Australian Government
Great Barrier Reef
Marine Park Authority

Mr Kelvin Thomson MP
Member for Wills
3 Munro Street
COBURG VIC 3058

9/1531

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Dear Mr Thomson

Thank you for the opportunity to submit comments as part of the Kyoto Protocol Review. The Great Barrier Reef Marine Park Authority responses are as follows:

- *What position Australia should be adopting in international negotiations concerning emissions reductions beyond 2012, i.e. what commitments should we be offering, and what commitments should we be seeking from other countries?*

The Intergovernmental Panel on Climate Change (IPCC) Special Report on Emissions Scenarios (SRES) storyline projects atmospheric CO_2 concentrations by 2080 to be 532 parts per million under a low emission storyline (B1: global solutions to economic, social and environmental sustainability) and 721 parts per million under a high emission storyline (A2: slow economic development and slow change to renewable energy technology)[1]. Based on these SRES, modelling conducted by CSIRO forecasts increases in the annual sea surface temperature of the Great Barrier Reef between +1.2 °C (B1) to +3.9 °C (A2) by 2080 (refer to Attachment A). In addition to rising sea surface temperatures, reefs are also predicted to experience changes resulting from ocean acidification. A decrease in ocean pH of 0.1 units has been observed since pre-industrial times and it is predicted by 2100 ocean pH will decrease between 0.3 to 0.5 units[1]. Ocean acidification is of concern to coral reefs as calcium carbonate binding organisms (such as corals) are unable to form their skeletons. Scientific evidence suggests that if CO_2 concentrations rise above 500 parts per million, corals will be unable to grow[2].

According to world-class coral reef scientists, a dramatic loss in coral reef biodiversity is inevitable at atmospheric CO_2 concentrations approaching 500 parts per million[3]. Other ecosystems are likely to be extremely impacted at atmospheric CO_2 concentrations between 450 to 500 parts per million[3]. Therefore, it is crucial for coral reefs and other ecosystems that emissions are effectively managed to maintain atmospheric CO_2 well below these critical thresholds.

2 - 68 Flinders Street | Townsville | + 61 7 4750 0700 Telephone | info@gbrmpa.gov.au
PO Box 1379 | Queensland 4810 | + 61 7 4772 6093 Facsimile | www.gbrmpa.gov.au

To ensure a sustainable future for the Great Barrier Reef and the socio-economic systems that are reliant upon it, global consensus and commitment to a low emissions storyline is imperative. The best possible outcome for the Great Barrier Reef would be for Australia and other countries to rapidly adopt targets to reduce CO_2 emissions that will stabilise atmospheric CO_2 well below the critical threshold of 450 parts per million. Importantly, this threshold is significantly below the 2080 projection of the low emissions SRES B1 storyline of 532 parts per million. Therefore, to ensure the long term persistence of the Great Barrier Reef strict emission targets must be coupled with management strategies that enhance the resilience of the Great Barrier Reef to climate change impacts by limiting local chronic stressors such as poor water quality and overfishing[4].

- *The obligations and opportunities arising from ratification of the Kyoto Protocol, including the proposed Carbon Pollution Reduction Scheme*

Ratification of the Kyoto Protocol and the proposed Carbon Pollution Reduction Scheme are highly significant strategies to create a low emissions future. A low emissions future will help to reduce the climate change threats to key values of the Great Barrier Reef, including ecosystem services that the Reef provides to the tourism and fishing industries, and to the wider national and international communities.

The Australian government, through the Great Barrier Reef Marine Park Authority, is implementing the Great Barrier Reef Climate Change Action Plan 2007-2012. Core objectives of the Climate Change Action Plan are to ensure reef dependant communities and industries adapt to a changing climate. Further, potential opportunities exist to enact behavioural change towards reducing climate footprints through sustainable use of resources.

The Great Barrier Reef Marine Park Authority see the introduction of the proposed Carbon Pollution Reduction Scheme and ratification of the Kyoto Protocol as critical measures in securing the long term future of the Great Barrier Reef.

- *The current state of climate science*

Climate change is already affecting coral reefs and these impacts will continue to have direct impacts on the Great Barrier Reef through:

- increasing sea surface temperatures (SSTs);
- ocean acidification;
- rising sea level;
- large scale changes to major oceanic and climatological circulation patterns including upwellings and El-Nino Southern Oscillation (ENSO) events;
- increasing frequency and severity of storms and cyclonic events;
- increasing terrestrial runoff into GBR waters and rainfall variability; and
- increasing virulence of marine pathogens.

At present, evidence suggests that climatological drivers are already causing adverse impacts to the Great Barrier Reef including:

- Unusual periods of high SSTs resulting in observed mass coral bleaching episodes of 1998 and 2002 and a severe but localised bleaching event occurred in the southern Great Barrier Reef in 2006.
- Oceanic acidity has increased (reduction in pH) by 0.1 units since preindustrial times with projections of further increases between 0.3-0.5 units in the years to 2100[1].
- Sea level rise at an average of 2.9 mm year over the 15 years from 1991-2006[1].

References

1 Lough J. (2007) Chapter 2 Climate Change on the Great Barrier Reef, In *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*. eds. Johnson JE and Marshall PA. Great Barrier Reef Marine Park Authority and Australian Greenhouse Office, Australia.

2 Hoegh-Guldberg O, Anthony K, Berkelmans R, Dove S, Fabricius KE, Lough J, Marshall P, van Oppen MJH, Negri A and Willis B (2007) Chapter 10 Vulnerability of reef-building corals on the Great Barrier Reef to climate change, In *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*, eds. Johnson JE and Marshall PA. Great Barrier Reef Marine Park Authority and Australian Greenhouse Office, Australia.

3 Fabricius KE, Hoegh-Guldberg O, Johnson J, McCook L, and Lough, J (2007) Chapter 17 Vulnerability of coral reefs of the Great Barrier Reef to climate change, In *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*, eds. Johnson JE and Marshall PA. Great Barrier Reef Marine Park Authority and Australian Greenhouse Office, Australia.

4 Olsson P, Folke C, Hughes TP (2008) Navigating the transition to ecosystem-based management of the Great Barrier Reef, Australia. *Proc Natl Acad Sci USA* **105**:9489-9494

5 Congdon BC, Erwin CA, Peck DR, Baker GB, Double, MC and O'Neill P (2007) Chapter 14 Vulnerability of seabirds on the Great Barrier Reef to climate change, In *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*, eds. Johnson JE and Marshall PA. Great Barrier Reef Marine Park Authority and Australian Greenhouse Office, Australia.

6 Webster N and Hill R (2007) Chapter 5 Vulnerability of marine microbes on the Great Barrier Reef to climate change, In *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*, eds. Johnson JE and Marshall PA. Great Barrier Reef Marine Park Authority and Australian Greenhouse Office, Australia.

7 Johnson JE, Marshall PA (editors) (2007) Climate Change and the Great Barrier Reef. Great Barrier Reef Marine Park Authority and Australian Greenhouse Office, Australia

Attachment A

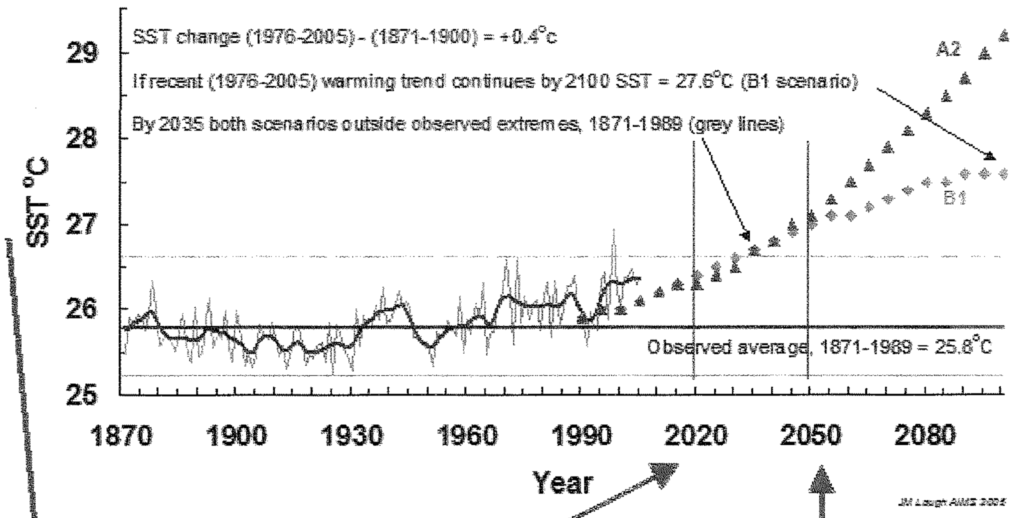
Climate Change Group: GBRMPA

Attachment A: IPCC 2001 – SRES cumulative CO2 emissions and GBR sea surface temperature predictions.

Table 2.2 [illegible]

	2020		2050	
Projected change	**A2**	**B1**	**A2**	**B1**
Air temperature (relative to 1961 to 1990 average and on basis that tropical and coastal areas of Australia will warm at ~global average[31])	+1.4°C	+0.6°C	+2.6°C	+0.9°C
Air temperature extremes	See Table 2.3 with example for Townsville temperature extremes and warming of 1°C			
SST for GBR (relative to 1961 to 1990 average 25.9°C)	+0.5°C	+0.5°C	+1.2°C	+1.1°C
Rainfall	No consensus on change in average precipitation however 1) Intensity of drought associated with given rainfall deficit will be increased due to higher air temperatures 2) Intensity of high rainfall events will increase (eg January 1998 Townsville flood event more frequent) 3) more extremes			
Tropical cyclones	No consensus on changes in frequency or spatial occurrence but intensity of tropical cyclones expected to increase, so that although there may not be more tropical cyclones or in new locations but sever tropical cyclones (eg TC Ingrid, TC Larry) likely to be more common (possibility already being muted of a higher category than 5)			
Sea level rise (relative to 1961 to 1990 baseline)	+38cm	+7cm	+68cm	+13cm
Ocean chemistry (estimated decrease in ocean pH based on projections of 0.3 to 0.5 decrease by 2100)	-0.10	-0.06	-0.25	-0.15
ENSO	No consensus on how ENSO frequency and intensity will change but likely to be continued source of aperiodic [illegible] in region			
CO_2 parts per million (pre-industrial = 270 ppm)	440	421	559	479

Observed and projected annual GBR SSTs: 1870-2100



	2020		2050	
Projected change	**A2**	**B1**	**A2**	**B1**
SST for GBR (relative to 1961 to 1990 average 25.9°C)	+0.5°C	+0.5°C	+1.2°C	+1.1°C
CO_2 parts per million (pre-industrial = 270 ppm)	440	421	559	479

† *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*, p.28

Attachment B: Vulnerability of key species groups and habitats of the Great Barrier Reef to climate change