Tropical Cyclone Larry
Supplementary Coastal Field Investigation
August 2006

N. Cleaves, J. Mohoupt and P.K. Boswood

Queensland Government
Environmental Protection Agency

Coastal Sciences technical report

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1 Introduction

Tropical Cyclone (TC) Larry crossed the coast near Innisfail, North Queensland between the coastal communities of Etty Bay and Mourilyan on Monday 20 March between 6:20 and 7:20am during a neap tide. A 915hPa central pressure was estimated from satellite imagery at the time of crossing with accompanying wind gusts up to 290km/h. TC Larry was a fast moving intense cyclone with a 20km to 30km radius to maximum winds. The Queensland Premier and the Minister for Emergency Services signed a Disaster Declaration (Disaster Management Act, 2003 Section 69 – Subdivision 2) on Sunday afternoon (19 March 2006).

Environmental Protection Agency (EPA) staff carried out an initial inspection of the damage to the coastal region between the 26th and 30th March 2006. This second inspection undertaken between 22nd and 25th August 2006 was required to verify, expand and finalise the survey work undertaken in the initial inspection and to see how the coastal region was recovering five months after TC Larry crossed the coast. Surveys and photographs were used as a record of the inspections. The photographs taken in the second inspection reproduced the initial inspection so a visual comparison of the coastal region could be carried out.

This report supplements Boswood and Mohoupt (2007), summarising the results of the August 2006 field investigation in terms of beach recovery through photography and beach profile surveys. For comparison purposes, beach profiles following TC Winifred are provided where available. TC Winifred was a category 3 cyclone (central pressure of 957hPa) that crossed the coast at low tide just south of Mourilyan Harbour on the 1 February 1986 (BPA, 1986). Though not as intense as TC Larry, TC Winifred was a larger cyclone (40 to 50km radius to maximum winds) which travelled southwards parallel to the coast for a number of days, initially as a low, prior to tracking landwards on 31 Jan 1986.

Details of the surveyed inundation levels are provided in Boswood and Mohoupt (2007).

2 Sequence of Inspection Activities

Staff from Regional and Central Office EPA undertook visual inspections of the affected coastal areas. Staff from both Cardwell Shire Council and Johnstone Shire Council assisted EPA staff with the surveys. A chronology of the inspection activities is summarised below in Table 1. The locality of these beaches is provided in figure 1.

Table 1. *Inspection activities during 23rd to 25th August 2006.*

Date	Time	Location	Remarks
23/8/2006	8:30am	Tully Heads	Inspection carried out at high tide. Water level taken at 9:05am.
23/8/2006	10:20am	South Mission Beach	Inspection carried out on outgoing tide. Water level taken at Beach Profile 9 at 10:52am.
23/8/2006	11:30am	Wongaling Beach	Inspection carried out on outgoing tide. Two water levels taken at 11:49am and 12:11pm.
23/8/2006	1:40pm	Hull Heads	Inspection carried out on outgoing tide. Water level taken at 3:00pm.
24/8/2006	8:30am	Mission Beach	Inspection carried out on incoming tide, just before high tide. Water level taken at 8:59am.
24/8/2006	9:30am	Bingil Bay	Inspection carried out on outgoing tide. Water level taken at 9:42am.
24/8/2006	11:00am	Kurrimine Beach	Inspection carried out on outgoing tide. Two water levels taken at 11:24am and 12:01pm.
24/8/2006	12:45pm	Cowley Beach	Inspection carried out on outgoing tide, about 2 hours prior to low tide. Water level taken at 12:57pm.
25/8/2006	8:20am	Etty Bay	Inspection carried out on incoming tide, about 1 hour before high tide. Water level taken at 8:29am.
25/8/2006	9:00am	Mourilyan Harbour	Inspection carried out on incoming tide, just before high tide. Water level taken at 9:21am.
25/8/2006	9:50am	Flying Fish Point	Inspection carried out on outgoing tide. No water level was taken here.

3 Beach Profiles

Beach profiles were surveyed with the assistance of surveyors from Cardwell and Johnstone Shire Councils. Surveyors from both of these councils were familiar with the area, had a good understanding of what was required and knew where temporary and permanent survey marks were located. Cardwell Shire carried out the surveys with a total station while Johnston Shire used a spirit survey level. Locations of all profiles were surveyed using either permanent survey marks (PSM), land marks or old Coastal Observation Programme Engineering (COPE) pole locations. COPE profile lines were used to provide a comparison with historic data, specifically profiles undertaken pre and post TC Winifred (BPA, 1986).

Details of the location of beach profiles are shown in table 2. Plots of the beach profiles are provided in figures 2 to 11.

Table 2. *Surveyed beach profiles.*

Date	Time	Location	Reference
23/8/2006	8:30am	Tully Heads	COPE Pole – Tully Heads(removed)
23/8/2006	10:20am	South Mission Beach	COPE Pole - Sth Mission Beach(removed)
23/8/2006	11:30am	Wongaling Beach	Property Line – Corner of retaining wall
23/8/2006	1:40pm	Hull Heads	COPE Pole – Hull Heads (found)
24/8/2006	8:30am	Mission Beach	Station number 9 – Cardwell Shire Council
24/8/2006	9:30am	Bingil Bay	PSM 75124
24/8/2006	11:00am	Kurrimine Beach	PSM 22878
24/8/2006	12:45pm	Cowley Beach	PSM 29637
25/8/2006	8:20am	Etty Bay	PSM 86347
25/8/2006	9:50am	Flying Fish Point	PSM 25788

4 Beach Conditions

The beaches in Cardwell Shire were inspected and surveyed on Wednesday 23rd August, stretching from Tully Heads in the south to Wongaling Beach in the north. Thursday 24th and Friday 25th of August, the beaches within the Johnstone Shire were inspected. These stretched from Mission Beach in the south to Flying Fish Point in the north. The following sections detail the findings of the inspections for each beach following the sequence listed in Table 1. Photographs of each beach are also provided in this sequence in Appendix A.

4.1 Tully Heads

Tully Heads is located 55km south of Innisfail and faces southeast. The foreshore of the Bedarra View caravan park has retreated approximately 10m inshore of the foredune vegetation. The erosion of this beach has been an ongoing issue for many years. At the time of the inspection it was high tide. The beach exhibited erosion at the vegetation line, to a height of approximately 0.5m. The beach was still littered with debris, mainly vegetation, and there were some large displaced rocks sited inland from the vegetation line.

4.2 South Mission Beach

The 10km easterly facing stretch of coastline between Clump Point and south to South Mission Beach includes Mission Beach to the north and Wongaling Beach to the south. Offshore are some coral reefs and Dunk Island that shelter the beaches. Wongaling and South Mission beach are within Cardwell Shire, while Mission beach is part of Johnstone Shire.

South Mission beach is positioned about 44km south of Innisfail, facing southeast. The southern end of South Mission beach has been slowly eroding for the past 30 years and has been the subject of a Coastal Erosion Investigation and Management Options study by EPA in 2005. Two profiles were taken; one opposite Jacky Jacky Street, and the other further north, known as beach profile 9.

The site opposite Jacky Jacky Street is close to the location of a toilet block, which has now been removed, where an inundation level was taken in March 2006. The beach at this location was in fairly good condition, with a gentle slope to the water from the base of the rockwall. There appeared to be a new section of rockwall at this location, and the area behind was filled and levelled, with course grain sand. The height of this rockwall is approximately 1m high.

The beach profile at the site known as beach profile 9 contained a small crest and swale approximately half way up the beach from the high water level. Sand has been dumped at the back of the beach around the

base of the trees. The beach slope from the small crest and swale to the water was gentle. There was little erosion visible in the area, though the sand dumped around the trees suggests that there may have been some erosion. See Figure 12 for the location of beach profile 9.

4.3 Wongaling Beach

Wongaling beach is sited 40km south of Innisfail and faces east. The beach exhibits a more concave profile with a steeper upper beach and gently sloping low tide beach. The inspection was at the southern end of Wongaling beach. A small sand bar was evident just offshore from the beach; this can be seen in the photographs in Appendix A. An erosion scarp of approximately 0.5m high still existed at the upper reach of the beach, and debris was still present on the upper beach.

4.4 Hull Heads

Hull Heads is located 50km south of Innisfail and faces southeast. A beach profile was taken from the corner of Luff Street, and the undeveloped Goddard Street, which was close to the location of the COPE surveys. During the survey the original COPE pole was located. The site of the COPE pole showed that this beach had been accreting for many years since as the COPE pole was completely within the foredune vegetation, and completely behind the current beach, as can be seen in the photographs in Appendix A.

The beach has a steeper slope than other beaches in the area, which flattens out in the intertidal zone. An erosion scarp of approximately 0.5m high was evident. A number of small sand shoals were present around the Hull River mouth, and there were also some shallow sand bars offshore from the beach at Hull Heads.

4.5 Mission Beach

Mission beach is positioned 2km south of the Clump Point jetty, and 35 km south of Innisfail. The beach has a gentle slope from the vegetation down to the intertidal zone. An erosion scarp of approximately 0.5m high to 1m high existed at the edge of the vegetation, and was noticeable around the base of the palm trees along the front of the vegetation. The 1m scarp was only evident in a few locations, with a lower scarp between them. A line of debris was still present on the beach, at the base of the palm trees. An inundation line was surveyed on the grounds of the Castaways Resort, approximately 2m seaward of the pool. See Appendix A for a photo showing this location.

4.6 Bingil Bay

Bingil Bay is approximately 33km south of Innisfail, facing east. The beach at low tide consists of moderately steep intertidal crest and trough system, with a slightly steeper narrow upper section that meets the flat foredune. The upper beach showed a number of undulations in the post Cyclone Larry profile, with a definite depression in the middle of the beach. The slope of the beach on either side of the depression was steeper than other beaches in the region. An erosion scarp of approximately 0.5m high was present and was particularly noticeable around the base of the palm trees.

4.7 Kurrimine Beach

Kurrimine beach located about 28km south of Innisfail and was in the vicinity of the maximum onshore winds to the south of the cyclone track. Two areas were inspected and profiles were taken, these being the area to the northern end of Kurrimine near the boat ramp off Bramble Street, and the southern end of Kurrimine from the King Reef caravan park, opposite Riser Street. The King Reefs are located offshore from Kurrimine beach.

The beach on the southern side of the boat ramp was in good condition, with a gentle slope from the vegetation line to mid way down the beach where the gradient increases and then flattens out in the intertidal zone. The erosion on this side of the boat ramp varies from about 0.5m to 1m high around the bases of the palm trees.

The beach on the northern side of the boat ramp, in front of the caravan park, was in a worse condition. The slope of the beach was still gentle, though the level of the beach was much lower, than the beach on the southern side of the boat ramp. A large amount of sand had been dumped in front of the caravan park, along the vegetation line, likely for beach nourishment, though no work had started. Due to the deposition of this sand, it was hard to determine the size of the scarp that is threatening the caravan park, however a 2m scarp was evident just on the northern end of the rock adjacent to the boat ramp.

The profile at the King Reef caravan park was similar to that on the southern side of the boat ramp, at the northern end of Kurrimine Beach. The beach slope was gentle to a flat intertidal zone. Offshore shallow sand bars were evident out from this profile.

4.8 Cowley Beach

Cowley beach is about 19km south of Innisfail and was getting towards the region of maximum winds to the south of the cyclone track. The beach profile survey was conducted approximately at the site of a COPE site. This is at the northern end of Cowley beach. The slope from the vegetation was steeper than other beaches in the region, and then it flattens out at the intertidal zone. Some sand shoals were present around the observed watermark, in the near shore area. The inspection took place about 2 hours prior to low tide.

The area of most interest was at the southern end of Cowley beach, near the boat ramp and caravan park. The beach on the northern side of the boat ramp had a gentle slope from the vegetation line for a distance of 3m to 5m in width. The gradient then increases, for a distance of approximately 10m to 15m in width. The beach then flattens out into the intertidal zone. An erosion scarp of about 0.5m high was evident around the vegetation line, and a large amount of debris was still present at the base of the palm trees.

The southern side of the boat ramp showed a shallow swale formed at the back of the beach, close to the vegetation line. This swale/hollow was about 8m to 10m wide, and about 0.5m in depth. The gradient from the front of this depression to the intertidal zone had approximately 1:8 slope which could be considered quite steep. Again an erosion scarp of about 0.5m existed around the vegetation line, and there still a large amount of debris at the base of the palm trees. Shallow sand shoals were evident in the near shore area.

4.9 Etty Bay

Etty Bay is located just south of Innisfail and in close proximity to where TC Larry crossed the coast. The beach was in a good condition, with a gentle beach slope from the upper beach to the middle of the beach, it then flattens out into the intertidal zone. There was no erosion scarp present. There was a small amount of debris present around the palm tree line at the back of the beach. No sand shoals or bars were observed in the offshore or near shore area; however it was close to high tide at the time of the inspection.

4.10 Mourilyan Harbour

Mourilyan Harbour is sited just south of Innisfail and in close proximity to where TC Larry crossed the coast. Mourilyan Harbour is the site of one of Queensland's storm tide gauges. The site visit discovered that the flagpole outside the new Mourilyan Coast Guard building was bent close to the base. Photographs of this flagpole are shown in Appendix A.

4.11 Flying Fish Point

Flying Fish Point is situated just north of Innisfail and the Johnstone River. Three sites were inspected on this visit, the southern beach opposite the café :-

- Edward Street; - Approx. coordinates 402050E 8064350N
- Beach Access 3, and Approx. coordinates 402000E 8065000N
- along the rockwall at the northern end of Flying Fish Point. Approx. coordinates 402000E 8065350N

The beach opposite the café – Edward Street, was in a good condition. The beach slope was relatively steep, in comparison to other beaches in the area. It appears that some sand may have been placed on the upper beach. No erosion scarp could be seen at the upper reach of the beach to the northern side of the toilet block, though there was still some erosion behind the rockwall that is in front of the toilet block. This erosion was up to 1m high in places, and was in a step formation. The pocket beach to the south of the toilet block had an erosion scarp of approximately 0.5m. An offshore bar was noticed to the northern end of these beaches, at a distance of about 100m out, and was causing the waves to break before the shoreline.

The beach at Beach Access 3 was again in a good condition, with a fairly steep slope from the mid beach to the intertidal zone. The upper beach was relatively flat. An erosion scarp was present and is approximately 0.5m high, and there was debris present at this location, and further down the beach as well. A shallow swale was evident to the south, just in front of the vegetation line. The offshore sand bars and near shore shoals were again present.

The rockwall at the northern end of Flying Fish Point was in good condition. There was erosion behind the rock, though this was not as significant as the erosion behind the wall at the toilet block to the south. The erosion behind the wall is about 0.2m to 0.3m in depth, and is a narrow strip of erosion. The beach here was in a good condition, with a gentle slope into the intertidal zone. No sand bars or shoals were evident at this location.

5 Conclusions

The beaches that were affected by TC Larry have faired considerably well during the storm event and in the recent months after TC Larry crossed the coast. The beaches in general had no significant erosion problems, though Tully Heads receded some 10m. The erosion scarps evident on all the beaches was between 0.5m – 1m in height, and generally these were located at the vegetation line. It appears as though the vegetation helped decrease the amount of erosion. The beaches are recovering well and returning to their normal profiles, most probably due to the nourishment from the large amount of sand that was located in the intertidal zone off most of the beaches surveyed.

6 Acknowledgements

The authors wish to acknowledge the following organisations and their staff who provided time and resources to collect the data presented in this report:

- The Australian Bureau of Meteorology for resources provided to this investigation.
- Cardwell Shire Council for providing survey assistance.
- Johnstone Shire Council for providing survey assistance.
- Queensland Department of Emergency Services for resources provided to this investigation.

7 References

Beach Protection Authority (BPA). (1986) Report on Cyclone “Winifred”, Data Report.

Boswood, P.K. and Mohoupt, J. (2007) *Tropical Cyclone Larry: Post Cyclone Coastal Field Investigation,* Coastal Sciences technical report, Environmental Protection Agency.

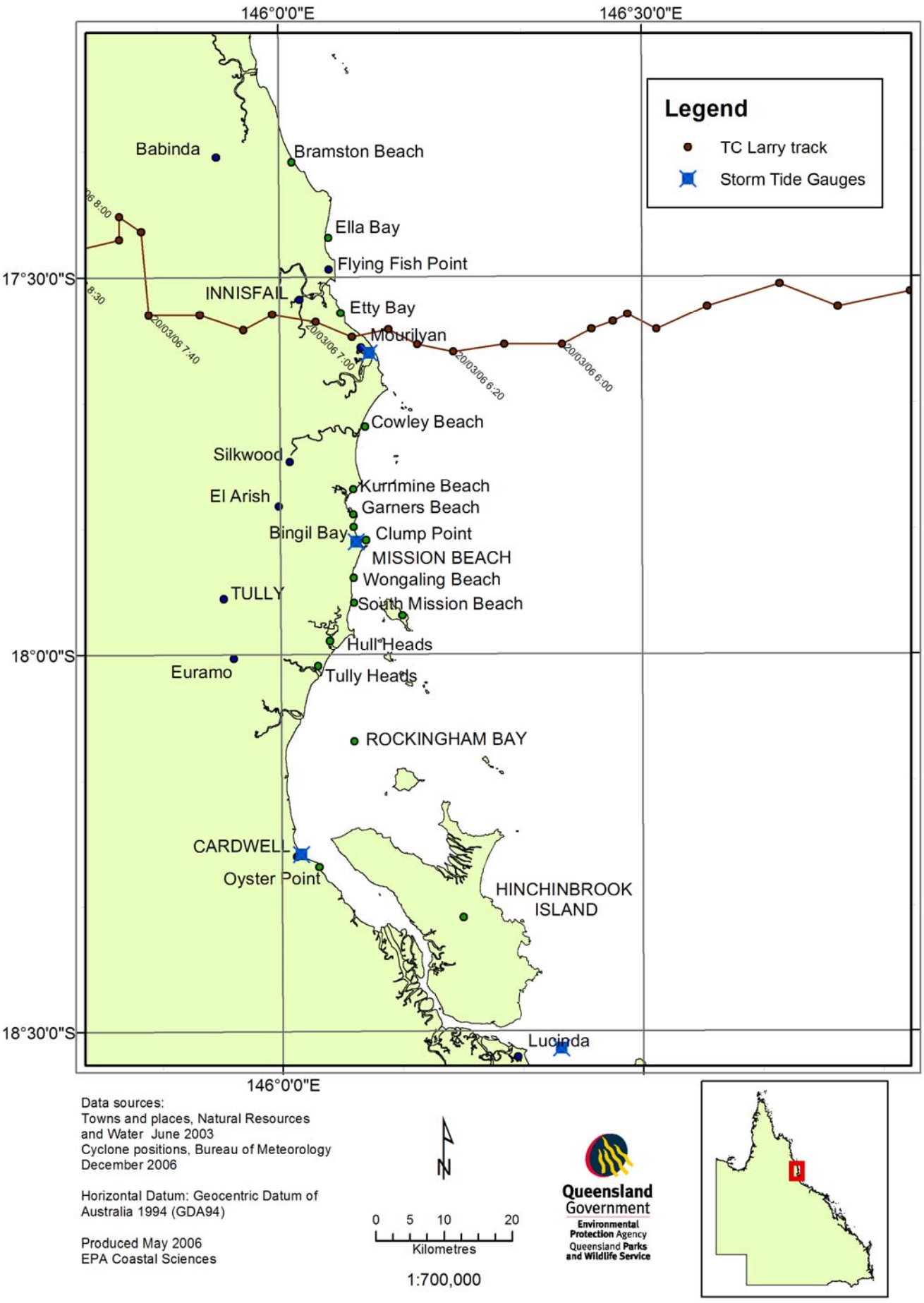

Figure 1. *Locality of post tropical cyclone Larry field inspection*

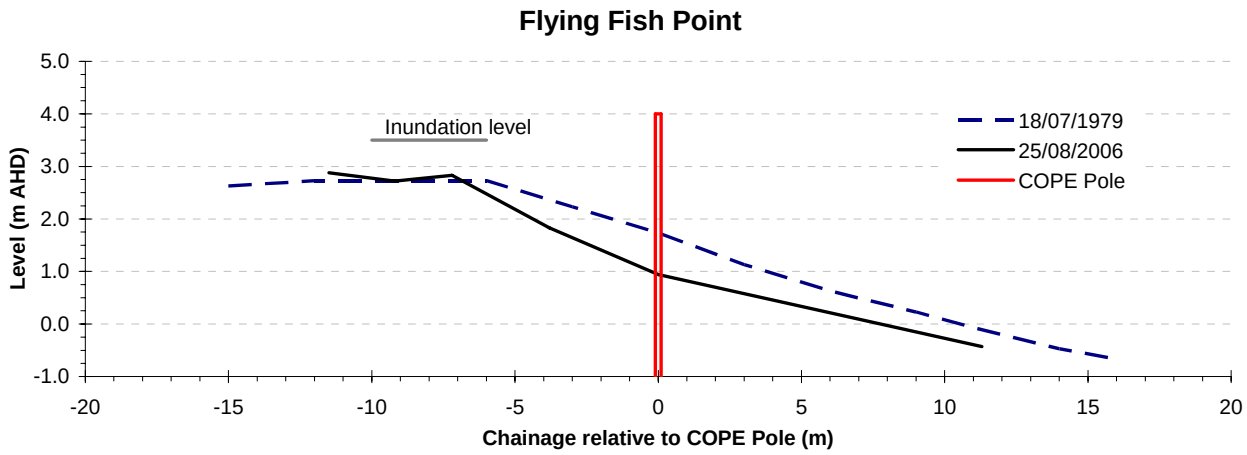

Figure 2. *Beach Profile at Flying Fish Point COPE location.*

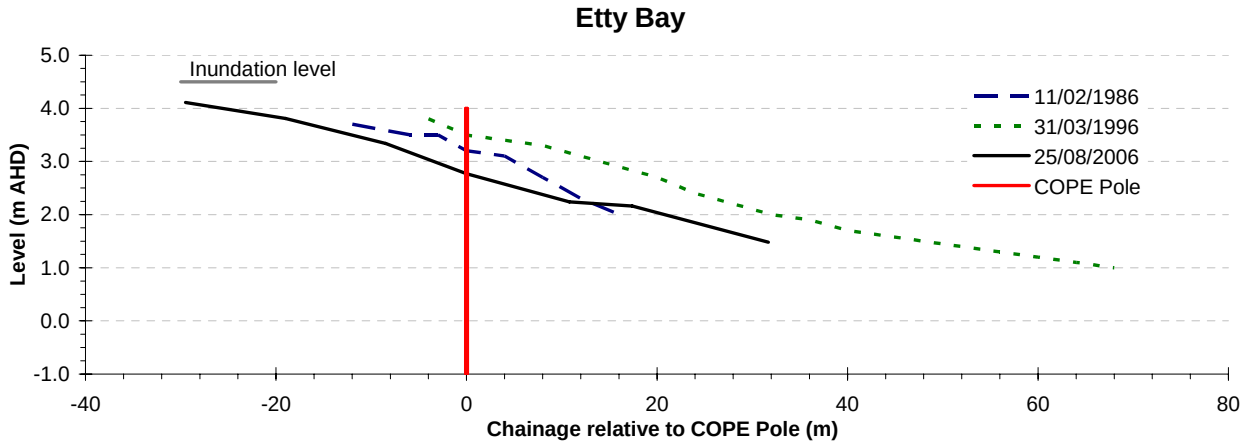

Figure 3. *Beach Profile at Etty Bay COPE location.*

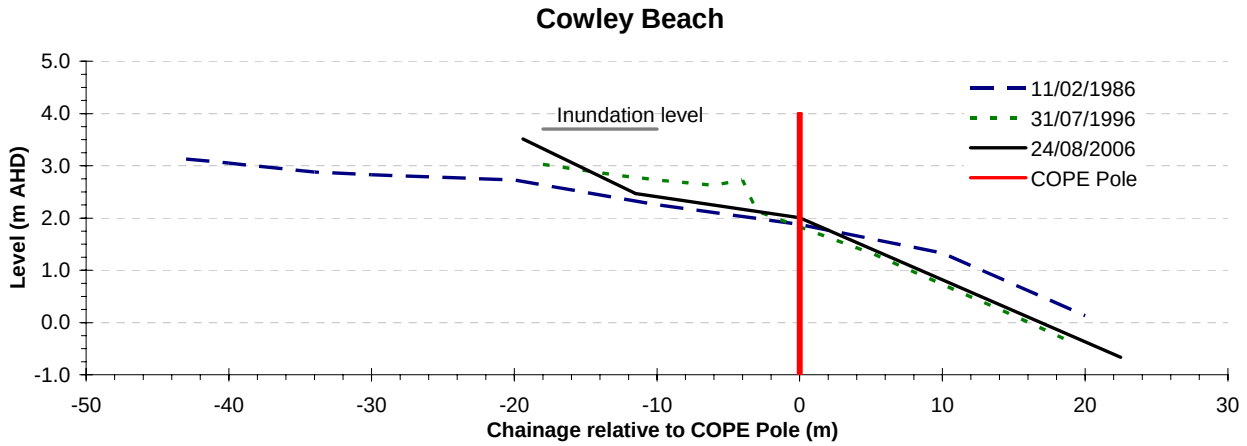

Figure 4. *Beach Profile at Cowley beach COPE location.*

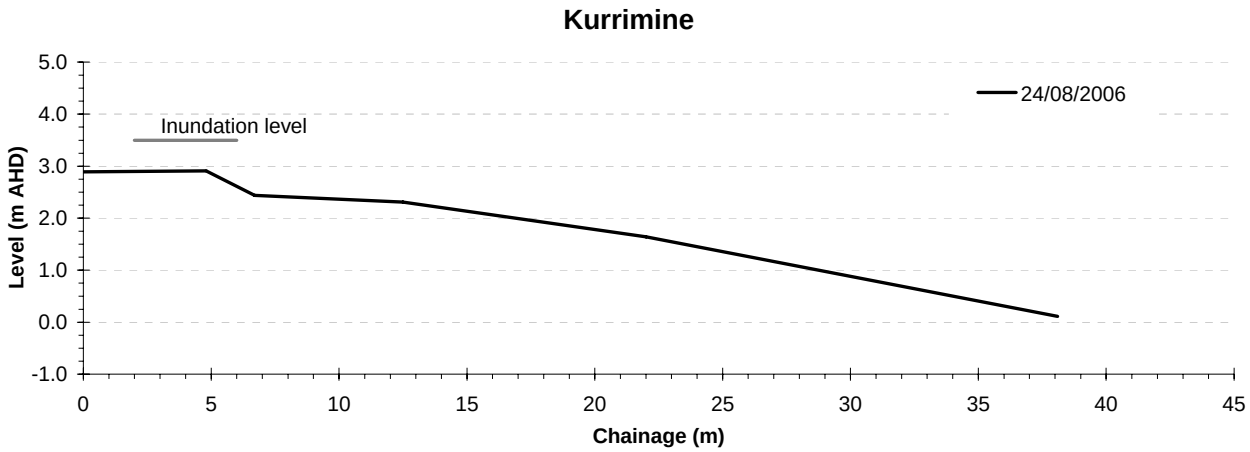

Figure 5. *Beach Profile at Kurrimine beach.*

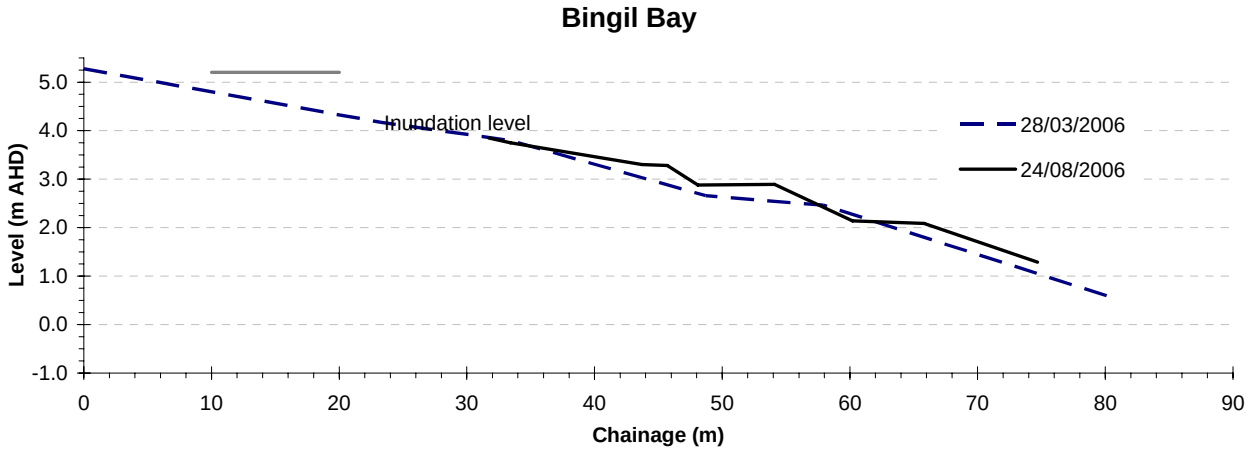

Figure 6. *Beach Profile at Bingil Bay.*

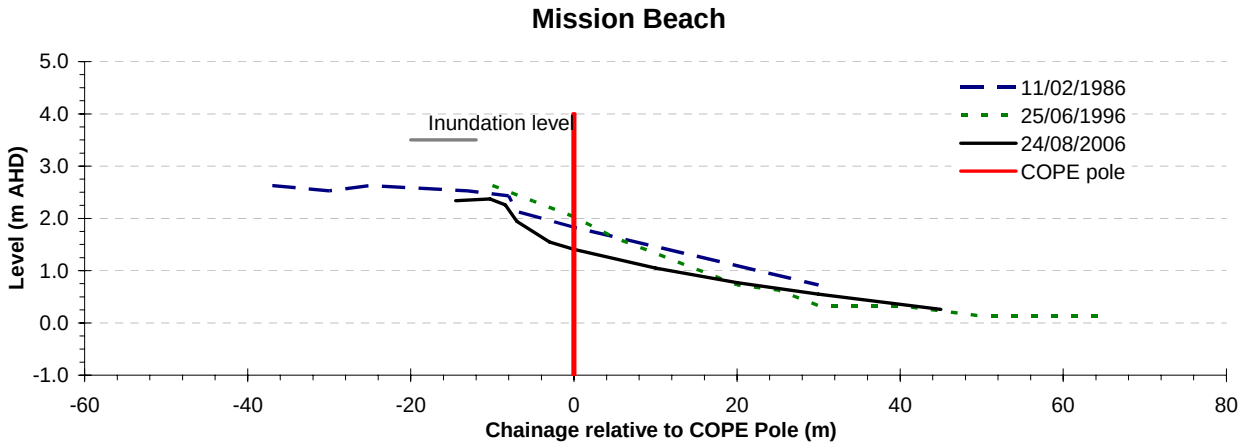

Figure 7. *Beach Profile at Mission Beach COPE location.*

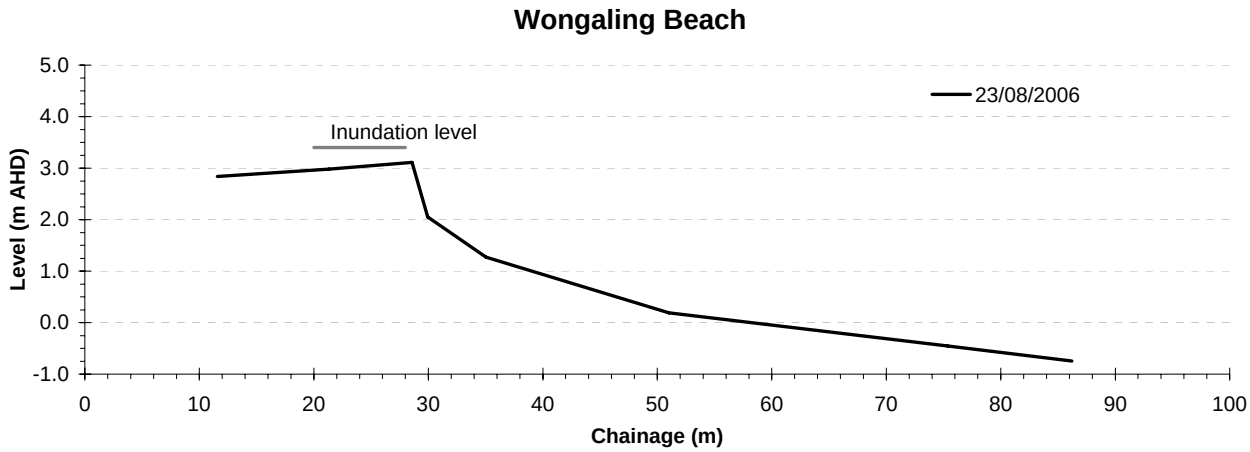

Figure 8. *Beach Profile at Wongaling Beach.*

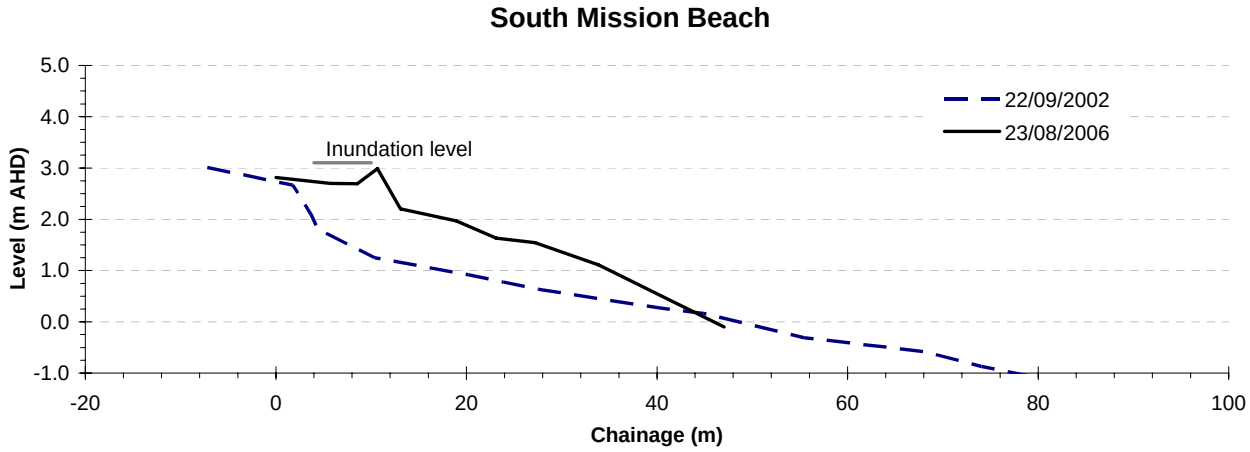

Figure 9. *Beach Profile at South Mission Beach.*

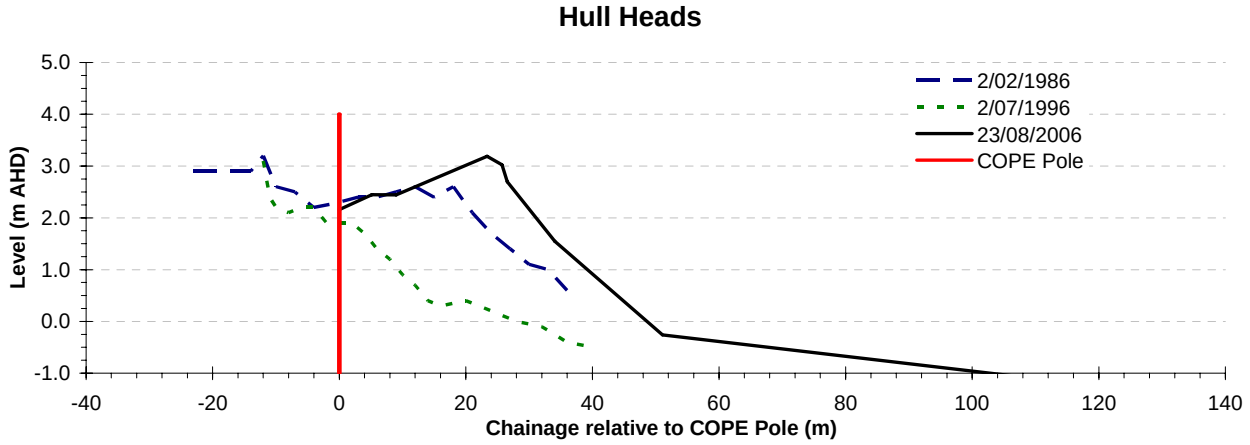

Figure 10. *Beach Profile at Hull Heads COPE location.*

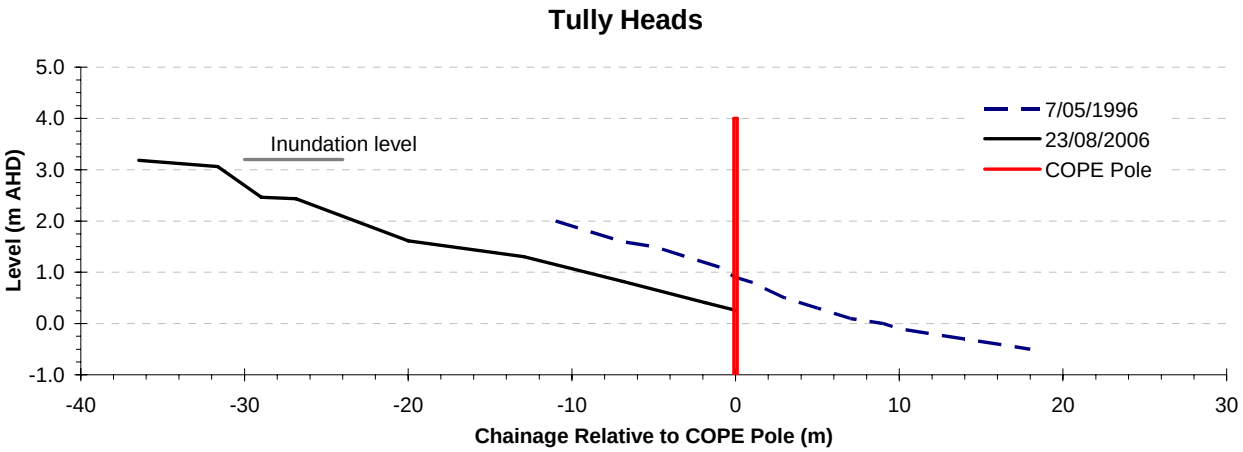

Figure 11. *Beach Profile at Tully Heads COPE location.*

Figure 12. *Location of Beach Profiles for South Mission Beach.*

Appendix A

Photography captured during field investigation

23 to 25 August 2006

Tully Heads

Looking south from the boat ramp

Looking north from the boat ramp

South Mission Beach

Looking south from the intersection of Kennedy Esplanade and Jacky Jacky Street. Graded area on the right side middle of the photo, is the probable location of a removed toilet block.

Rockwall constructed along Kennedy Esplanade opposite Jacky Jacky Street. The area behind this rockwall has be filled and graded.

South Mission Beach – Beach Profile 9

Beach profile 9 along Kennedy Esplanade

Beach profile 9 along Kennedy Esplanade

Wongaling Beach

Looking south from the park at the southern end of Wongaling Beach

The erosion scarp present at Wongaling Beach – southern end

Hull Heads

Looking south from in front of 48 Luff Street (corner of Luff Street and the unformed Goddard Street)

Looking north from in front of 48 Luff Street, to location of survey and position of COPE pole

The COPE pole located in front of 44-46 Luff Street

Mission Beach

Looking at the debris and erosion in front of Castaways

Replicate of photo taken in the March report of Castaways

Location of inundation line in front of the pool at Castaways (when men are standing)

Approximate location of COPE pole, just north of Central Avenue

Bingil Bay

Looking south from opposite toilet block

Looking south at the main road to Mission Beach

Looking north and the erosion and debris

Signpost damaged from the winds, on the northern side of Bingil Bay on the road back to the Bruce Highway

Kurrimine Beach

Looking south from the boat ramp

Sand dumped along the vegetation line in front of the caravan park

Looking south at the boat ramp, the beach is lower on this the northern side, than it is on the southern side of the boat ramp

Caravan that survived the cyclone, while one next to it was completely destroyed

Cowley Beach

Looking at the caravan park on the southern side of the boat ramp

Looking north from the boat ramp

The approximate location of the COPE pole, at the northern end of Cowley Beach

Looking down Bambrook Avenue, the house of the right had water in the back yard and the pump box as shown in the next photo

Water line in pump box in back yard, opposite the caravan park on Bambrook Avenue

Etty Bay

Looking south, from in front of the stinger net winch

Looking north, from in front of the stinger net winch

Looking back at kiosk and caravan park

Mourilyan Harbour

Coast Guard building at Mourilyan Harbour, the flagpole has been structurally damaged by the cyclone, notice the tree in the foreground has also been damaged and is at a similar angle to the flagpole

A close up on the flagpole outside the Coast Guard building at Mourilyan Harbour

Close up of the flagpole, outside the Coast Guard building at Mourilyan Harbour

Flying Fish Point – Southern Beaches

Looking south from in front of the toilet block at the southern end of Flying Fish Point

Looking north from in front of the toilet block at the southern end of Flying Fish Point

Tree outside the toilet block, where a scour mark was surveyed in March, it is evident that erosion has occurred around the roots of the tree

Erosion behind the rockwall outside the toilet block and the southern end of Flying Fish Point

Looking south from Beach Access 3, a sand bar is noticeable in the middle of the photo, by the change in the wave patterns

Looking towards the northwest from Beach Access 3, an erosion scarp of approximately 0.5m is evident, as is the debris

Flying Fish Point – Rockwall

Looking south from the corner of George Street and the Esplanade

Looking north from the corner of George Street and the Esplanade