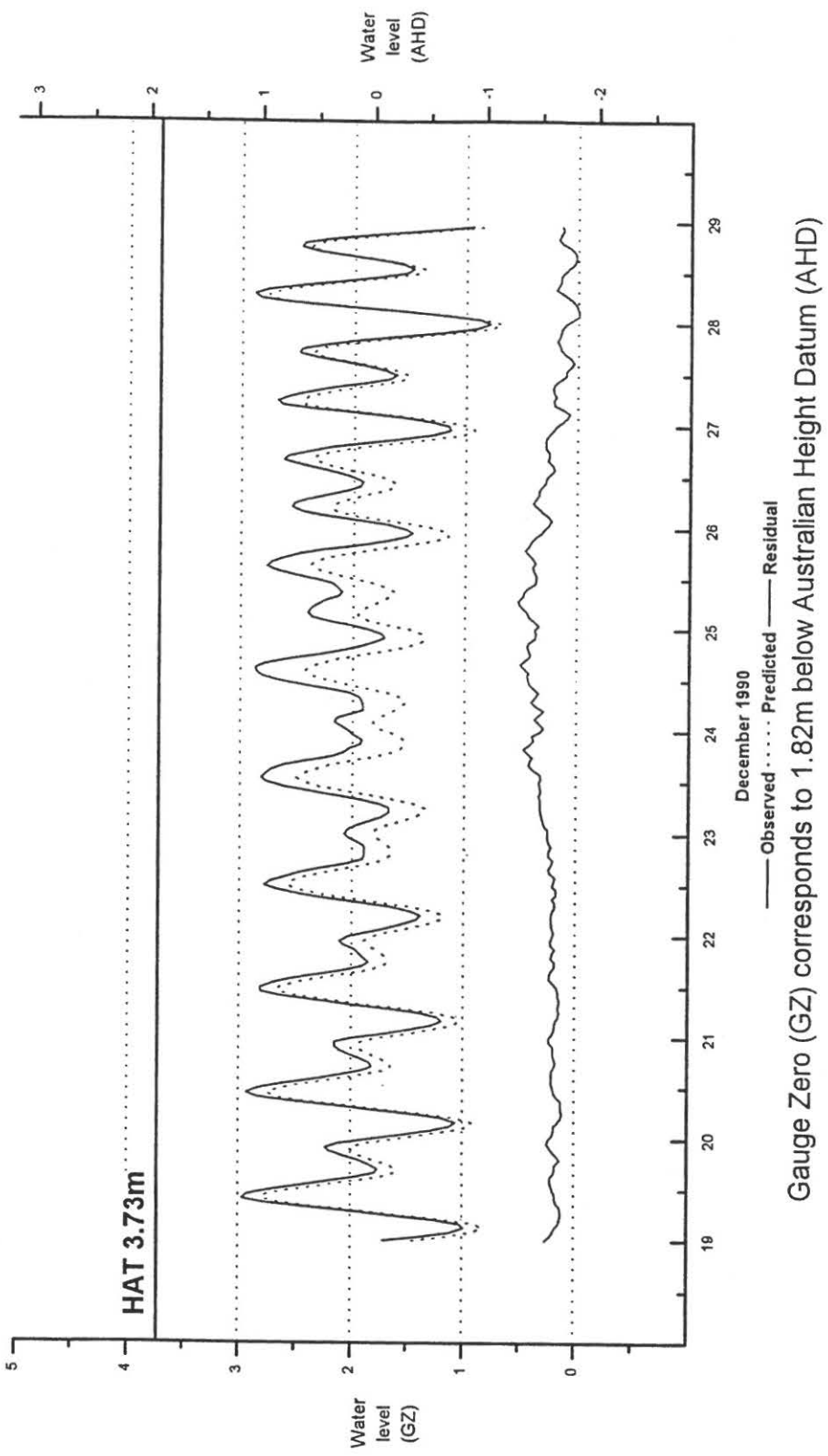


Mourilyan storm surge tide data and predictions

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 7

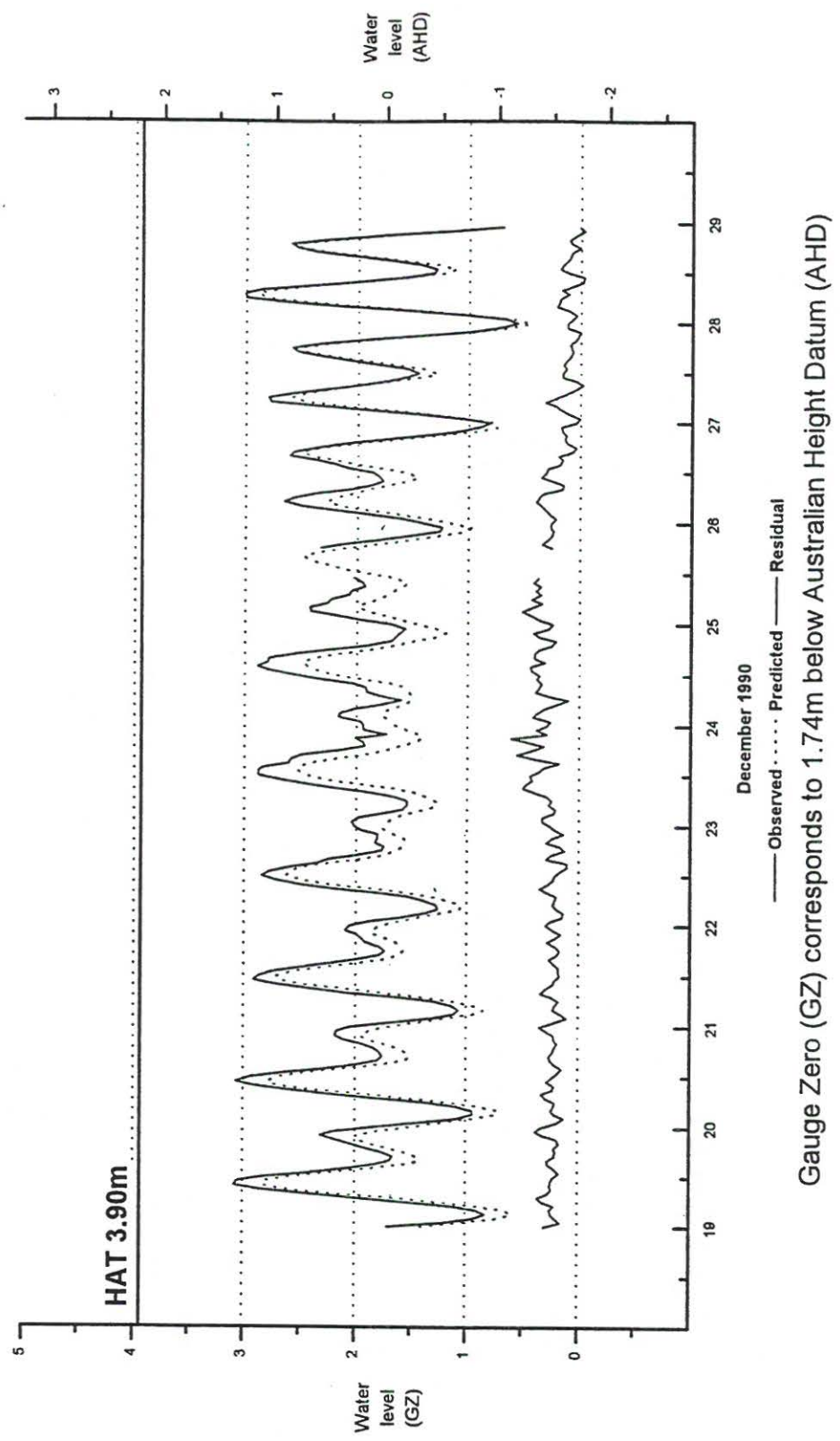


Clump Point storm surge tide data and predictions

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 8

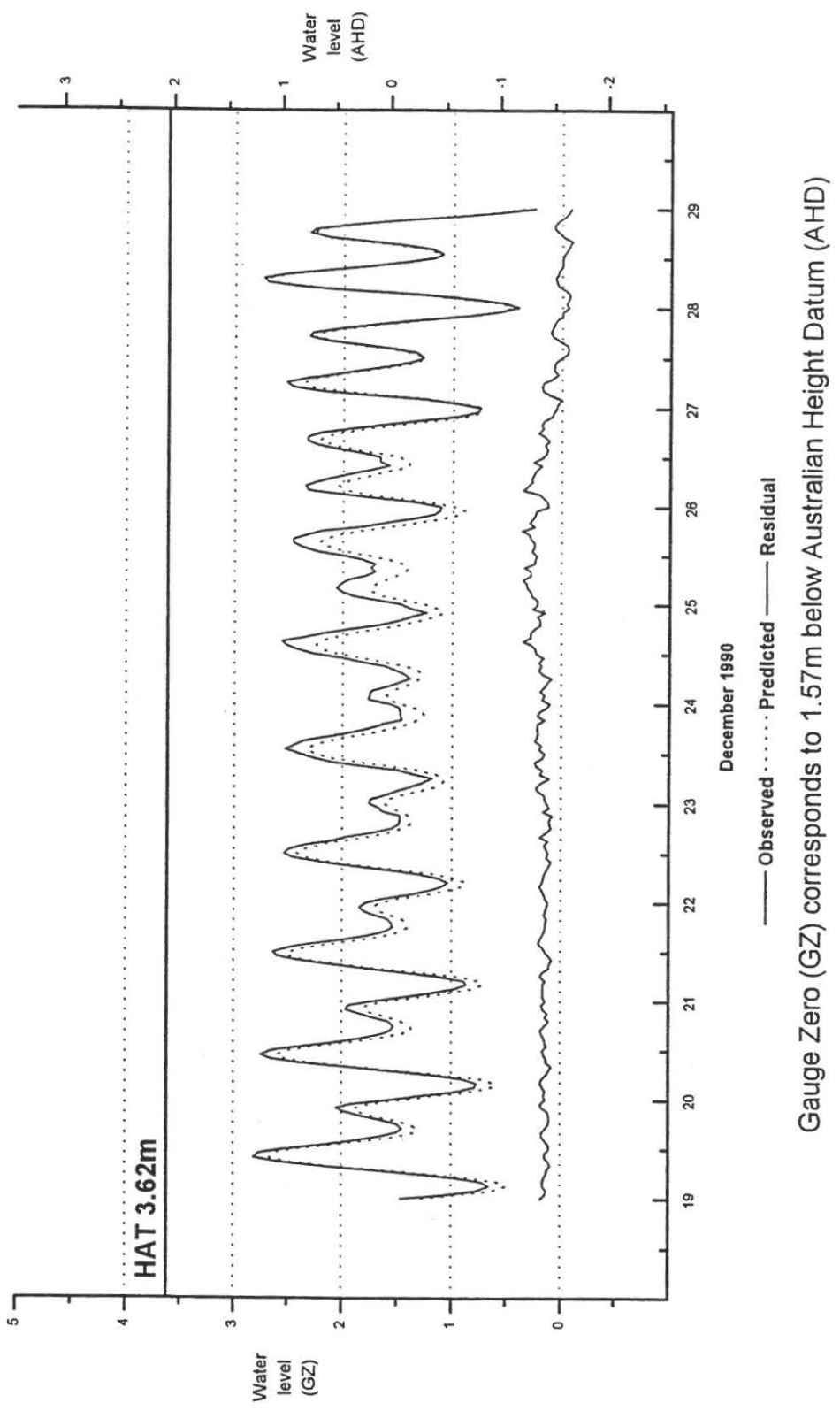


Cardwell storm surge tide data and predictions

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 9

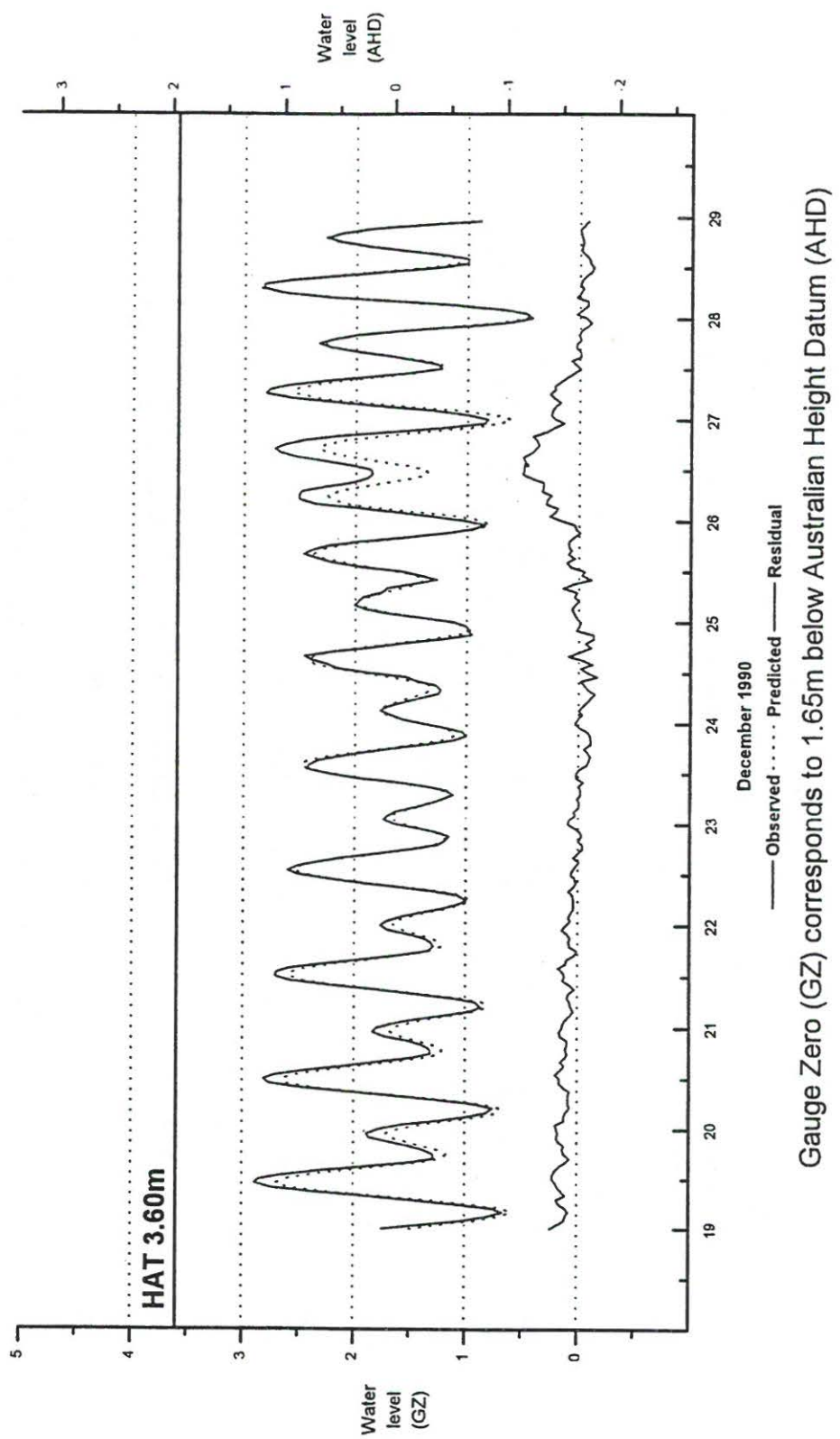


Lucinda storm surge tide data and predictions

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 10

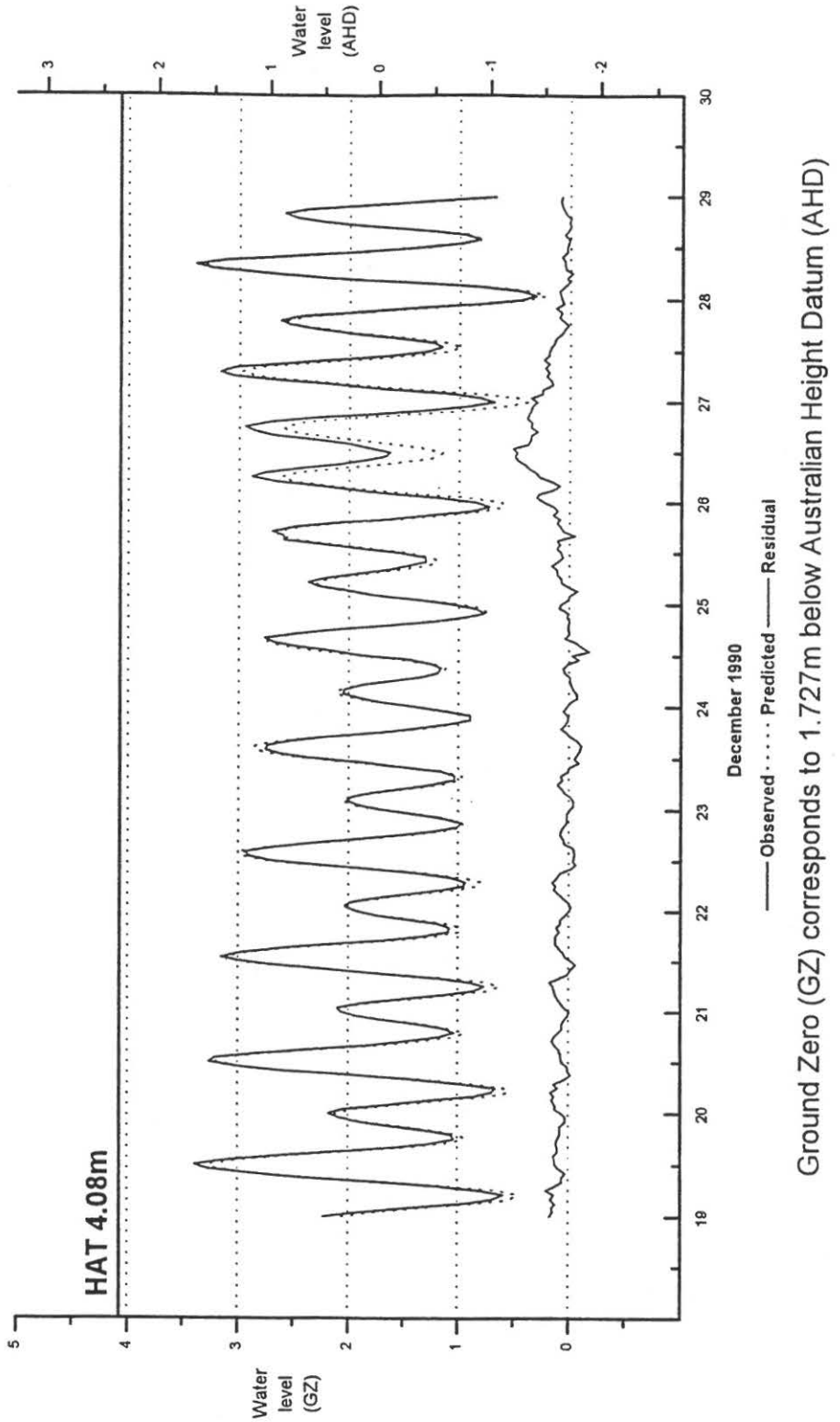


Bowen storm surge tide data and predictions

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

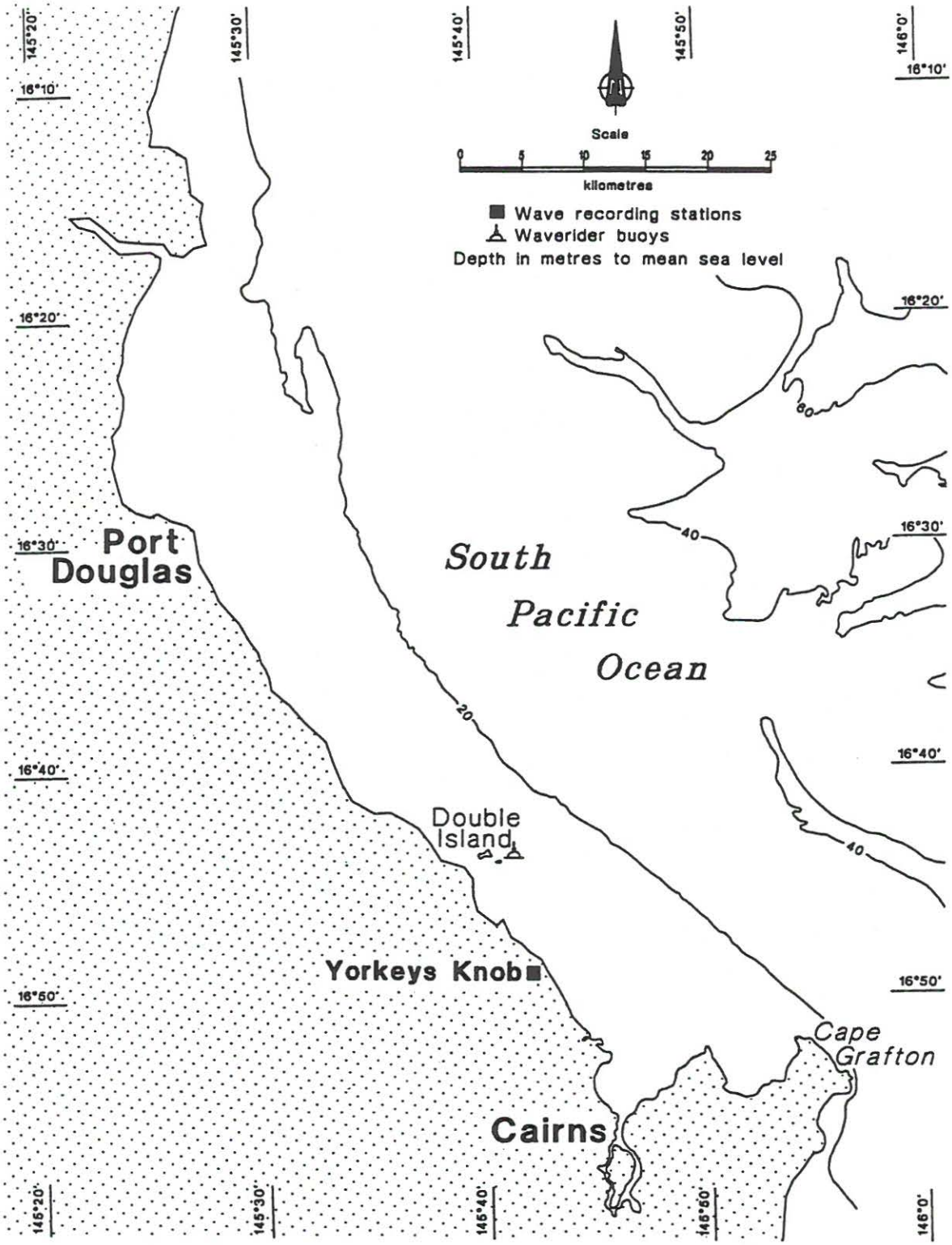
Tropical Cyclone Joy

Figure 13



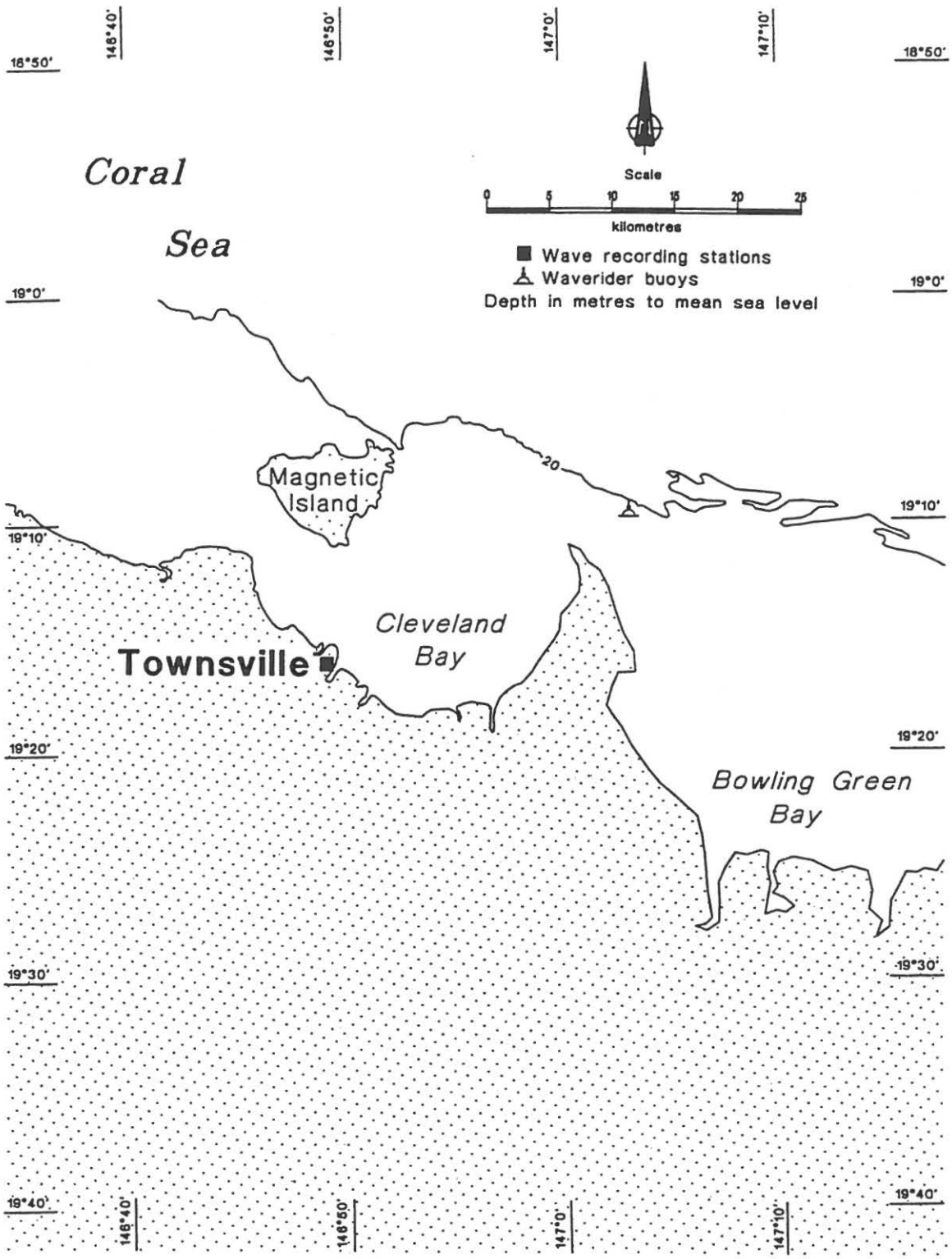
Shute Harbour storm surge tide data and predictions

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 14



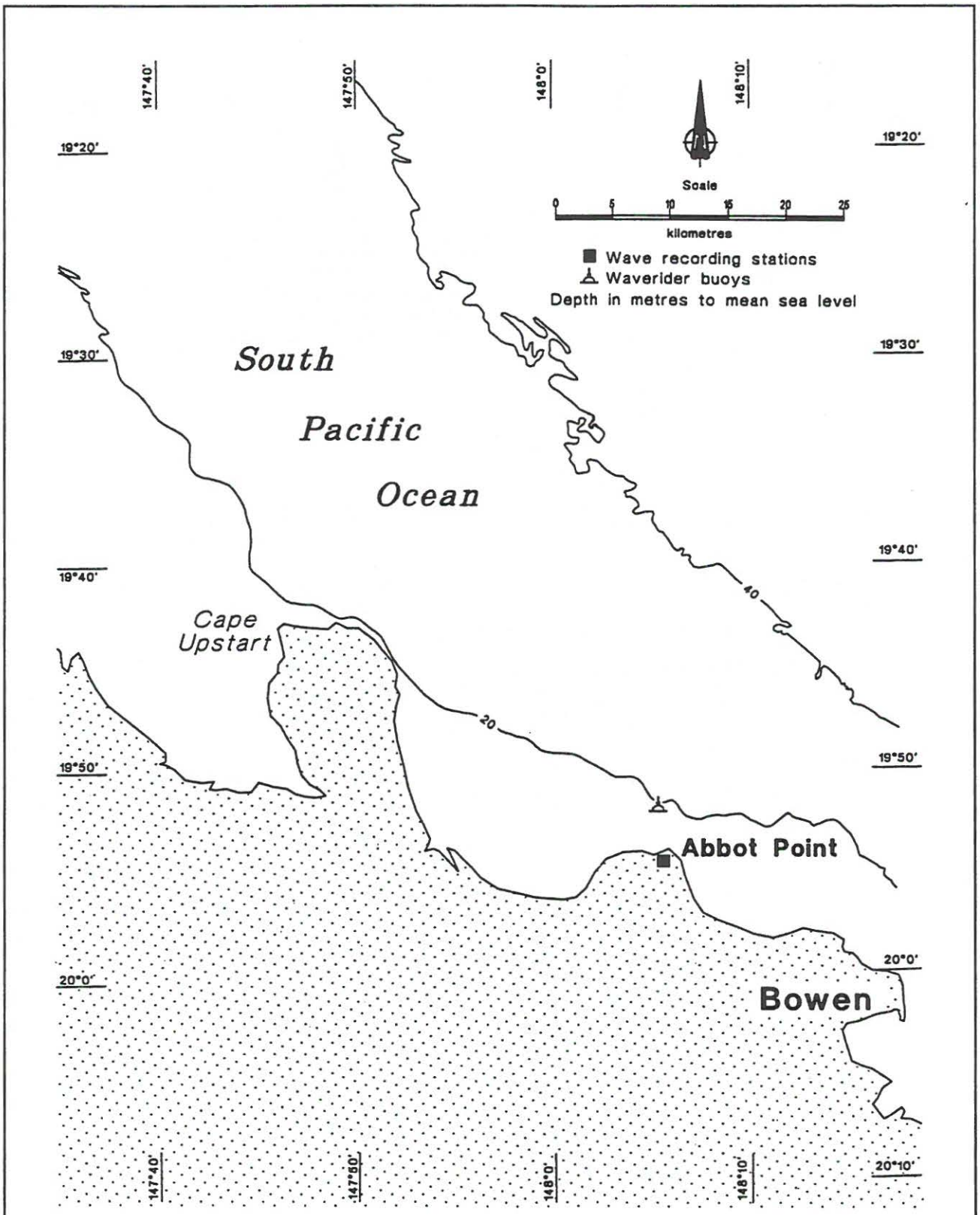
Location of wave recording station – Cairns

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 19



Location of wave recording station – Townsville

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 20

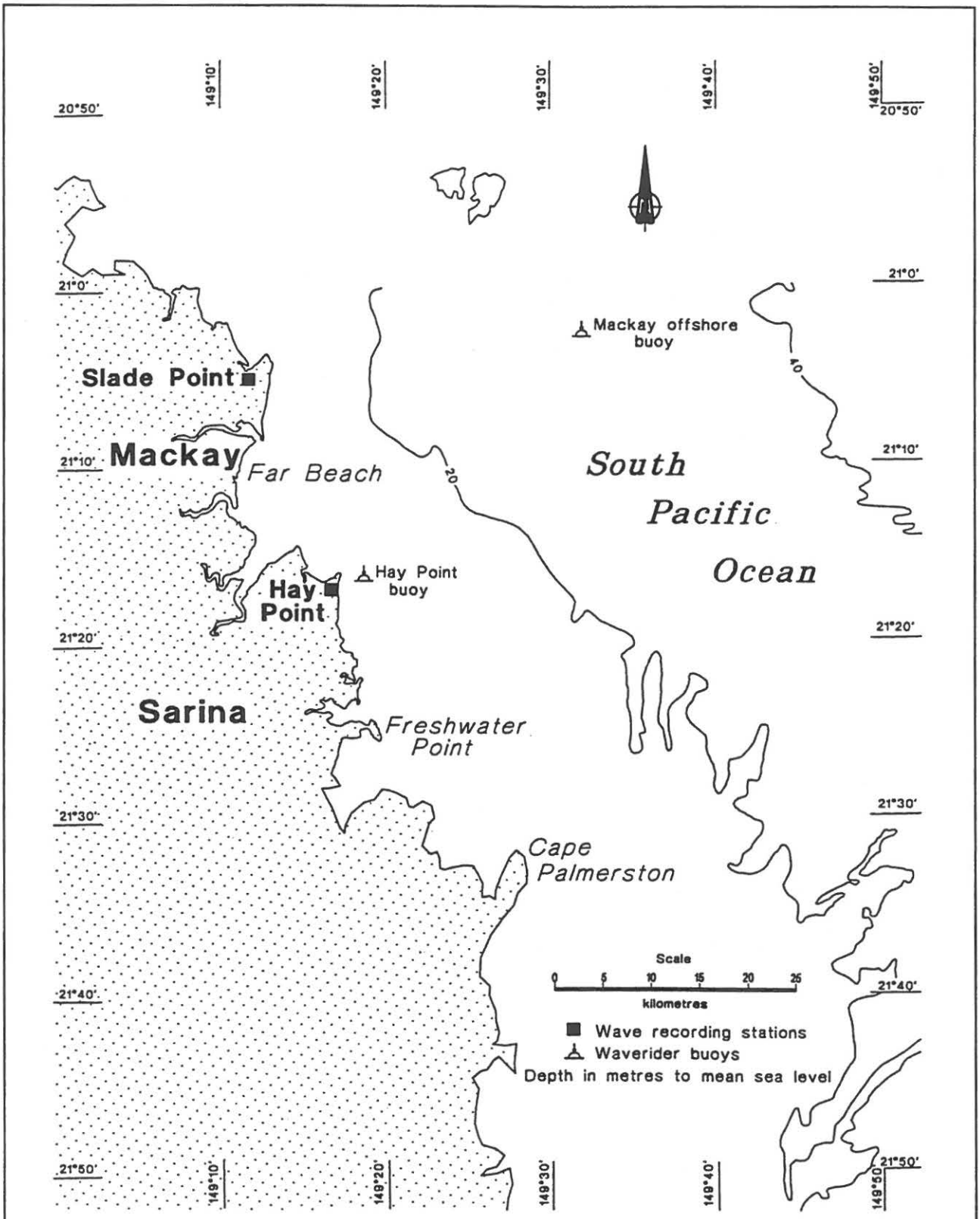


Location of wave recording station – Abbot Point

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

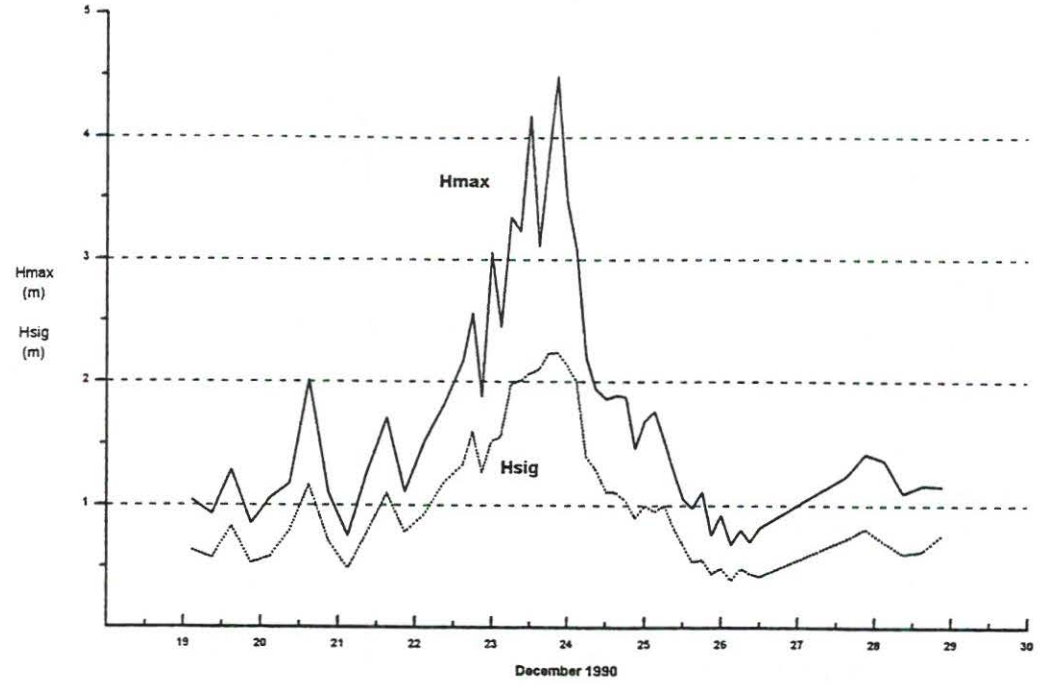
Tropical Cyclone Joy

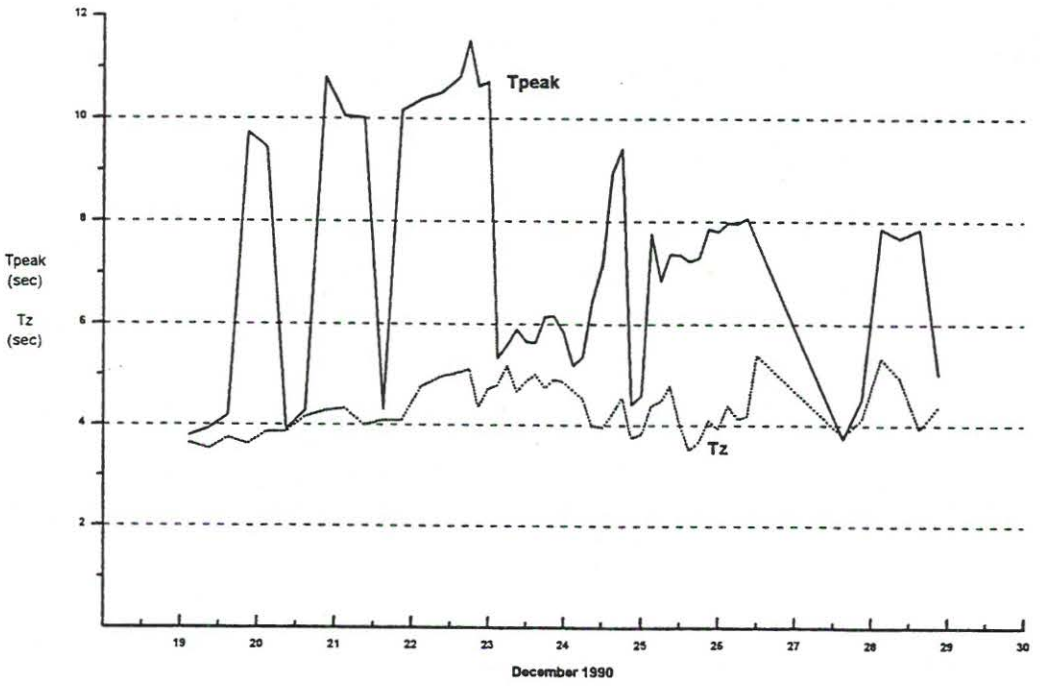
Figure 21



Location of wave recording station – Mackay

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 22



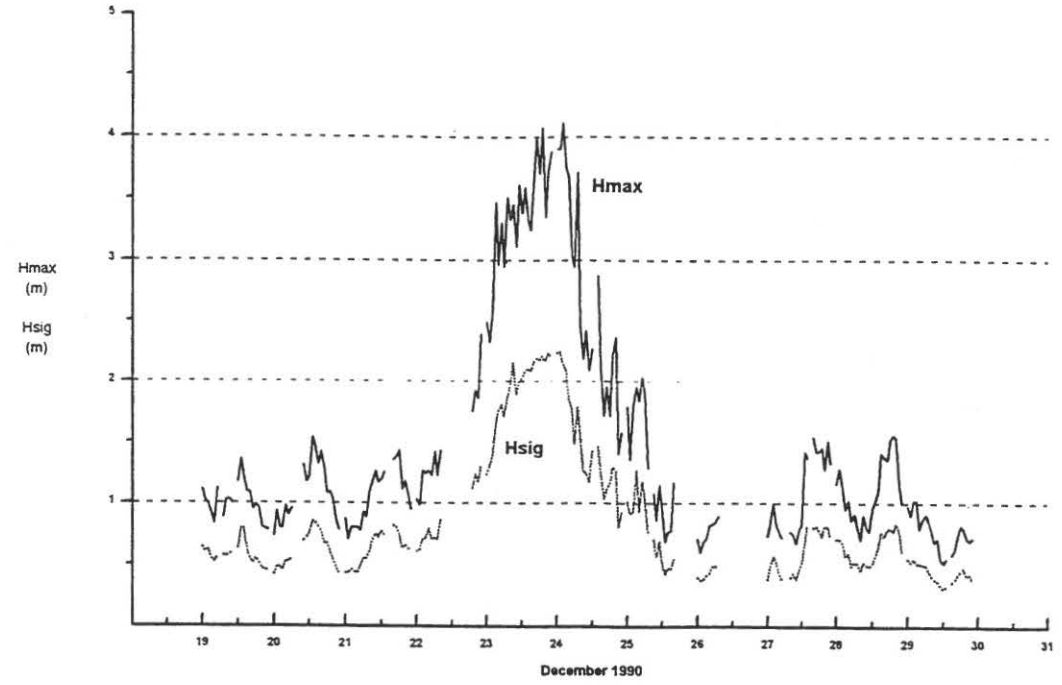


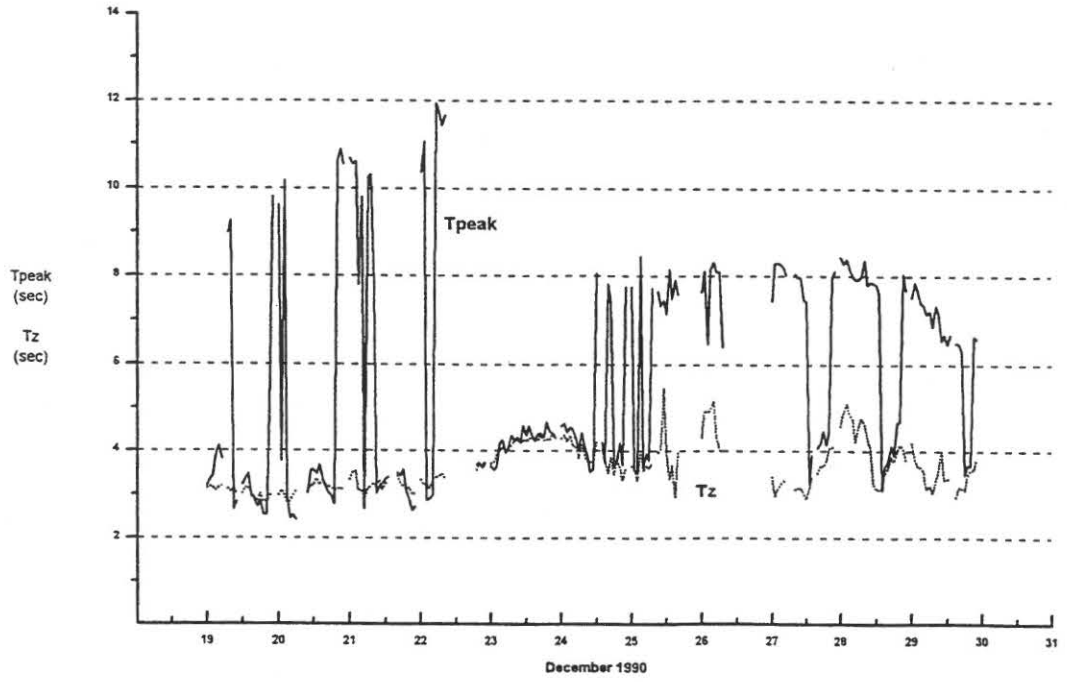
Cairns wave recording station wave height and period parameters

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

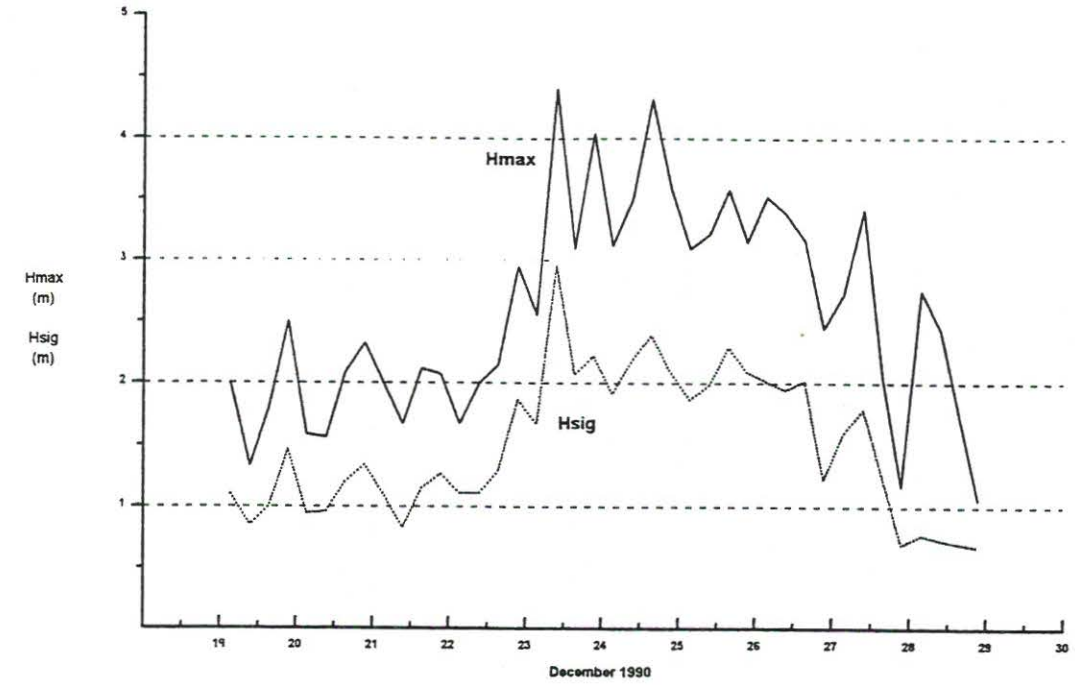
Figure 23

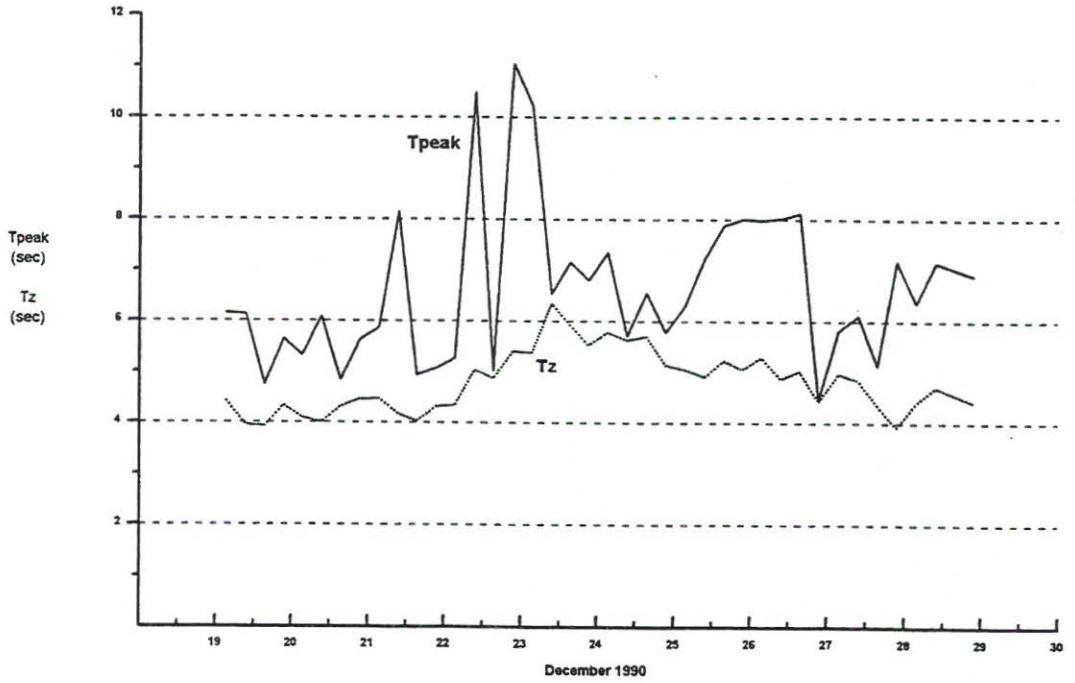




Trinity wave recording station wave height and period parameters

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 24



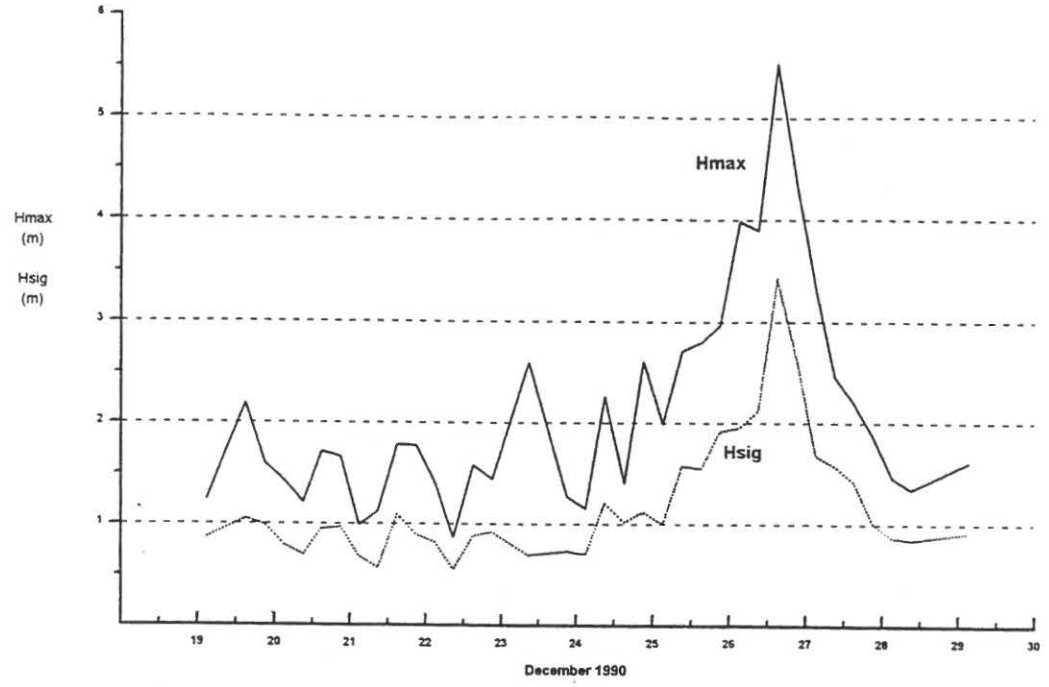


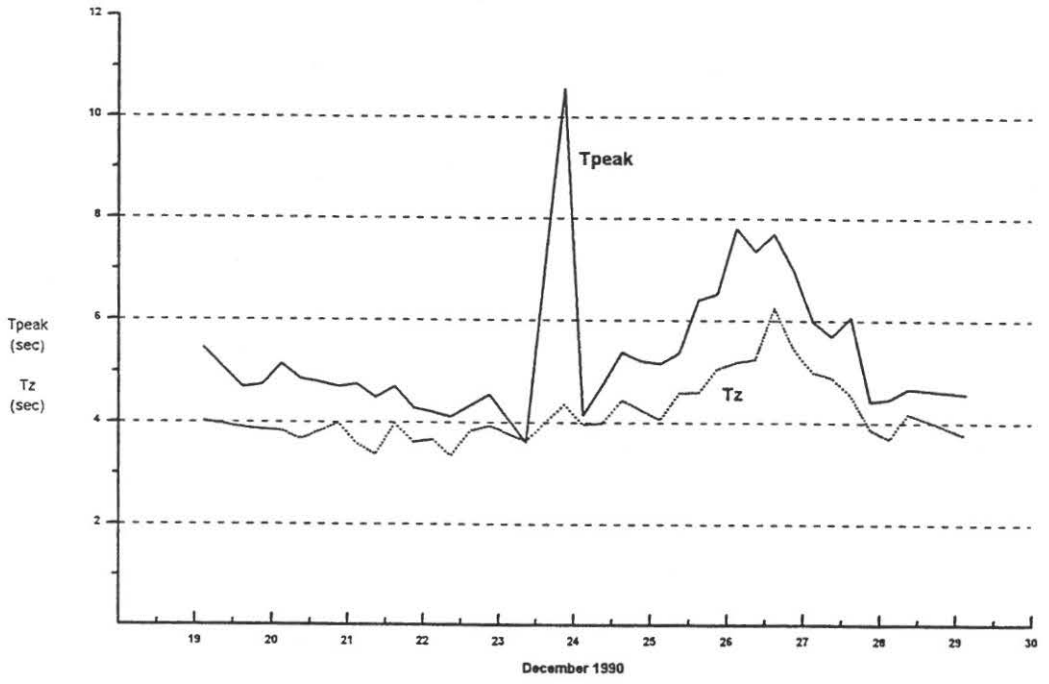
Townsville wave recording station
wave height and period parameters

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

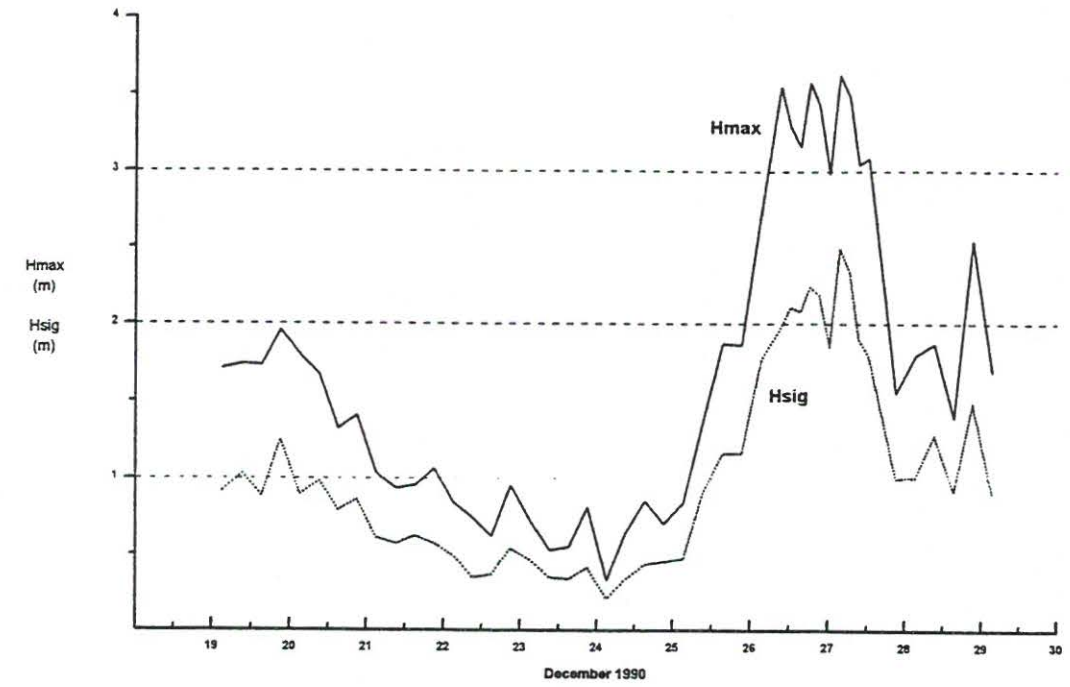
Figure 25

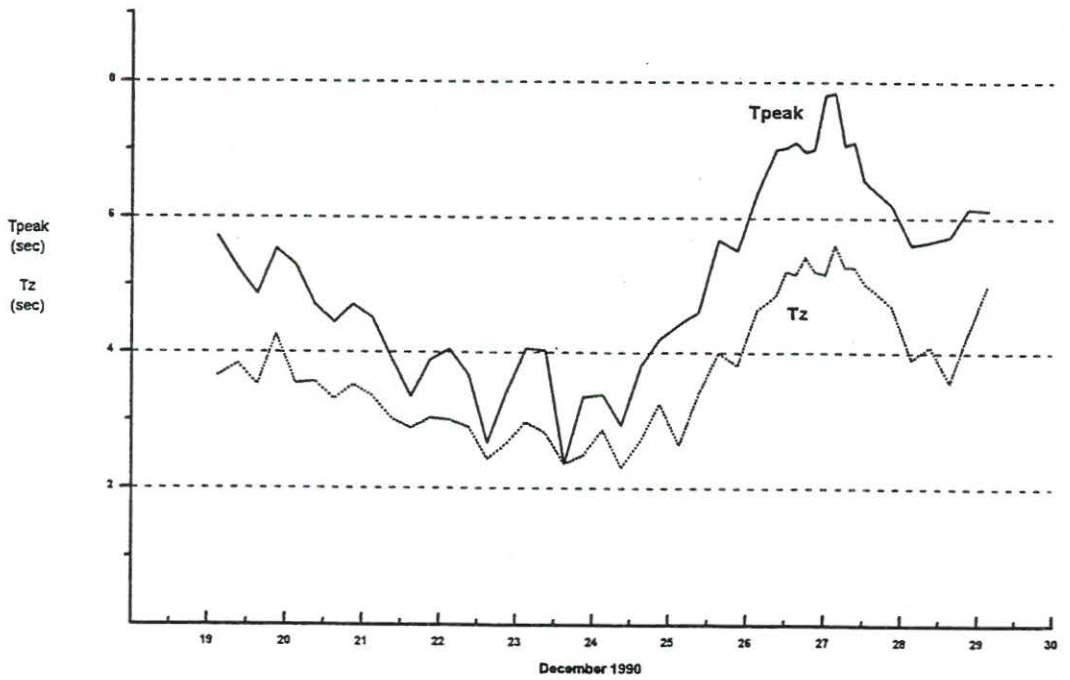




Abbot Point wave recording station wave height and period parameters

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 26



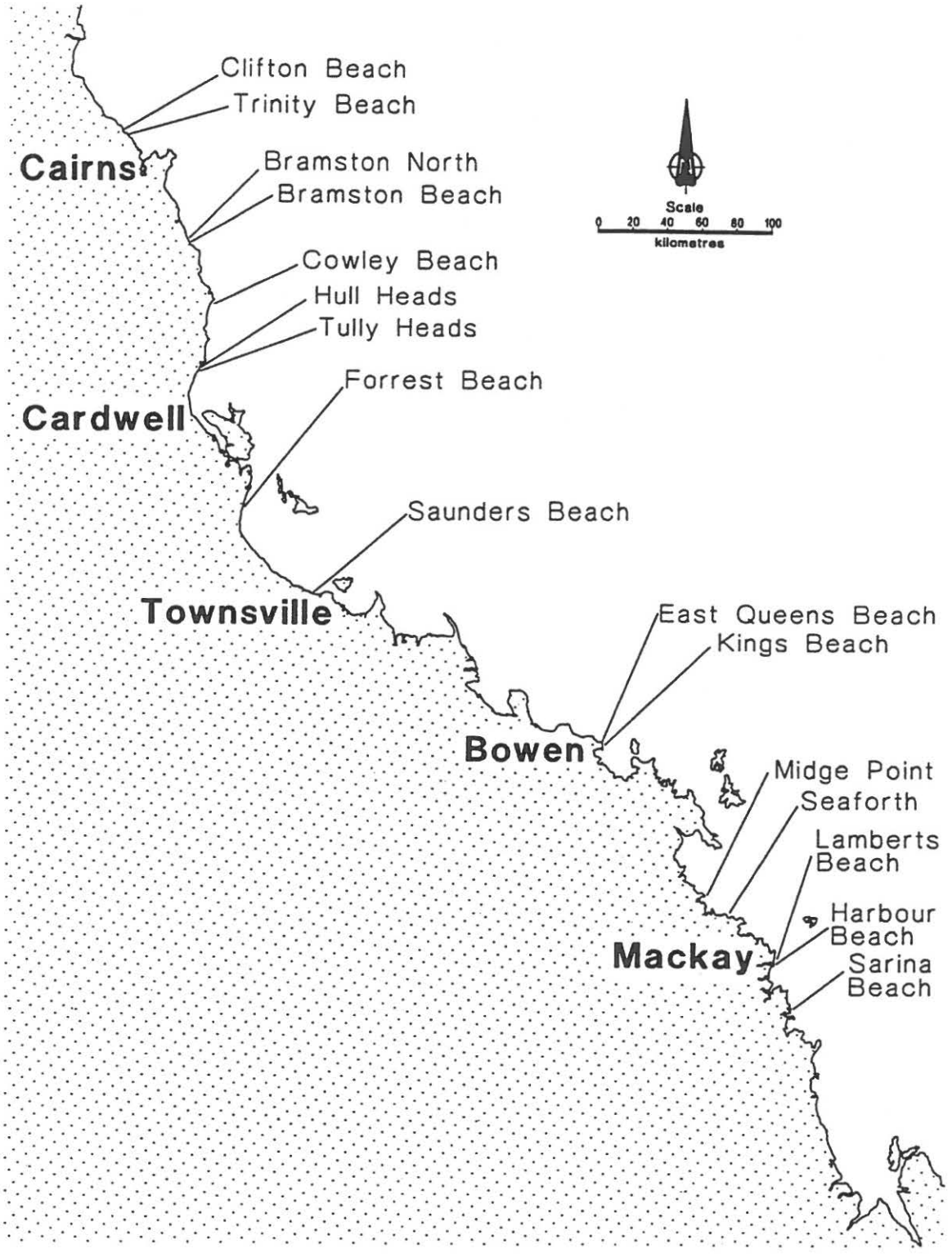


Mackay (Far Beach) wave recording station wave height and period parameters

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

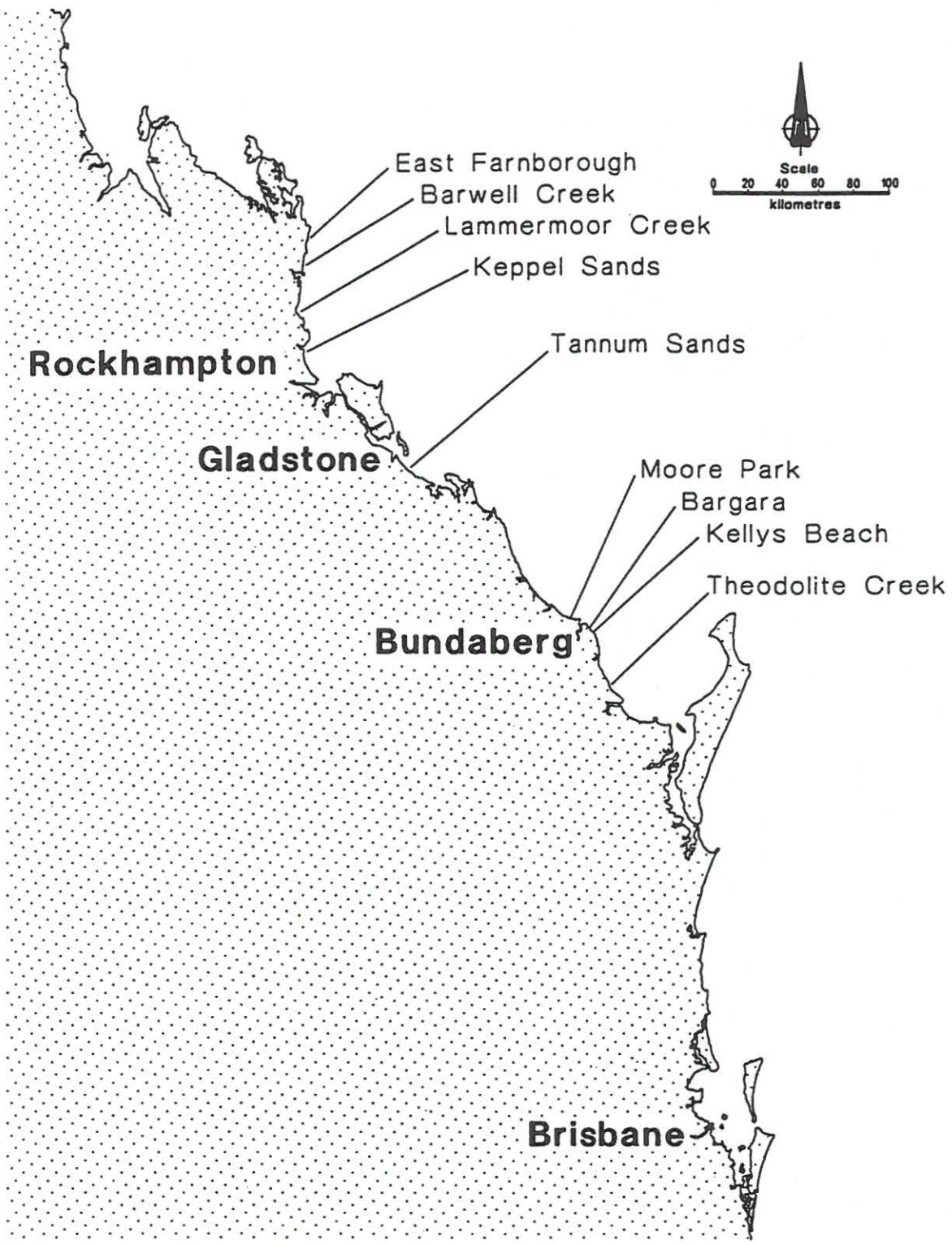
Tropical Cyclone Joy

Figure 27



Location of COPE stations

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 28



Location of COPE stations

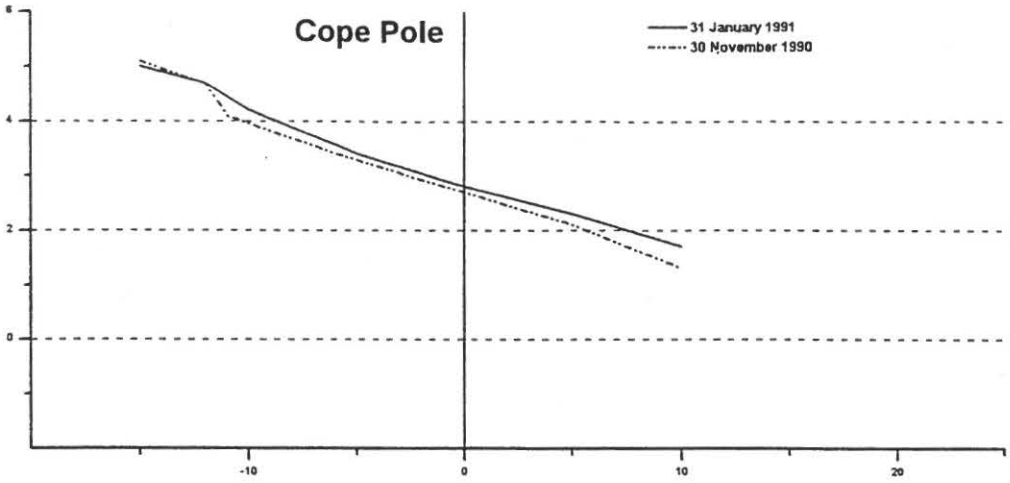
Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 29

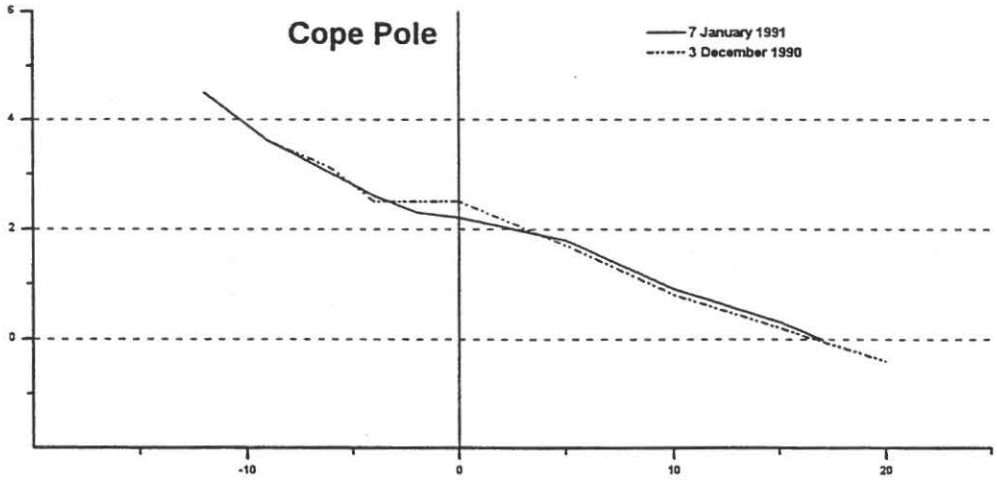
Clifton Beach

Level datum is -1.55 AHD



Trinity Beach

Level datum is 0.00 AHD



Distances and levels are measured in metres.
Level datum is AHD

Beach profiles

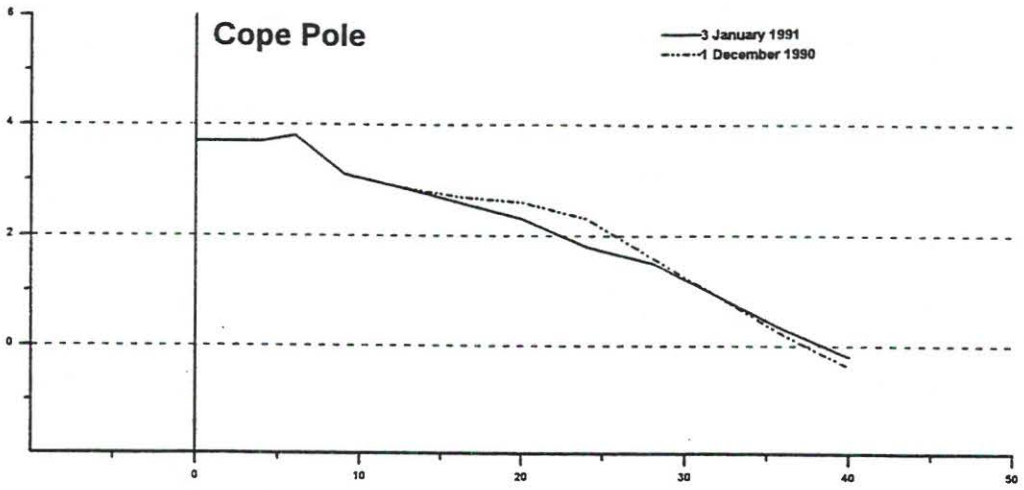
Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 30

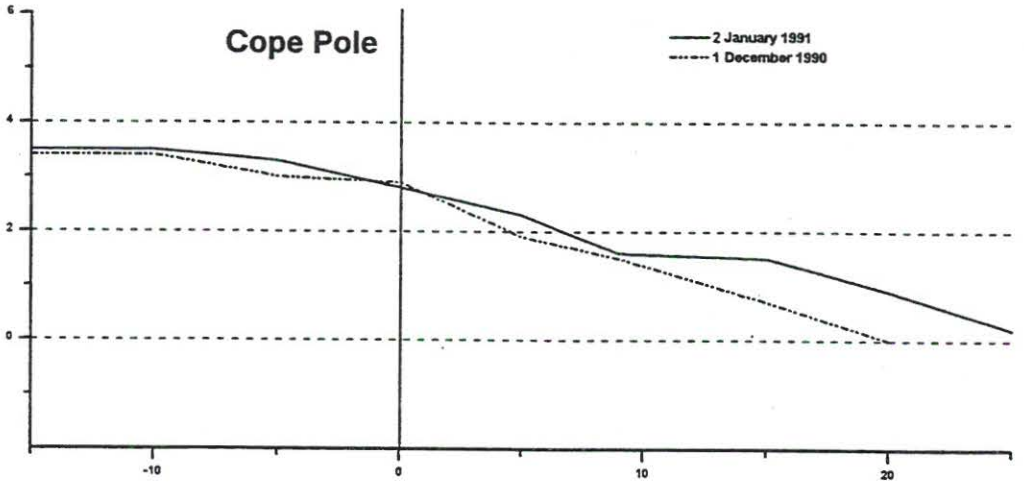
Bramston Beach North

Level datum is -0.005 AHD



Bramston Beach

Level datum is 0.00 AHD



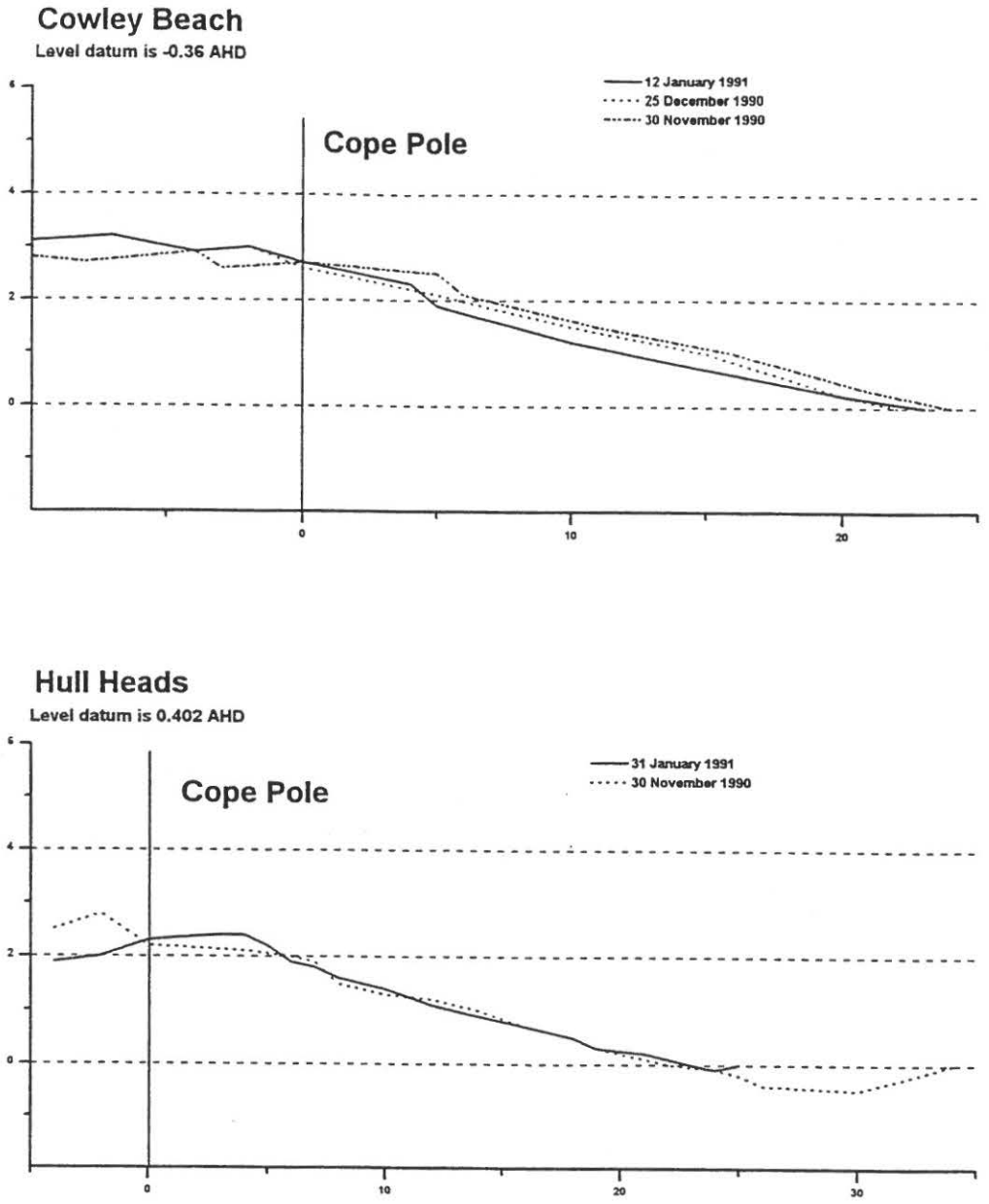
Distances and levels are measured in metres.
Level datum is AHD

Beach profiles

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 31



Distances and levels are measured in metres.
Level datum is AHD

Beach profiles

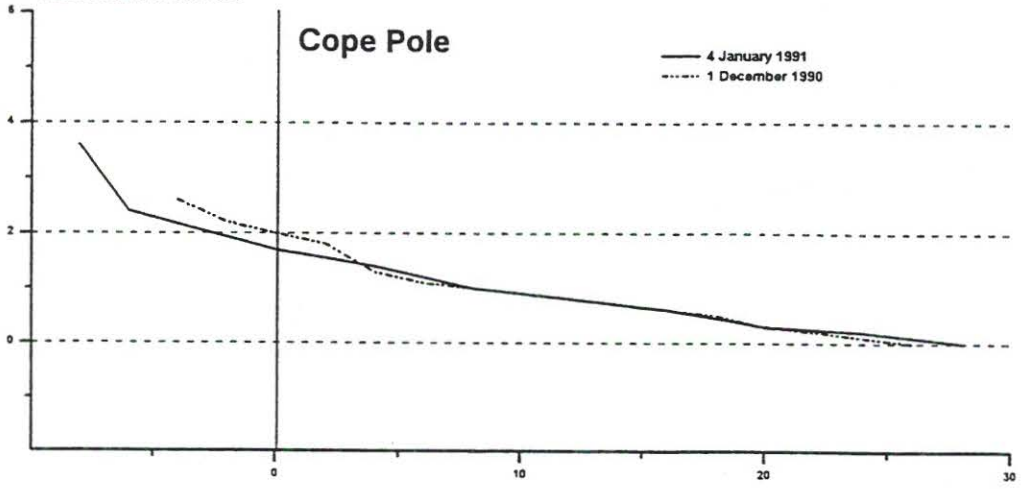
Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 32

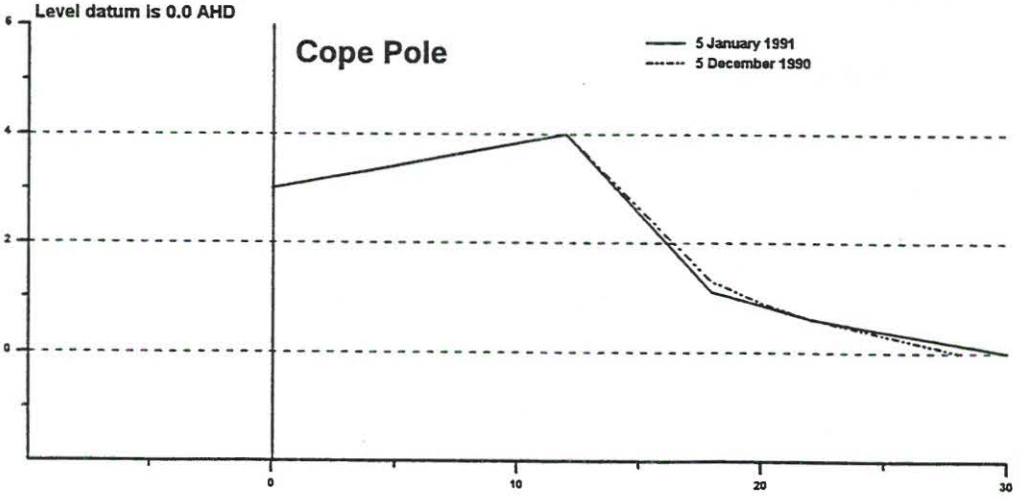
Tully Heads No. 1

Station No. 2703 (North)
Level datum is 0.0 AHD



Tully Heads No. 2

Station No. 2704 (South)
Level datum is 0.0 AHD



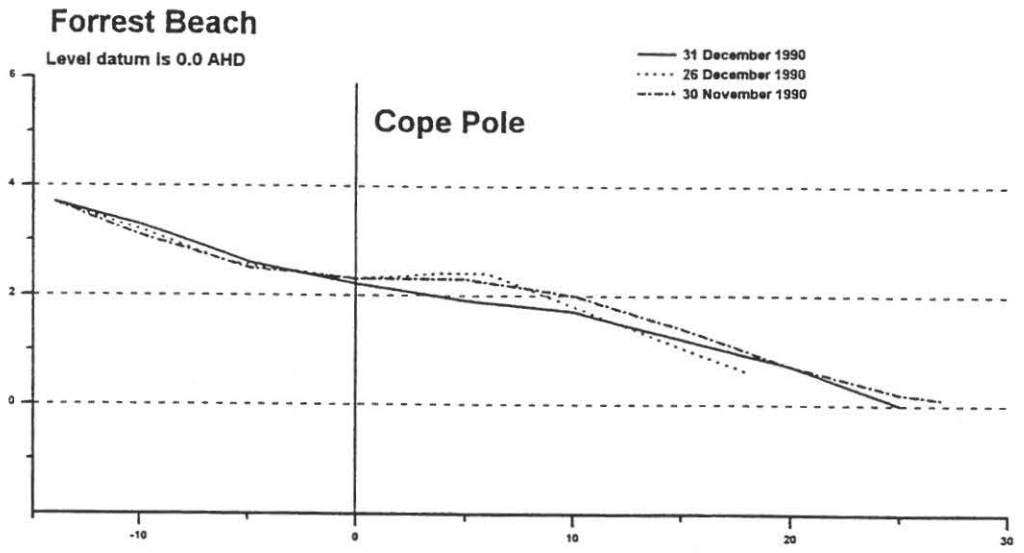
Distances and levels are measured in metres
Level datum is AHD

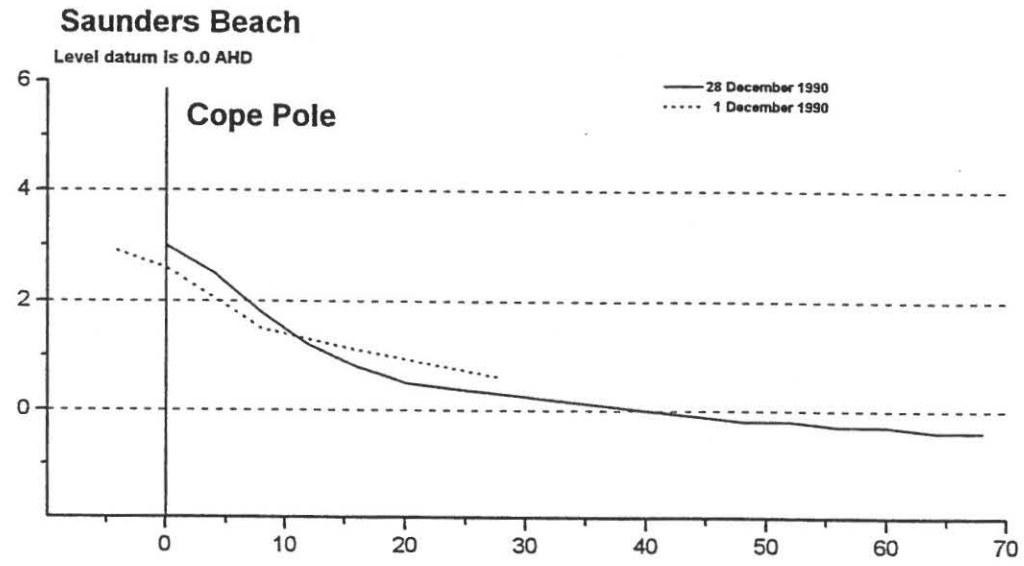
Beach profiles

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 33

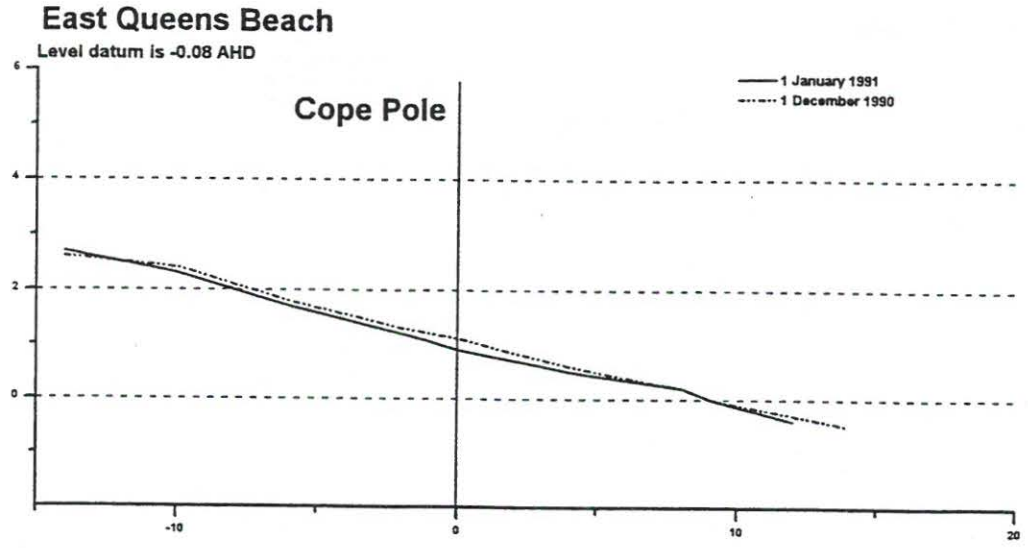


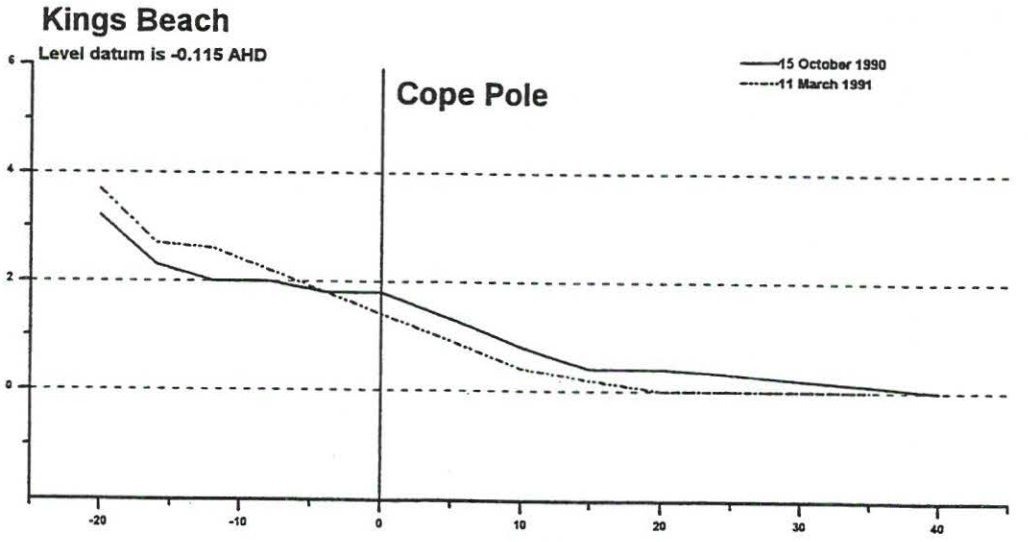


Distances and levels are measured in metres.
Level datum is AHD

Beach profiles

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 34





Distances and levels are measured in metres.
Level datum is AHD

Beach profiles

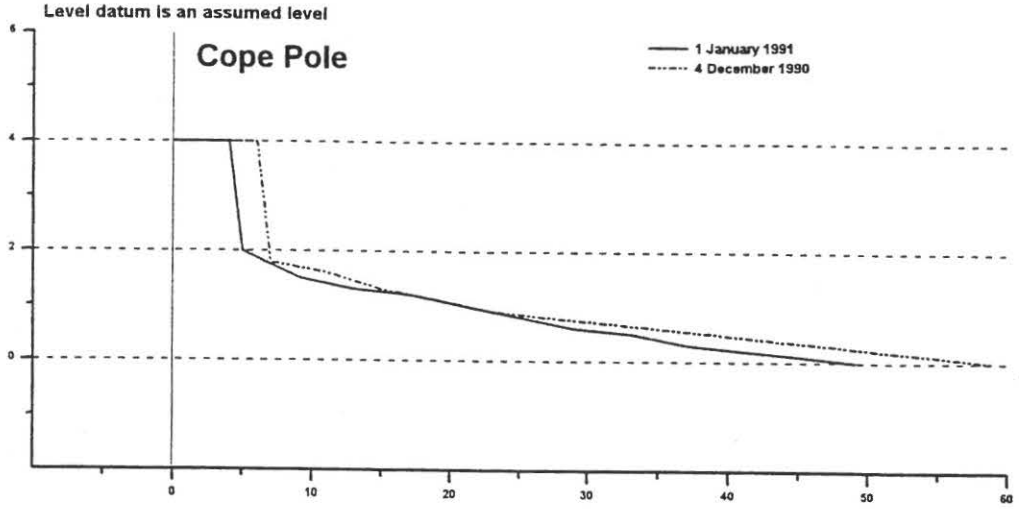
Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 35

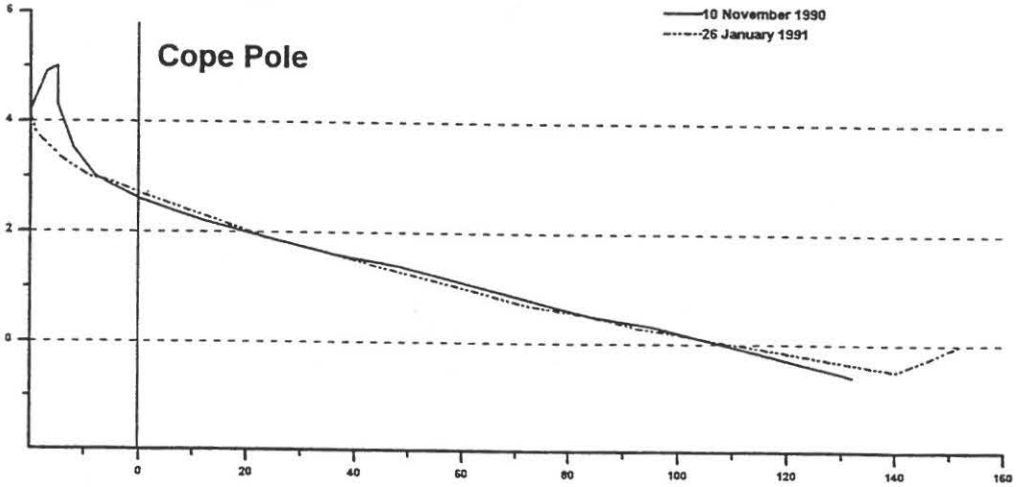
Midge Point

Level datum is an assumed level



Seaforth Beach

Level datum is -0.058 AHD



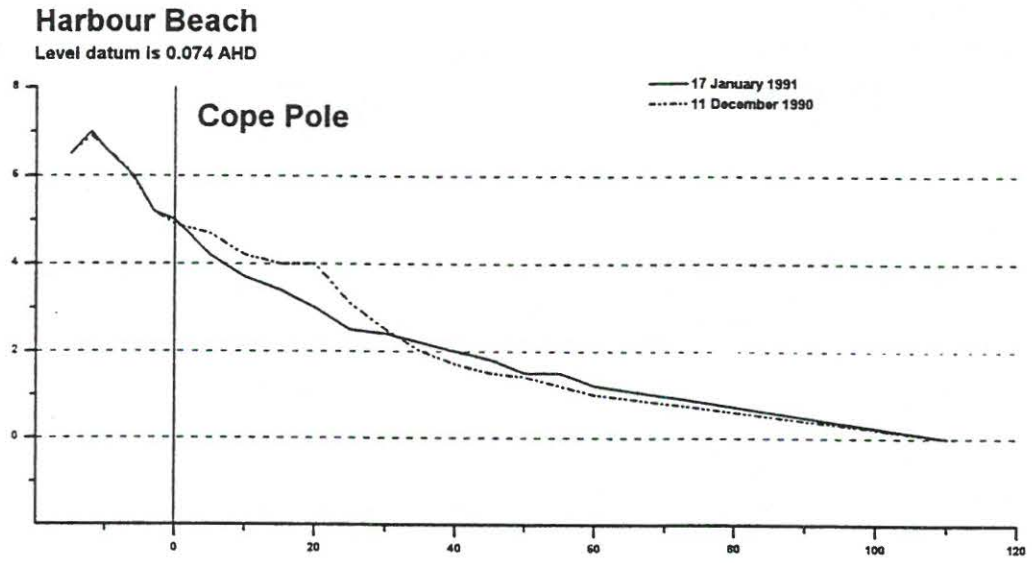
Distances and levels are measured in metres.
Level datum is AHD

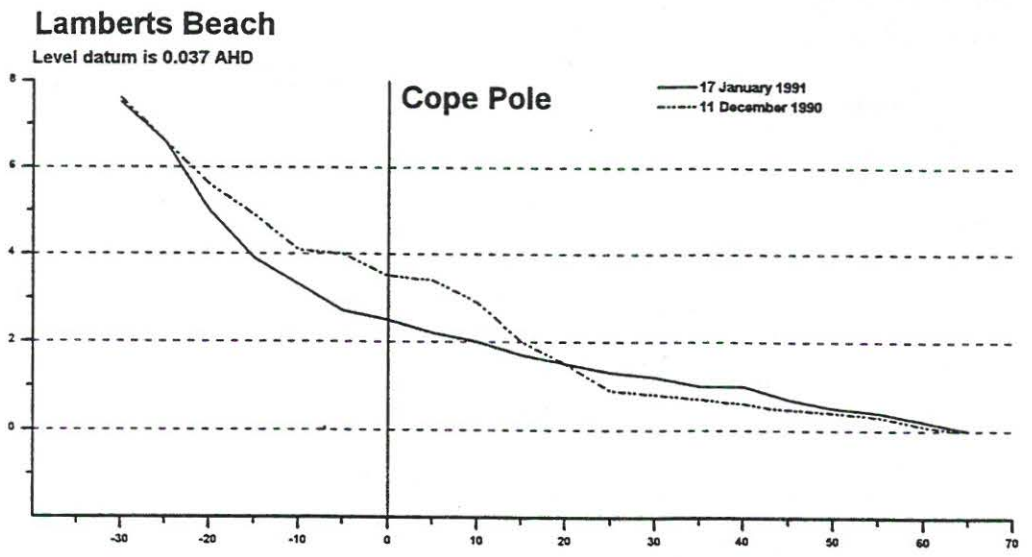
Beach profiles

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 36





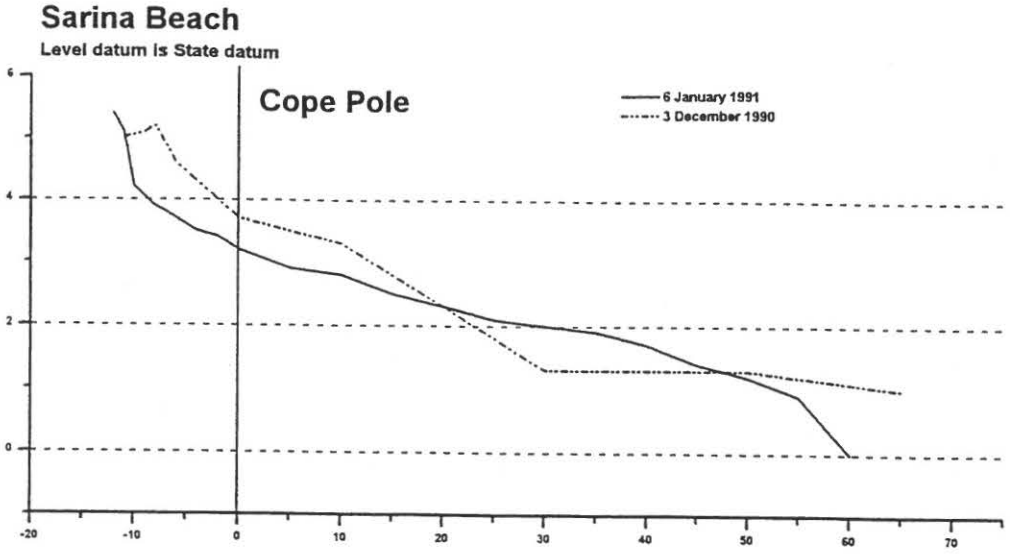
Distances and levels are measured in metres.
Level datum is AHD

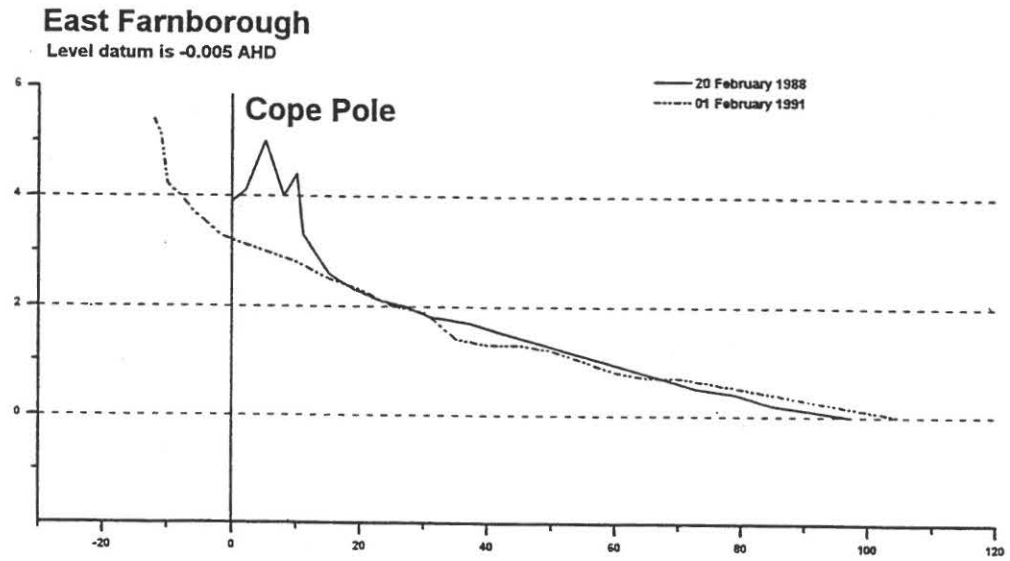
Beach profiles

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 37





Distances and levels are measured in metres.
Level datum is AHD

Beach profiles

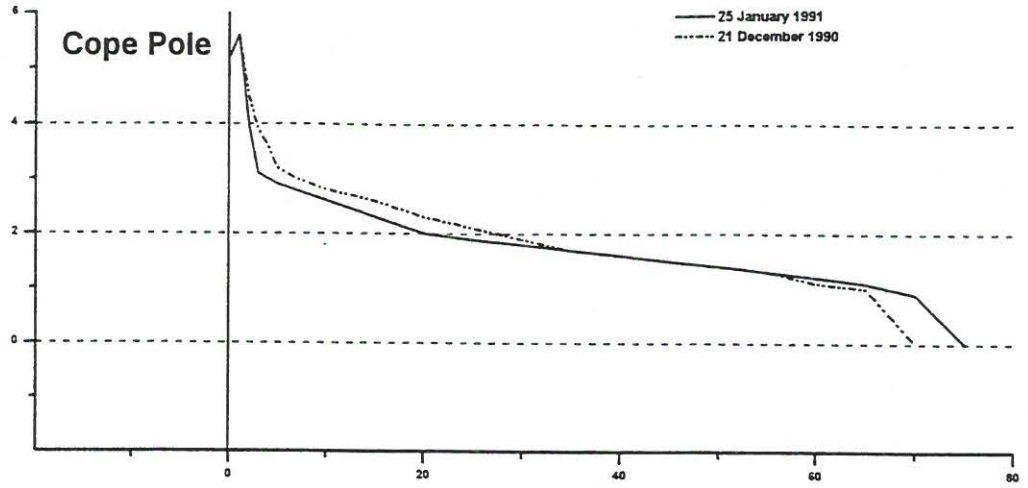
Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 38

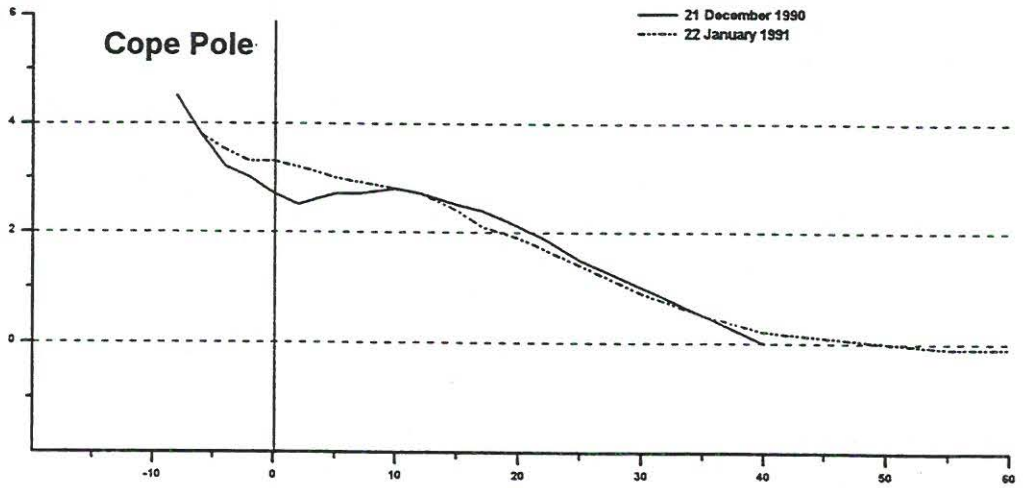
Barwell Creek

Level datum is 0.301 AHD



Lammermoor Beach

Level datum is -0.024 AHD



Distances and levels are measured in metres.
Level datum is AHD

Beach profiles

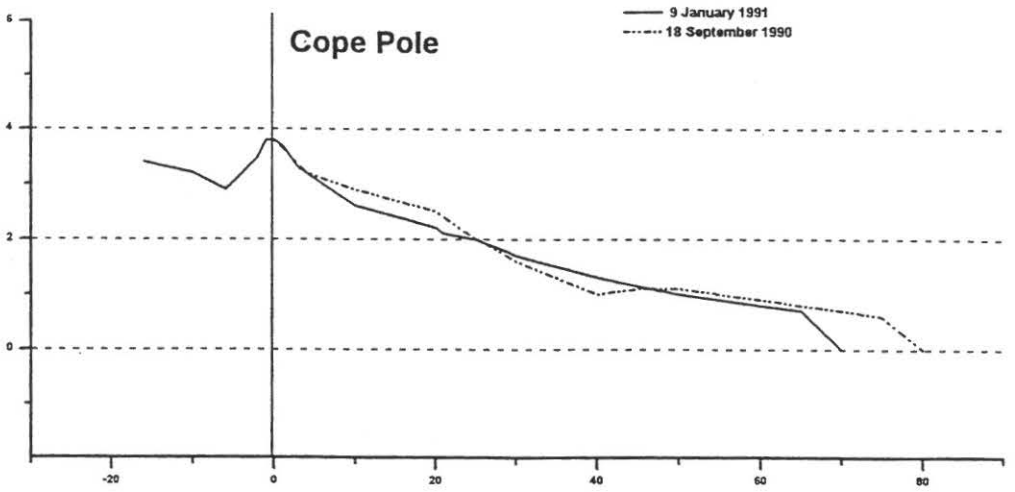
Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 39

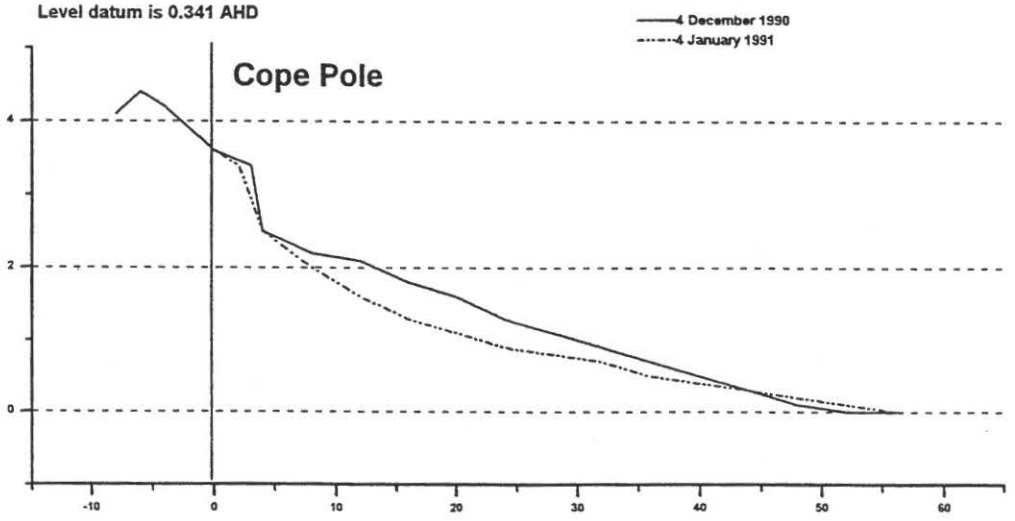
Keppel Sands

Level datum is -0.017 AHD



Tannum Sands

Level datum is 0.341 AHD



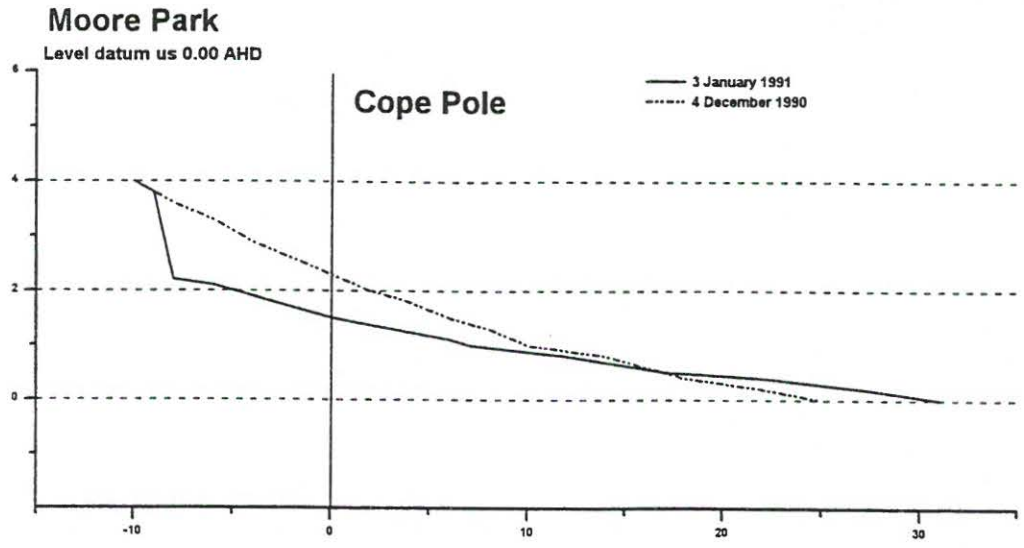
Distances and levels are measured in metres.
Level datum is AHD

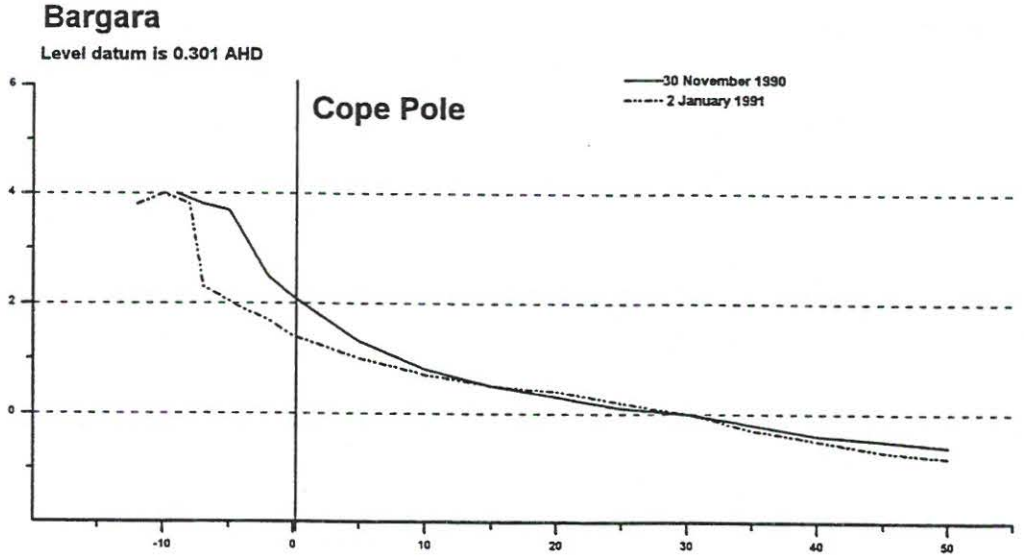
Beach profiles

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 40





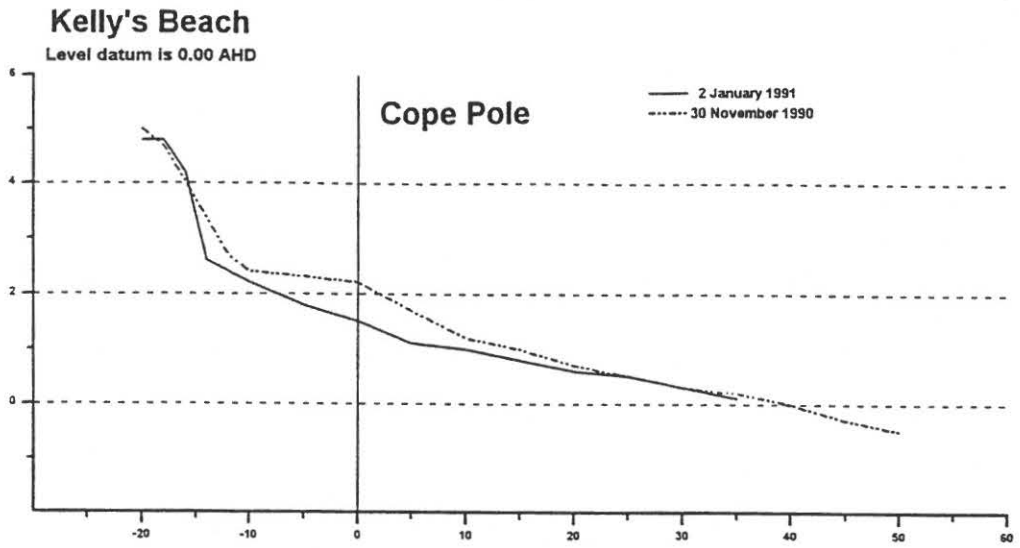
Distances and levels are measured in metres.
Level datum is AHD

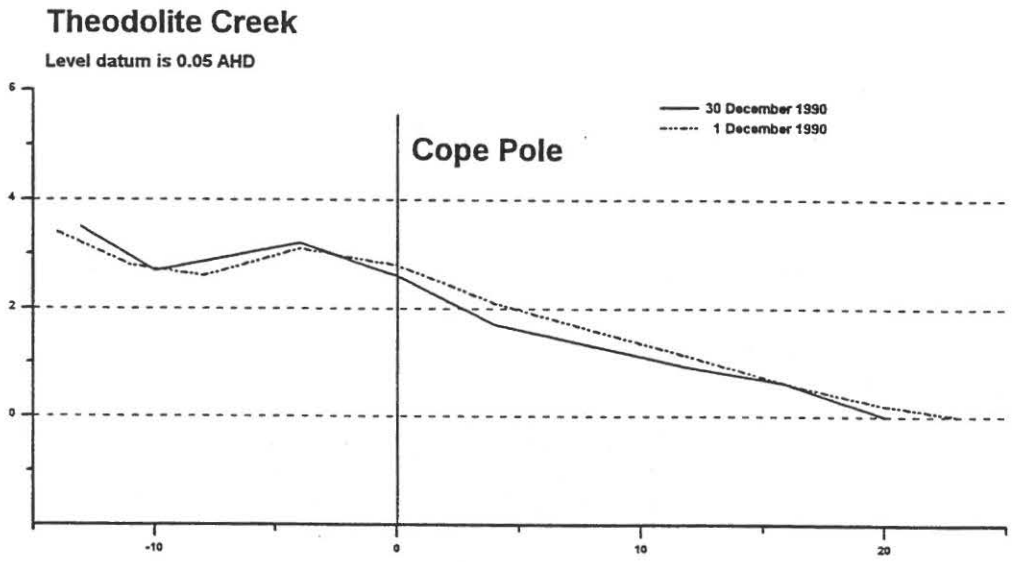
Beach profiles

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 41





Distances and levels are measured in metres.
Level datum is AHD

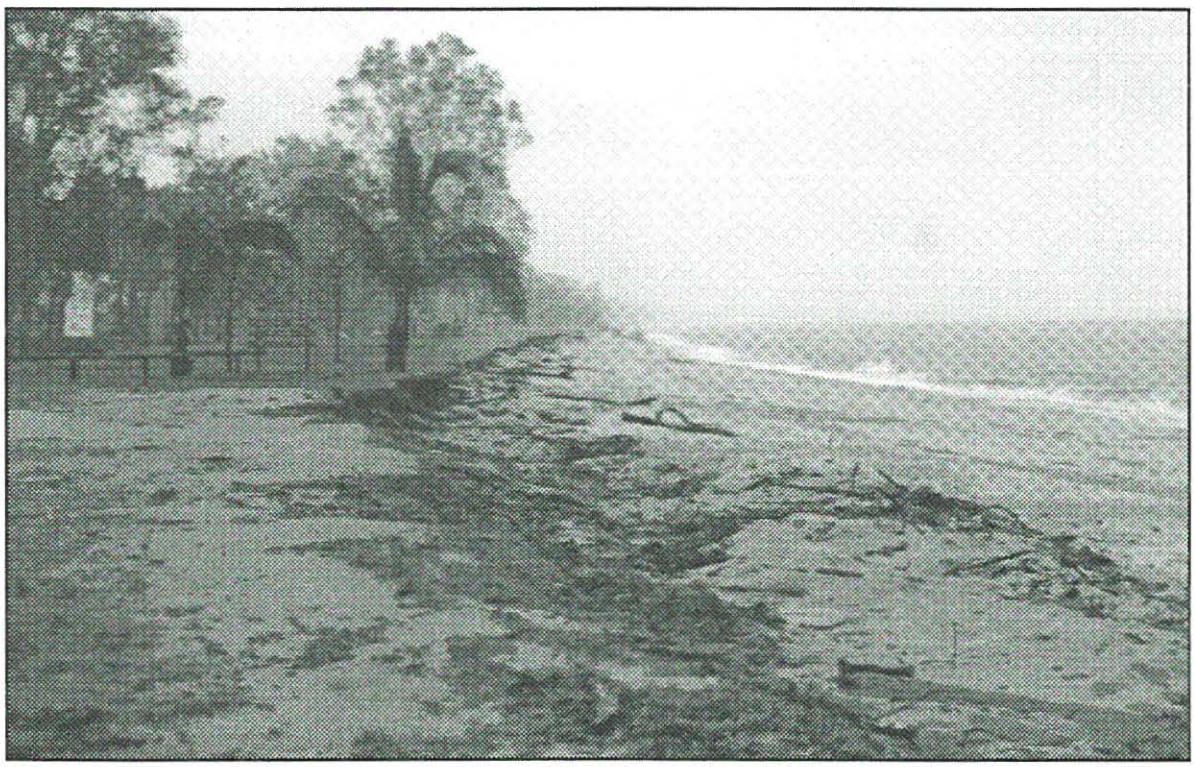
Beach profiles

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 42

Trinity Beach (northern end).
Erosion along this section of beach was caused by wave action and water run-off.



Bramston Beach.
Slight erosion occurred to the north of this grove.

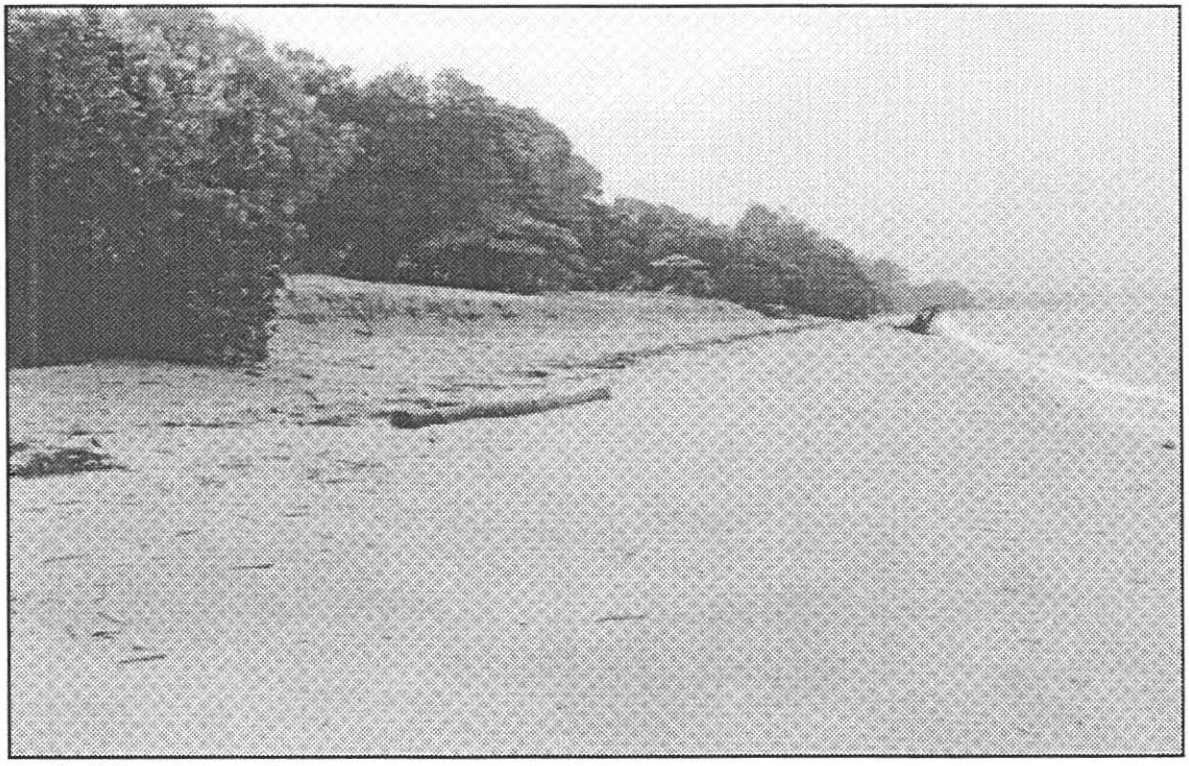
Field inspection photographs

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 43

Tully Heads.
Minor slumping of the rock wall was evident.



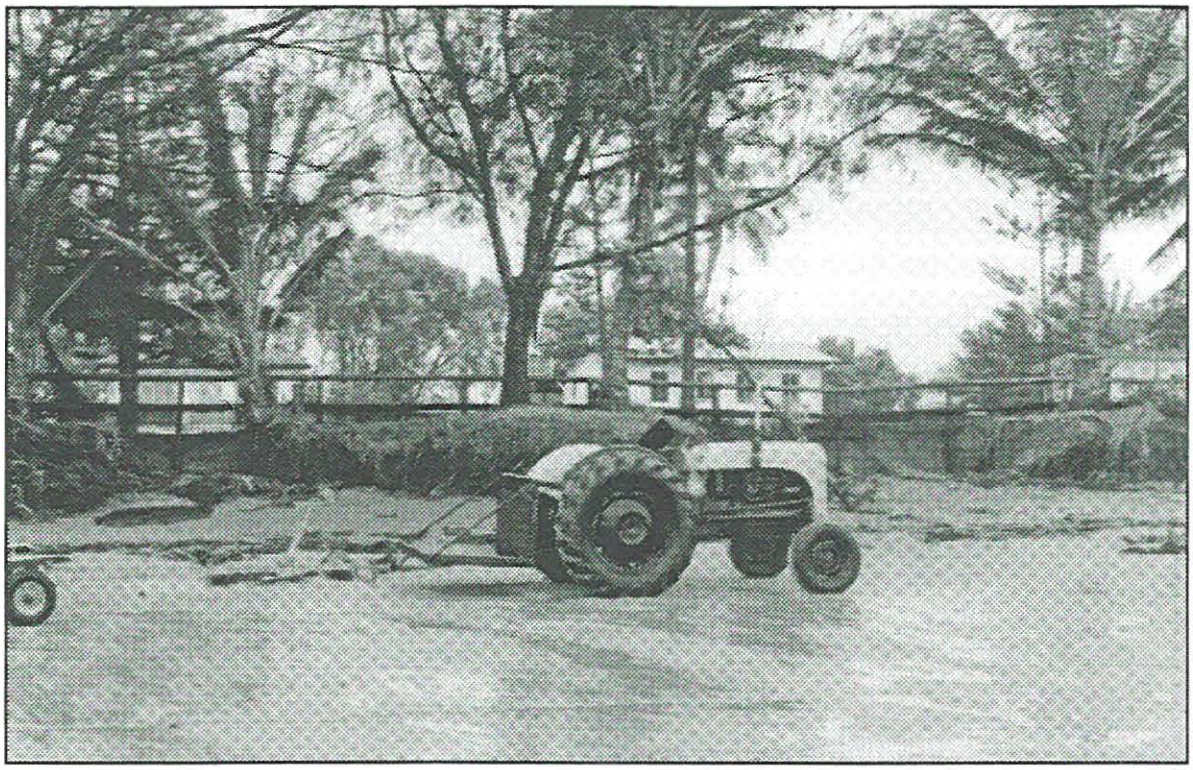
Cardwell Beach.
Area where sand replenishment took place.

Field inspection photographs

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 44



Midge Point.

Ball Bay.

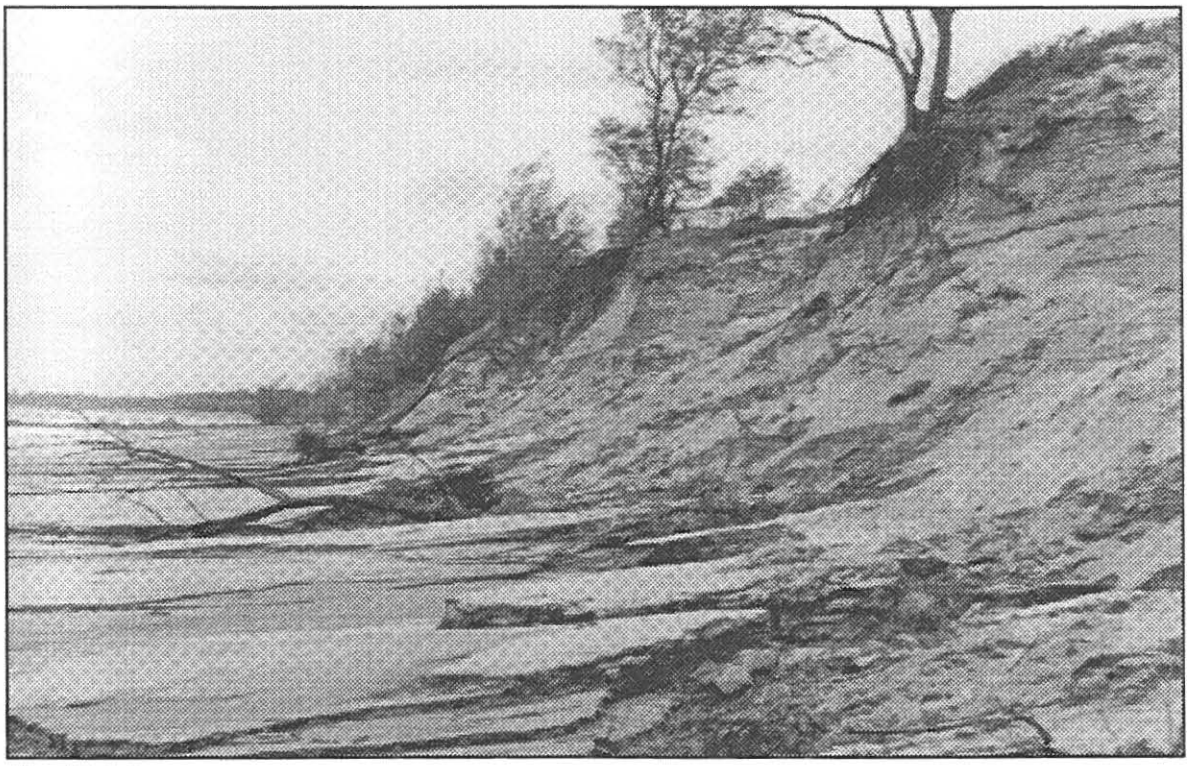
Field inspection photographs

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 45

Bucasia.



Shoal Point.

Field inspection photographs

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 46

Far Beach. Rock wall.

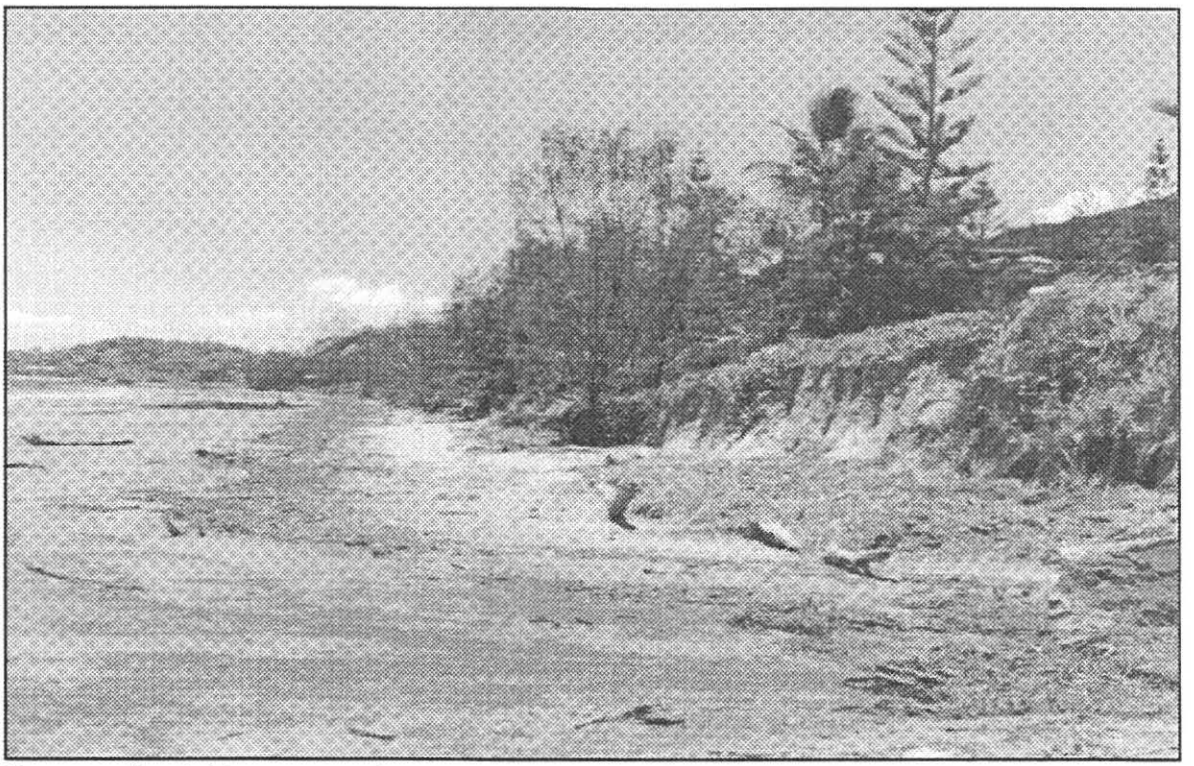
Louisa Creek.

Field inspection photographs

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Tropical Cyclone Joy

Figure 47



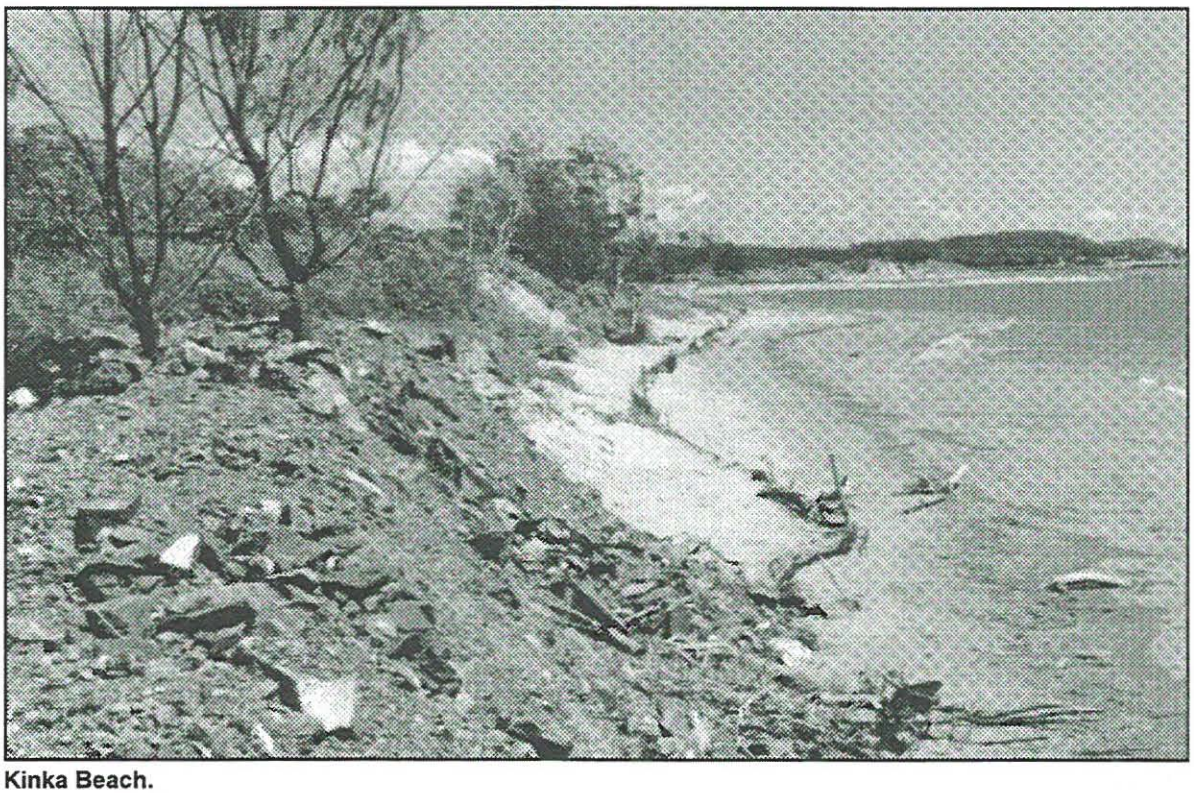
Yeppoon. Beachside caravan park.

Bangalee.

Field inspection photographs

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 48

Kinka Beach.



Kinka Beach.

Field inspection photographs

Beach Protection Authority Queensland Queensland Department of Environment and Heritage	Tropical Cyclone Joy	Figure 49