FACT SHEET Tropical cyclone Nelson

Summary
On Tuesday 6 February 2007 tropical cyclone Nelson was finally named as the first cyclone of the 2006-07 cyclone season (after existing as a tropical low since 31 January 2007). At its peak, the Bureau of Meteorology issued Top Priority cyclone advices for coastal communities between Kowanyama and Karumba.

- Category 2 cyclone with predicted central pressure of 980hPa forecast by the Bureau of Meteorology.
- Very large significant wave heights recorded at Weipa (tables 1 and 2).
- 1.1m storm surge recorded at Weipa – to the north of the cyclone track (table 3).
- Ten crew members rescued by helicopter from disabled mineral barge MV *Wunma*.
- The cyclone degenerated into a tropical low, crossed Cape York, and tracked southeast into the Coral Sea.

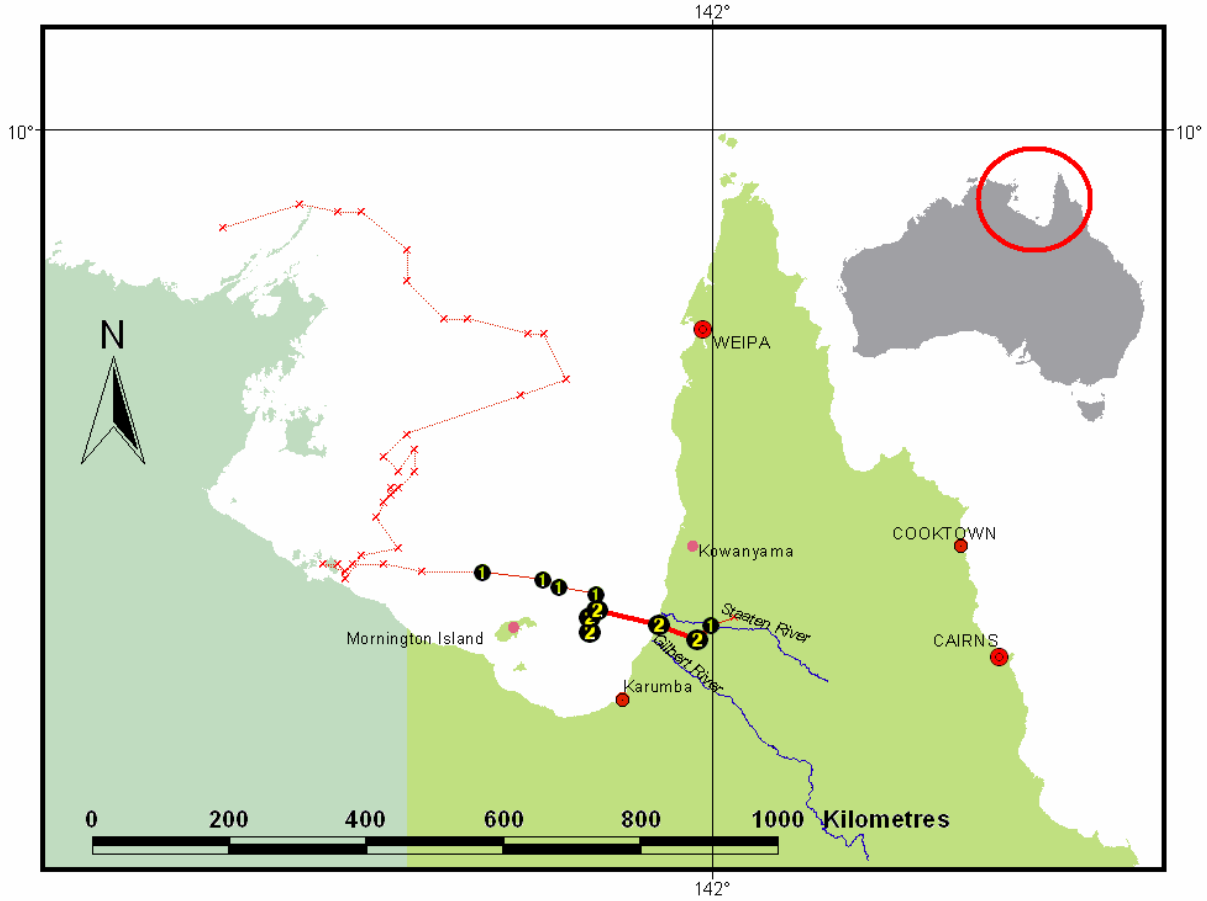

Figure 1 – Track of tropical cyclone Nelson, 31 January–7 February 2007 (from Bureau of Meteorology tropical cyclone advices)

Wave recording
The EPA operates a network of wave monitoring stations along the Queensland coastline. The station near Weipa (in the Gulf of Carpentaria) was monitored during this event (figure 1).

Peak wave conditions recorded at this station are shown in tables 1 and 2.

Table 1 – Recorded significant wave heights*

Site	Hsig (m)	Time / Date	Rank
Weipa	3.1	7/02/2007 07:00	3

Table 2 – Maximum recorded individual wave heights*

Site	Hmax (m)	Time / Date	Rank
Weipa	5.6	6/02/2007 15:30	3

* *See Glossary*

Plots of wave heights and periods from the Weipa wave recording station are shown in figure 2. The peak maximum individual wave height (5.6m Hmax) during this event is the third largest recorded by the EPA at this site since recordings commenced there in December 1978.

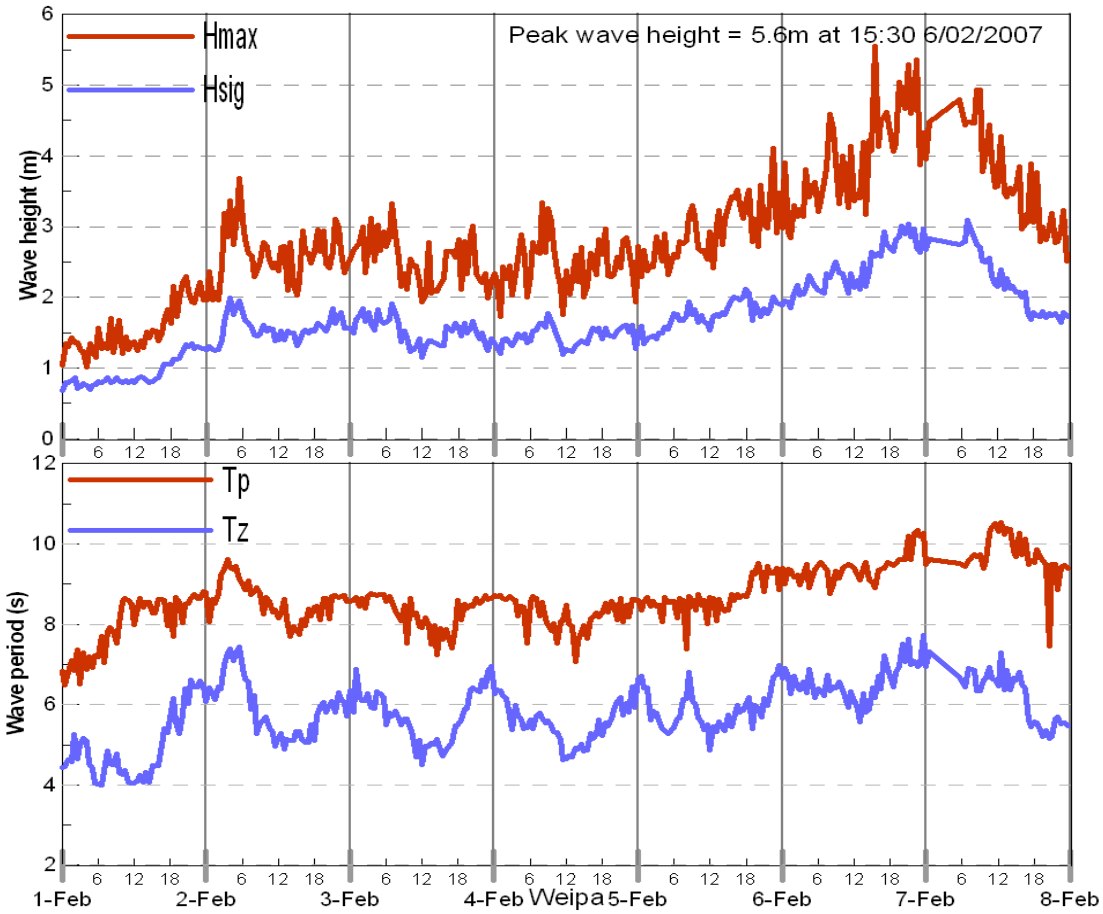

Figure 2 - Weipa wave data 1–7 February 2007

Tide recording

The EPA operates a storm tide system (comprising 22 tide gauges along the Queensland coastline). This allows real-time access to tide data via the public telephone network during events to monitor the effects of coastal flooding from tidal surge.

For this event, tide data was obtained from the Weipa and Karumba gauges (see figure 1). Plots of the records from these sites are shown in figures 3 and 4. Table 3 shows a list of the maximum surge values recorded at each of the above storm tide gauges.

Table 3 – Recorded surge heights

Site	Date & time	Surge (m)	Exceeded HAT
Weipa	7/02/2007 03:10	1.1	Yes
Karumba	5/02/2007 12:10	0.8	No
Mornington Island	4/02/2007 19:00	0.7	Yes

Had the maximum surge recorded at Weipa occurred only eight hours earlier (the previous predicted high tide at 19:20 on 6 February, shown in figure 3), the actual storm tide would have been 0.4m above Highest Astronomical Tide (HAT), and this would have resulted in flooding of low lying areas around Weipa. Similarly, had the maximum surge recorded at Karumba occurred on the spring tide four days earlier (at 19:30 on 1 February, shown in figure 4), the actual storm tide would have been 0.6m above HAT, and this may have resulted in substantial flooding around Karumba. The Peak (unrecorded) storm tide is likely to have occurred near the Gilbert and Staaten Rivers, about 120km north of Karumba.

The EPA had recently installed a new storm tide gauge at Mornington Island (near the township of Gununa). This gauge is still undergoing testing, and, although it did not provide a continuous record of the event, it did appear to have captured the peak surge (and indicate that the storm tide also exceeded HAT at this site, as shown in figure 5). This result should be treated with some caution though, as the datum for the site has still to be confirmed.

These examples show how important the time of occurrence of a storm surge is (in relation to the state of the tide) in determining the amount of flooding that may occur. This coincidence is, in turn, directly related to the time of coast-crossing of the tropical cyclone event (see Glossary for more information).

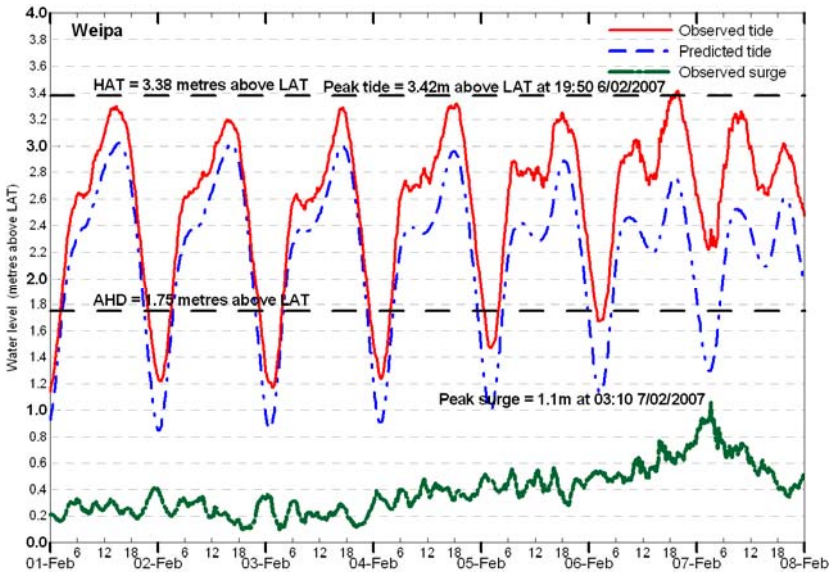

Figure 3 –Tides at Weipa 1–7 February 2007

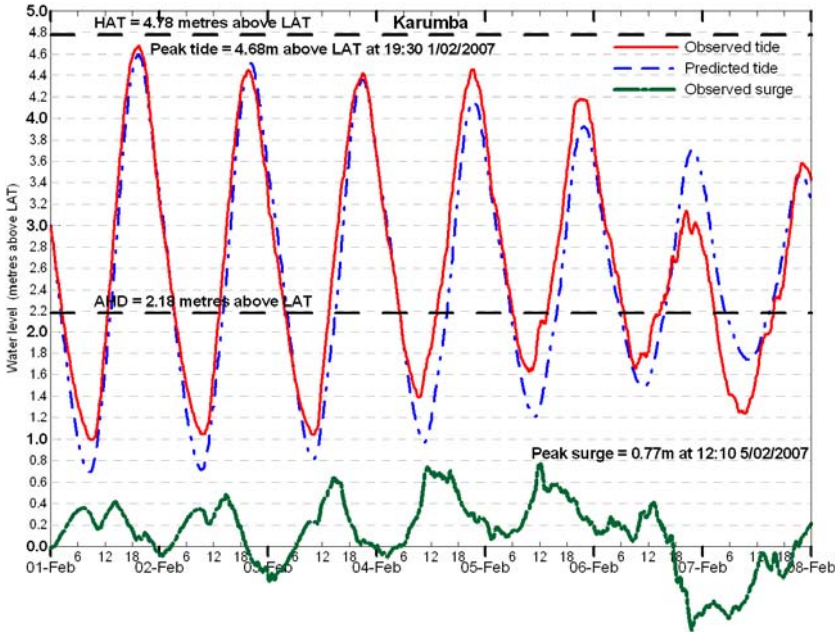

Figure 4 –Tides at Karumba 1–7 February 2007

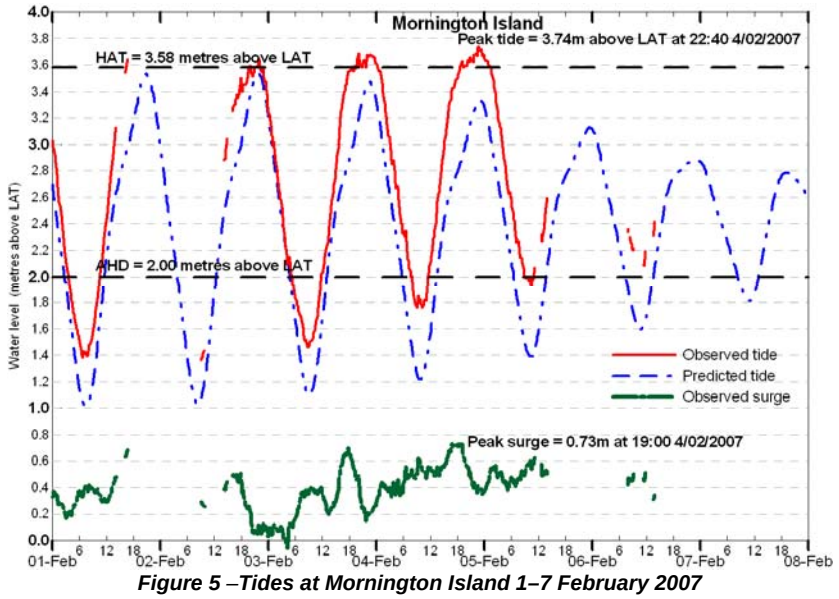

Figure 5 –Tides at Mornington Island 1–7 February 2007

EPA Web Sites
During the event, the following EPA wave and tide web sites were updated at regular intervals:
www.epa.qld.gov.au/waves
www.epa.qld.gov.au/tides

Glossary

Hsig	The significant wave height (in metres), defined as the average of the highest one third of the zero up-crossing wave heights in a 26.6-minute wave record. This wave height closely approximates the value a person would observe by eye. Significant wave heights are the values reported by the Bureau of Meteorology in their forecasts.
Hmax	The maximum zero up-crossing wave height (in metres) in a 26.6-minute record.
Tz	The average of the zero up-crossing wave periods (in seconds) in a wave record.
Tp	Wave period at the peak spectral energy (in seconds). This is an indication of the wave period of those waves that are producing the most energy in a wave record. Depending on the value of Tp, waves could either be caused by local wind fields (sea) or have come from distant storms and have moved away from their source of generation (swell).
HAT	HIGHEST ASTRONOMICAL TIDE is the highest water level which can be predicted to occur at a particular site under average weather conditions. This level won't be reached every year.
AHD	AUSTRALIAN HEIGHT DATUM is the reference level used by the Bureau of Meteorology in Storm Tide Warnings. AHD is very close to the average level of the sea over a long period (preferably 18.6 years), or the level of the sea in the absence of tides.
Storm tide	The total water level obtained by adding the STORM SURGE and WAVE SETUP to the height of the ASTRONOMICAL TIDE.
Storm surge	A storm surge is an increase (or decrease) in water level associated with some significant meteorological event, e.g. persistent strong winds and change in atmospheric pressure, or tropical cyclone. Its typical effect is to raise the level of the tide above the predicted level. In some situations, e.g. when winds blow offshore, the actual tide level can be lower than that predicted. The storm surge height depends on a range of factors including: (a) intensity and size of the tropical cyclone – the stronger the winds the higher the surge, (b) shape of the seafloor – the more gentle the slope the greater the surge, and (c) speed and angle of approach of the cyclone to the coast. The can be worsened by funnelling effects of bays and estuaries - and river and local flooding caused by torrential rain. In Queensland, most large surges are caused by tropical cyclones.
Wave setup	The increase in mean water level above the SWL towards the shoreline caused by wave ction in the surf zone. The amount of rise of the mean water level depends on wave height and beach slope such that setup increases with increasing wave height and increasing beach steepness. It can be very important during storm events as it results in a further increase in water level above the tide and surge levels.
Astronomical tide	Or more simply, the tide, is the periodic rise and fall of water along the coast because of gravitational attraction on the water by the moon and sun. When the moon, sun and earth are in line their combined attraction is strongest and the tide range is greater (spring tides). When the moon and sun are at right angles to each other (in relation to the earth) the effect of the attraction is somewhat reduced and the tide range is smaller (neap tides).
Predicted tide	The tide expected to occur under average meteorological conditions. Tide predictions are typically based on previous actual tide readings gathered over a long period (usually one year or more). The sun, moon and earth are not in the same relative position from year to year. Accordingly, the gravitational forces that generate the tides, and the tides themselves, are not the same each year.

Number	Date	Lat	Long	CP	Cat	Max Wind
1	31/01/2007 16:00	-11.3	135.6	1001	0	-
2	31/01/2007 22:00	-11.0	136.6	1001	0	-
3	01/02/2007 04:00	-11.1	137.1	1001	0	-
4	01/02/2007 10:00	-11.1	137.4	1000	0	-
5	01/02/2007 16:00	-11.6	138.0	998	0	-
6	01/02/2007 19:00	-12.0	138.0	998	0	-
7	01/02/2007 22:00	-12.5	138.5	998	0	-
8	02/02/2007 01:00	-12.5	138.8	998	0	-
9	02/02/2007 04:00	-12.7	139.6	998	0	-
10	02/02/2007 07:00	-12.7	139.8	998	0	-
11	02/02/2007 10:00	-13.3	140.1	997	0	-
12	02/02/2007 13:00	-13.5	139.5	997	0	-
13	02/02/2007 16:00	-14.0	138.0	998	0	-
14	02/02/2007 19:00	-14.3	137.7	998	0	-
15	02/02/2007 22:00	-14.5	137.9	998	0	-
16	03/02/2007 01:00	-14.2	138.1	998	0	-
17	03/02/2007 04:00	-14.5	138.1	998	0	-
18	03/02/2007 07:00	-14.7	137.9	998	0	-
19	03/02/2007 10:00	-14.8	137.8	999	0	-
20	03/02/2007 13:00	-14.7	137.8	1000	0	-
21	03/02/2007 16:00	-14.9	137.7	998	0	-
22	03/02/2007 22:00	-15.1	137.6	998	0	-
23	04/02/2007 04:00	-15.5	137.9	998	0	-
24	04/02/2007 10:00	-15.6	137.4	1000	0	-
25	04/02/2007 16:00	-15.9	137.2	999	0	-
26	04/02/2007 22:00	-15.7	137.1	999	0	-
27	05/02/2007 04:00	-15.7	136.9	998	0	-
28	05/02/2007 10:00	-15.8	137.2	999	0	-
29	05/02/2007 16:00	-15.7	137.3	996	0	-
30	05/02/2007 22:00	-15.7	137.7	998	0	-
31	06/02/2007 04:00	-15.8	138.2	995	0	75
32	06/02/2007 07:00	-15.8	139.0	992	1	95
33	06/02/2007 10:00	-15.9	139.8	990	1	100
34	06/02/2007 13:00	-16.0	140.0	990	1	100
35	06/02/2007 16:00	-16.1	140.5	990	1	100
36	06/02/2007 19:00	-16.6	140.4	985	2	130
37	06/02/2007 22:00	-16.4	140.4	985	2	130
38	07/02/2007 01:00	-16.3	140.5	985	2	130
39	07/02/2007 04:00	-16.5	141.3	980	2	140
40	07/02/2007 07:00	-16.7	141.8	983	2	130
41	07/02/2007 10:00	-16.5	142.0	992	1	95
42	07/02/2007 13:00	-16.4	142.3	995	0	75

Table 4 –Tropical cyclone Nelson track information (from Bureau of Meteorology tropical cyclone advices)