

Planning responses to inundation - overview of options

*presentation at NSW Estuaries conference
11 November 2014*

by **John R Corkill OAM**

Post-graduate researcher and candidate for PhD

School of Law & Justice, Southern Cross University, Lismore NSW Australia

Preview

- ▶ Introduction & recap on climate change
- ▶ Overview of 3 macro-options
- ▶ Quick review of literature, recent texts
- ▶ Decisions making by whom? to achieve what?
- ▶ Key concepts to consider
- ▶ Conclusions, next steps...

Introductions ...

- ▶ **life experience: environmentalist, plaintiff, public interest advocate, policy adviser, teacher.**
- ▶ **candidate for PhD, School of Law & Justice, Southern Cross University;**
- ▶ **two articles in relevant peer-reviewed journals;**
- ▶ **see Corkill, JR, 'Ambulatory boundaries in New South Wales' (2013) 3 *Property Law Review* 67-84**
- ▶ **former Chair of Ocean Watch Australia Ltd;**
- ▶ **member Coastal Council of NSW 1999-2003**

Inundation ...

- ▶ inundate *verb (t)* 1. to overspread with a flood; overflow; flood; deluge; ... inundation *noun*.

See Macquarie Dictionary (3rd ed 1997) 1119.

- ▶ specific reference re estuaries infers the area covered by sheltered, tidal waters; not subject to wave action [?];
- ▶ natural tides, 'king' tides, storm surges; + sea level rise;
- ▶ see DECCW, *Snapshot of ... King Tide, 12 January 2009*.

Climate change ...

- ▶ is real and is happening already;
- ▶ trend of 'actual' SLR exceeds high projections;
- ▶ will be 'likely' to create up to 80 cm of sea-level rise by 2100;
- ▶ Any extra increase will depend on ice shelves;
- ▶ Is predicted to generate increased storminess; more severe and potentially extreme events;

Key estimates 2008...

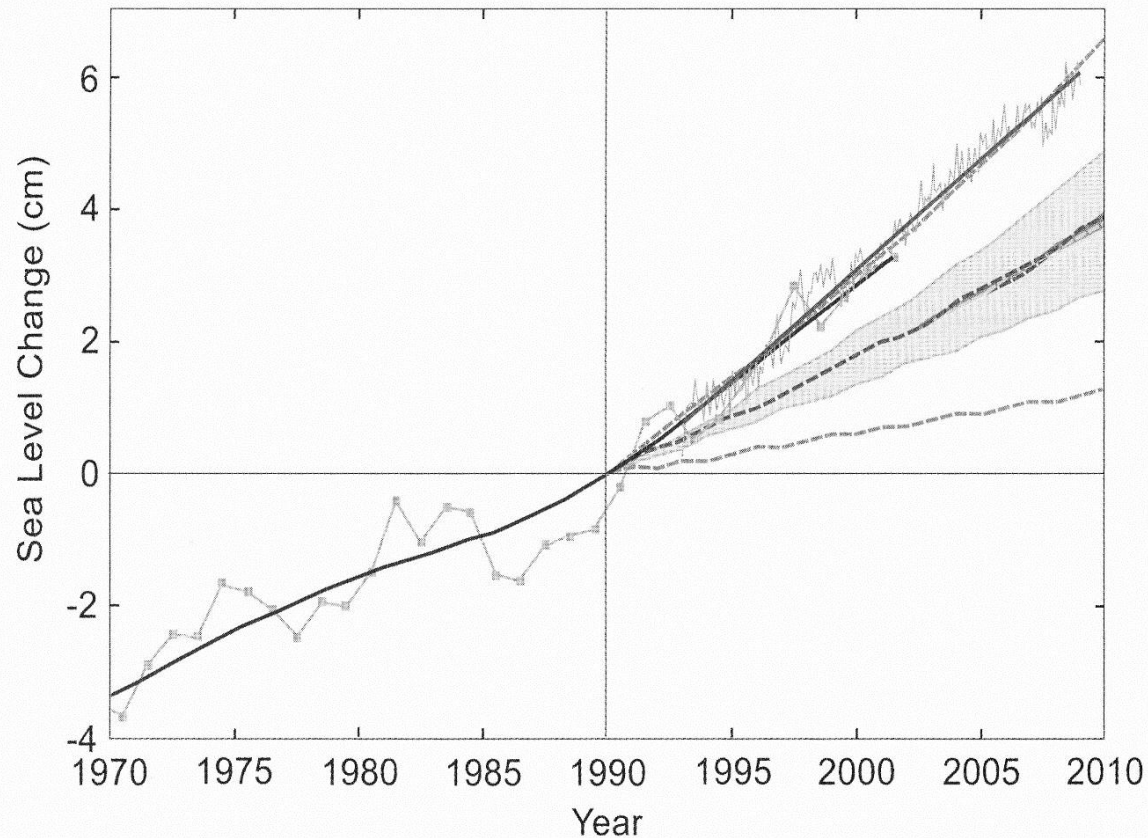
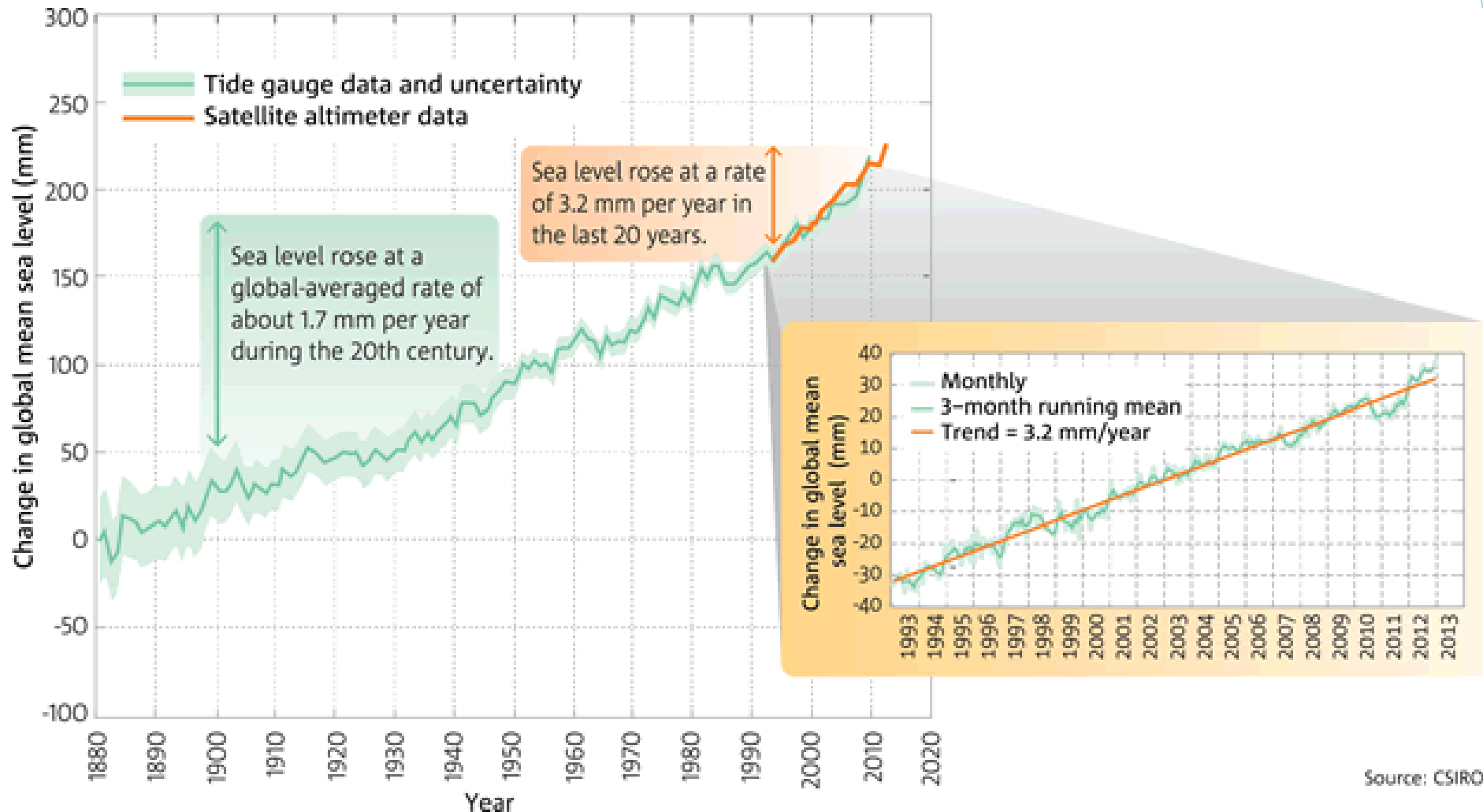


Figure 4.6 Change in sea level from 1970 to 2008, relative to the sea level at 1990. The solid lines are based on observations, smoothed to remove the effects of interannual variability. The envelope of IPCC projections is shown for comparison (broken lines with grey shading showing the uncertainty levels). Source: Rahmstorf *et al.* (2007), based on data from Cazenave and Narnem (2004); Cazenave (2006) and A Cazenave for 2006–2008 data; Reprinted with permission from AAAS.

Key indicators 2013...



Source: CSIRO

Key projections to 2100 ...

Forecasts		2046 - 2065		2081 - 2100	
	Scenario	Mean	Likely range	Mean	Likely range
Global Mean Sea Level Rise (m)	RCP2.6	0.24	0.17 to 0.32	0.40	0.26 to 0.55
	RCP4.5	0.26	0.19 to 0.33	0.47	0.32 to 0.63
	RCP6.0	0.25	0.18 to 0.32	0.48	0.33 to 0.63
	RCP8.5	0.30	0.22 to 0.38	0.63	0.45 to 0.82

IPCC *Climate Change 2013 : Summary for Policymakers*, Table SPM.2 at p 21

IPCC, *Climate Change 2014*

Synthesis Report - Summary for Policymakers ...

- ▶ Significant improvement in understanding and projection of sea level change since AR4 in 2007;
- ▶ Seas will rise at a faster rate than 1971-2010;
- ▶ Sea level rise will not be uniform across regions;
- ▶ Confirms 2013 ranges of SLR → 0.82 m by 2100;
- ▶ Any extra rise depends on melt of ice shelves.

Implications for coastlines ...

- ▶ Greater coastal inundation on peak tides;
- ▶ Increased incidence of ‘severe’, ‘extreme’ events;
- ▶ → repeated episodes of beach erosion;
- ▶ Sand lost in storms not replaced in beach recovery;
- ▶ Net trend of shoreline recession becomes apparent.



Advancing high-water mark at Old Bar

'High tide for housing' *Sydney Morning Herald*, October 19, 2009 Marian Wilkinson ENVIRONMENT EDITOR

Elaine Pearce, the president of the Old Bar Beach Sand Replenishment Group Beach, whose unit is under threat from coastal erosion. *Photo: Shane Chalker*

Implications for coastal communities ...

- ▶ Repeated short and long term interruption to functioning infrastructure;
- ▶ Negative impacts on delivery of services incl. health, education, emergency services;
- ▶ Adverse impacts on mechanisms for social cohesion;
- ▶ Loss of or damage to sites significant for ecological, recreational and economic values;
- ▶ Future use of the coast will need to be different.

Implications for coastal land-uses ...

- ▶ Coastal hazards are noted on s149 Planning Certificates;
- ▶ Slumping and undermining of fences, out buildings;
- ▶ Damage may compromise foundations, access or services;
- ▶ Residences will no longer be safe for habitation;
- ▶ Progressive, then total, loss of land to the sea = pollution?



Shoreline recession ... coming to a beach near you.

The number of coastal properties affected by shoreline recession will increase in the future, exacerbated by climate change conditions.

Coastal erosion at Collaroy NSW : from < <http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm> >

Implications for coastal properties

- ▶ **Whether and where ‘temporary’ works can be built?**
- ▶ **Who pays to build and maintain a seawall?**
- ▶ **Legal liability for nuisance created by increased erosion?**
- ▶ **The danger of a ‘false sense of security’...**

Implications for coastal environments

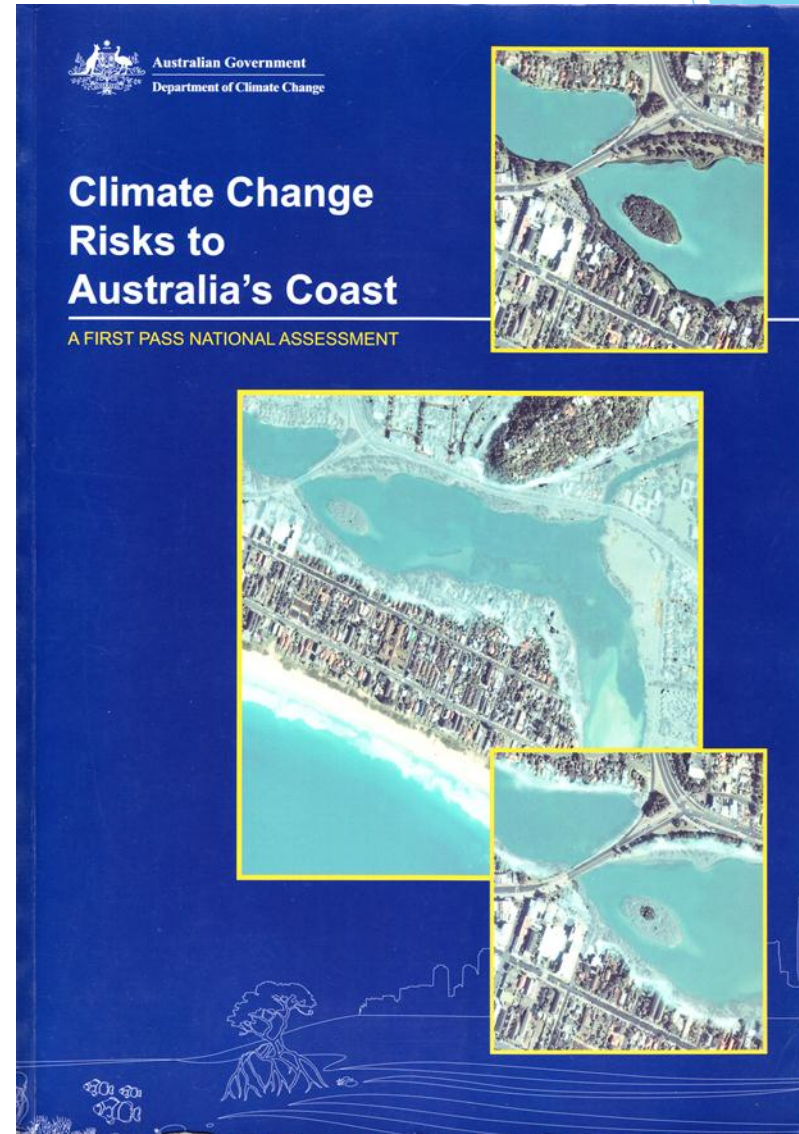
- ▶ coastal habitats transition to higher saline conditions;
- ▶ + higher temperature and changed fire regimes;
- ▶ Impacts from changed wind and wave climate;
- ▶ → adverse effects coastal vegetation/ habitat;
- ▶ can the beach retreat?

Implications ... for property law

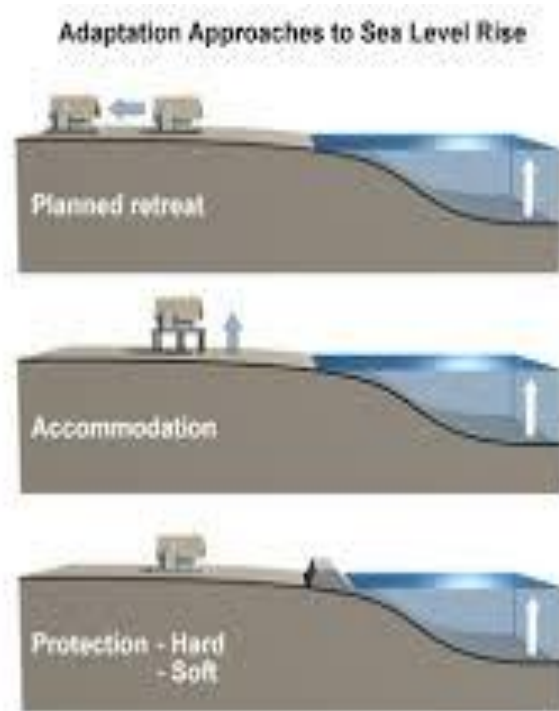
- ▶ Land title gains an ambulatory boundary, incremental, then eventual total, loss of property;
- ▶ Compensation is not payable for land lost to the sea;
- ▶ Council &/or the Crown have no 'duty' to protect;
- ▶ No common law 'right' to defend against sea in NSW;
- ▶ Where can 'temporary protection works' be built?

Key summary

- ▶ Sea level rise of 1.1m + 1:100 year storm tide;
- ▶ Residential land only;
- ▶ Between 40,800 and 62,400 buildings at risk;
- ▶ Replacement value in \$2009 between \$12.4 - \$18.7 billion;
- ▶ Approx 3,600 homes < 110m 700 building < 55m of 'soft' coast.



Macro-policy options ...



©The COMET Program

- ▶ **IGNORE** aka ‘do nothing’;
- ▶ **RETREAT** aka planned relocation;
- ▶ **ACCOMMODATE** aka modify / adapt;
- ▶ **PROTECT** aka defend;

Protect / Defend ...

Protection

Protection of the shoreline typically involves the construction of seawalls or other defences to maintain coastal assets in their current location. It includes the repeated nourishment of beaches with sand and engineering works, such as tide gates, to constrain flooding.

Many protection works will have a decadal life, as they will be constructed to a particular standard that will be exceeded over time with climate change. As indicated in Chapter 2, the effectiveness of beach nourishment will decrease over time as beaches switch from being stable to eroding.

Areas where ongoing coastal protection is a long-term option include highly developed urban areas with a long history of protection, and areas where there is a need to preserve irreplaceable cultural, Indigenous and heritage values.

The public will often call for protection when private property is threatened by coastal erosion. However, the use of protective structures can also lead to a false sense of security and encourage greater development in areas behind protective structures, than for similar locations that do not have protective barriers. Protection should only be considered as a long-term option as part of a wider management plan for the area.

Costs	Benefits
<ul style="list-style-type: none">• Construction and ongoing maintenance costs could be high• Expectations that area will continue to be protected can limit the flexibility of retreat options in the future• Costs are likely to be much higher if structures fail, because their construction encourages development in protected areas compared with similar but unprotected areas• Impacts on areas upstream or downstream of protective works include loss of coastal and marine habitats	<ul style="list-style-type: none">• Avoided damages or loss of land and structures• Continued public access to beaches and other recreational areas• Improved public safety

Australian Government, *Climate Change Risks to Australia's Coast - First Pass National Assessment* (2009) Appendix 1, 152

FNC NSW examples of beach seawalls



Lennox Beach, Ballina Shire



Surf Club, Kingscliff, Tweed Shire



Belongil Spit, Byron Shire



Belongil beach, Byron Shire

Examples of estuary seawalls



Kogarah Bay Georges River



McCarr's Creek, Pittwater



Defend could look like this..

Shore protection works Nigeria.

Concerns about protect: conflict between private property rights and public rights

- ▶ Will the foreshore become privately owned?
- ▶ Public access and safe use of foreshore, coastal waters;
- ▶ Construction & maintenance of 'protection' works: EIA? approval? costs?
- ▶ Seawall impacts on: amenity, public safety, environment, increased erosion, overall effectiveness;
- ▶ Adverse impacts on a range of economic interests based on public access to the beach, foreshore and waters.

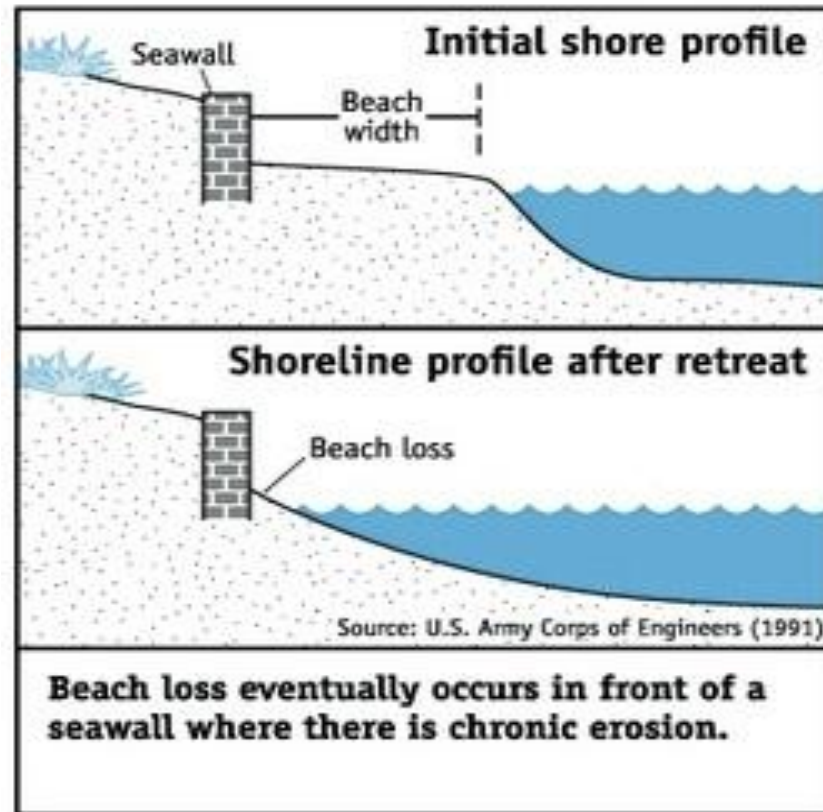
Implications for public safety?



Bespoke warning sign, Belongil Beach, Byron Bay NSW

Seawalls create coastal squeeze

- ▶ Normally the beach fluctuates around mean position;
- ▶ Rising seas and beach erosion narrow and move beach profile;
- ▶ Seawall creates immobile barrier;
- ▶ Beach habitat and public uses squeezed between wall and sea;
- ▶ Before long, beach is totally lost.



Implications for public access?



Rock, concrete rubble seawall, Belongil Beach Byron Bay

Accommodate ...

Accommodation

Accommodation includes a range of usually minor works to allow continued or extended use of at-risk areas. Measures include elevated floor requirements, increased setback requirements, and preparation of emergency evacuation plans.

Accommodation measures are often cost-effective in a transitional strategy. They are suitable for areas with modest to higher value assets where exposure to climate change risk is low to medium. An example is The Honeysuckles, Ninety Mile Beach, Victoria where new residents are required to provide a response plan to climate change, identifying how structures would deal with possible flooding and storms for the next 60 years, and a caveat is included on the property title to warn future owners of risk. While accommodation strategies may also generate a false sense of security, they do start to signal restricted access or development requirements and begin a difficult task of managing private ownership development expectations.

Costs

- Marginal additional construction costs
- Costs from loss or damage that may occur if measures not adequate
- Possible reduction in investment values

Benefits

- Continued use of land and infrastructure
- Generally less impact on surrounding environment than protection measures
- Generally cheaper than protective measures
- Increased public safety
- Promotes risk management

Australian Government, *Climate Change Risks to Australia's Coast - First Pass National Assessment* (2009) Appendix 1, 152



Accommodate could mean this..

Building raising Poquoson, Virginia.

Concerns about accommodation ...

- ▶ limited application for a limited time only;
- ▶ the trap of mal-adaptation;
- ▶ assumptions may not prove accurate;
- ▶ the danger of the ‘false sense of security’;
- ▶ deflects focus from & defers longer term options;

Planned retreat ...

Planned retreat

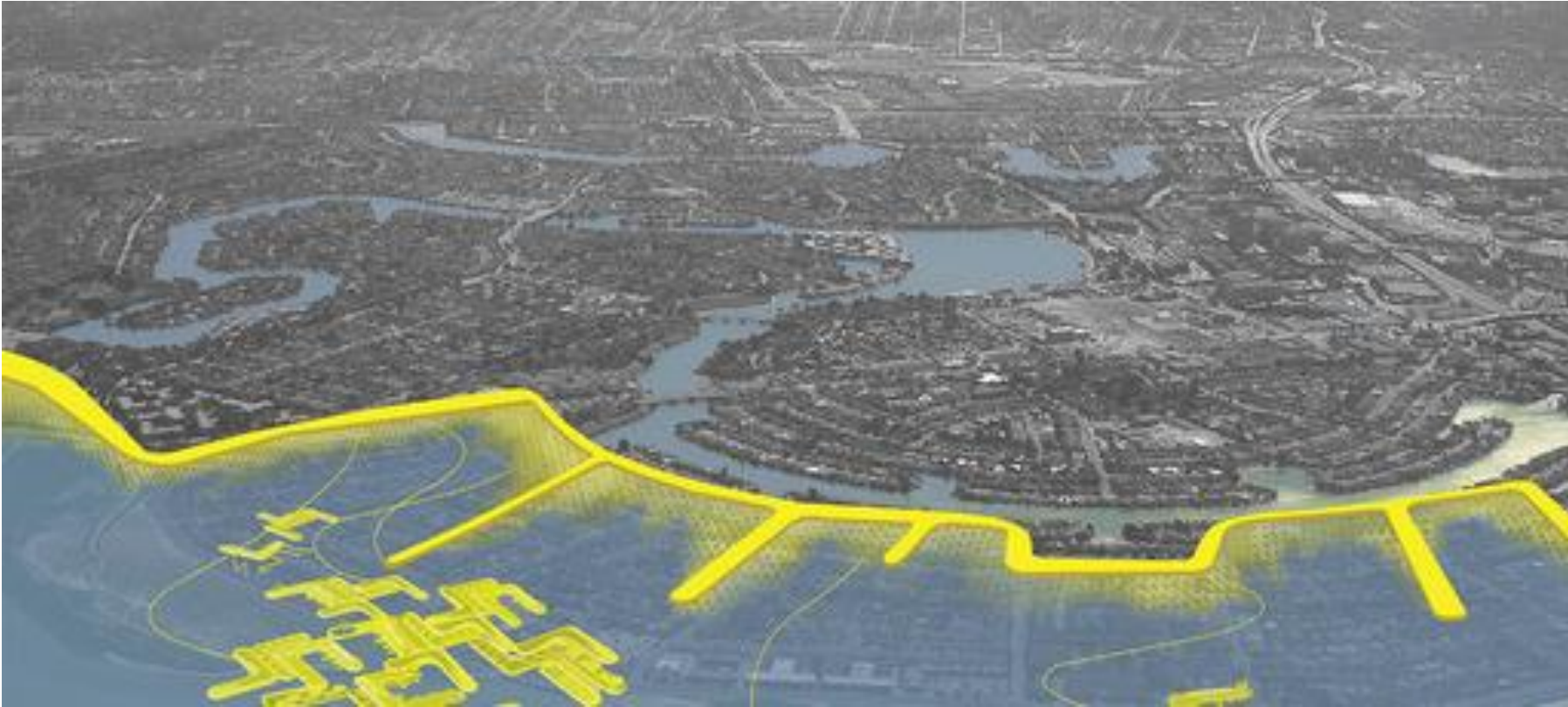
Planned or managed retreat involves a decision to withdraw, relocate or abandon assets that are at high risk of being affected by climate change hazards in the coastal zone. In the longer term, planned retreat often provides the most cost-effective approach to managing risks to medium to high-value assets exposed to inundation or erosion risk.

Planned retreat, which can occur on a range of scales, can involve increased setback provisions, relocation of structures within properties, and rezoning of land (for example, to constrain ribbon development in high risk areas or to provide for horizontal migration of wetlands). It can include buyouts of properties.

At present there have been few experiences with planned retreat to deal with climate change, with the exception of Byron Bay. Lessons can also be learned from property relocations caused by the construction of new dams. In some areas, early community consultation suggests that there could be opposition to the early adoption of planned retreat. Options for implementing planned retreat would probably include a mix of regional planning, constraints on property title, financial instruments and insurance incentives.

Costs	Benefits
<ul style="list-style-type: none">• Lost value of land, infrastructure, and social, economic and environmental values• Potential compensation costs for loss of land or infrastructure• Management costs associated with retreat plan (for example, removal of septic tanks as houses retreat)	<ul style="list-style-type: none">• Increased public safety• Significantly lower ongoing maintenance costs than for protection measures• Reduced need for costly adaptation measures in future, should risks increase• Potentially allows for greater space for ecosystems to horizontally adapt

Australian Government, *Climate Change Risks to Australia's Coast - First Pass National Assessment* (2009) Appendix 1, 152



Retreat could require this..

An aerial view of a 'managed retreat' project in Forster City, California.

Concerns about planned retreat ...

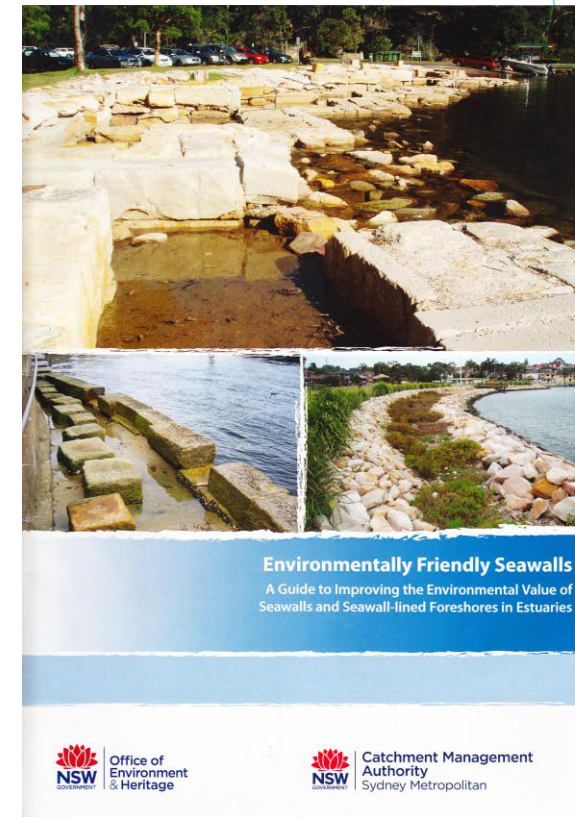
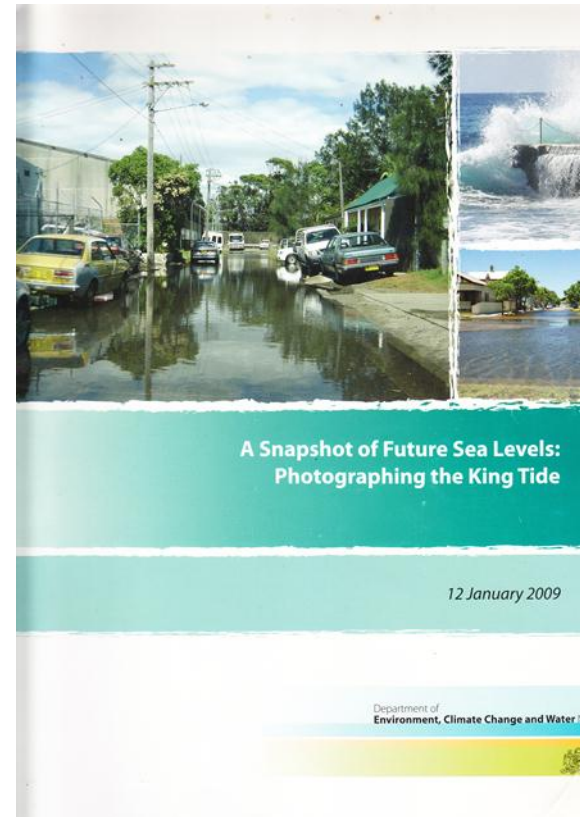
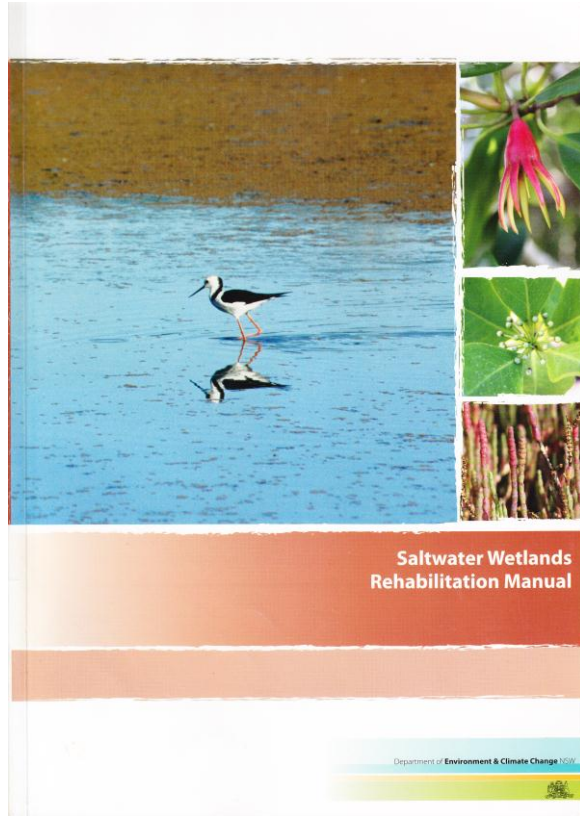
- ▶ Who decides who will need to relocate ? When ?
- ▶ Who pays for costs of relocation ?
- ▶ Retreat / relocate to where ?
- ▶ Loss of market value ?
- ▶ Loss of amenity: recreational access, views etc.

Seven principles of Coastal Zone Climate Change Adaptation

- ▶ Climate change adaptation needs clearly defined goals;
- ▶ Climate change adaptation decision making must include stakeholders from environmental, social and economic realms;
- ▶ Climate change adaptation decision making requires data to be easily available and shared;
- ▶ Climate change adaptation demands a drastic re-think of existing policy and planning constraints;
- ▶ Climate change adaptation in the coastal zone requires a thorough understanding of connectivity, both within and between ecosystems;
- ▶ Adapt at local / regional scales but don't lose sight of the bigger picture;
- ▶ Climate change adaptation should not be considered in isolation of non-climate threats coastal environments already face.

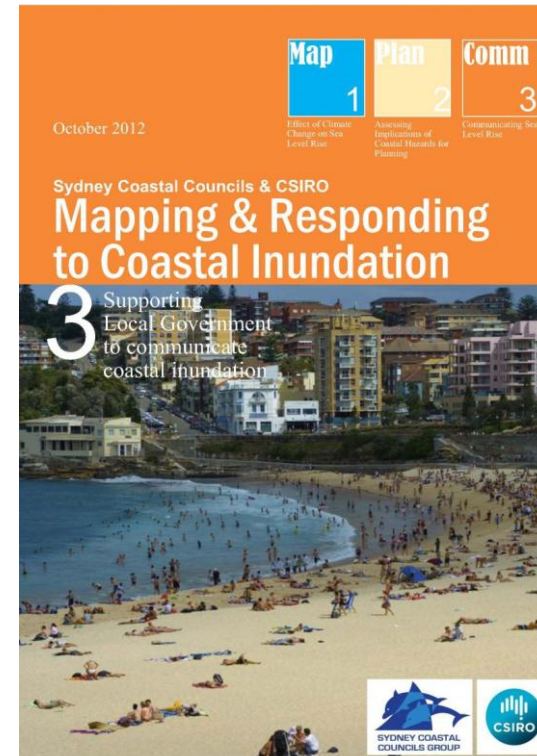
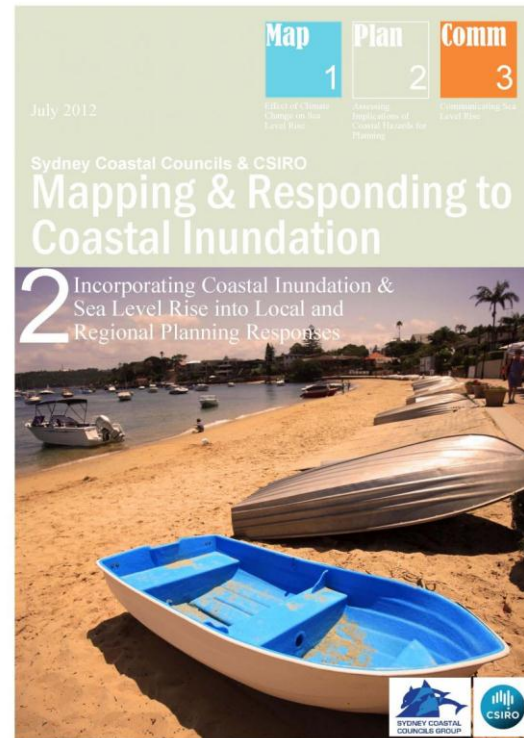
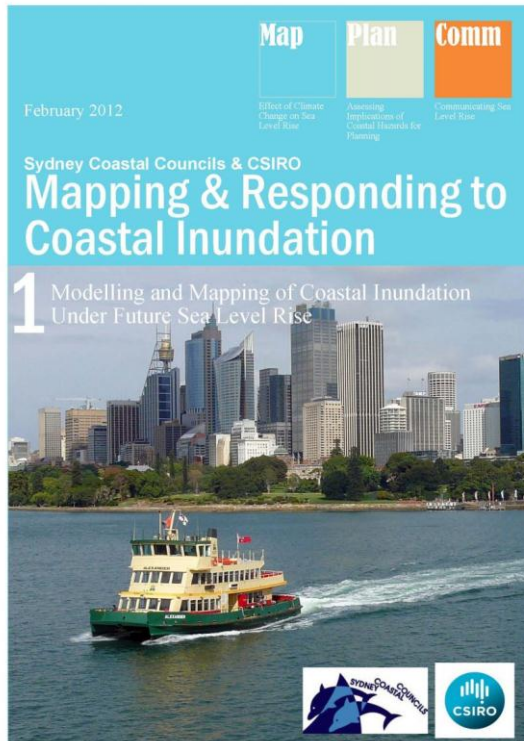
From Information Sheet prepared by CERCCS and NCCARF (2012)

NSW Government publications



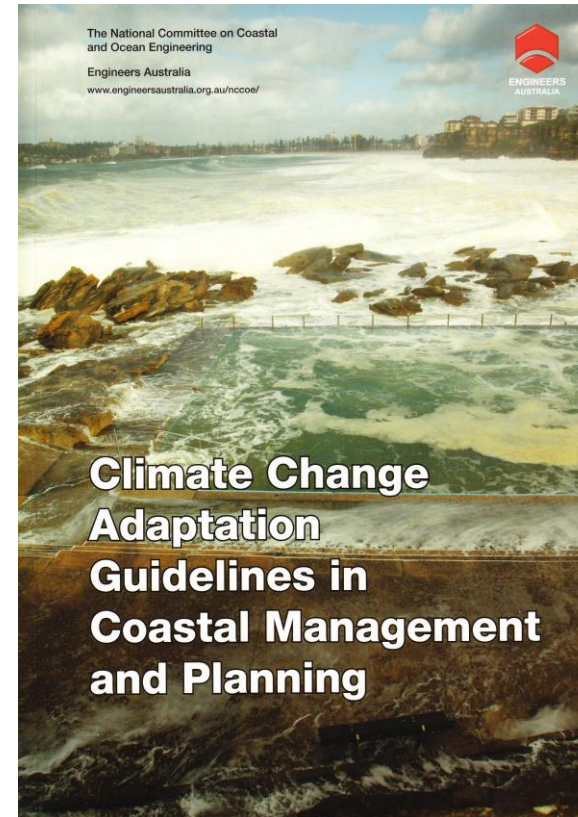
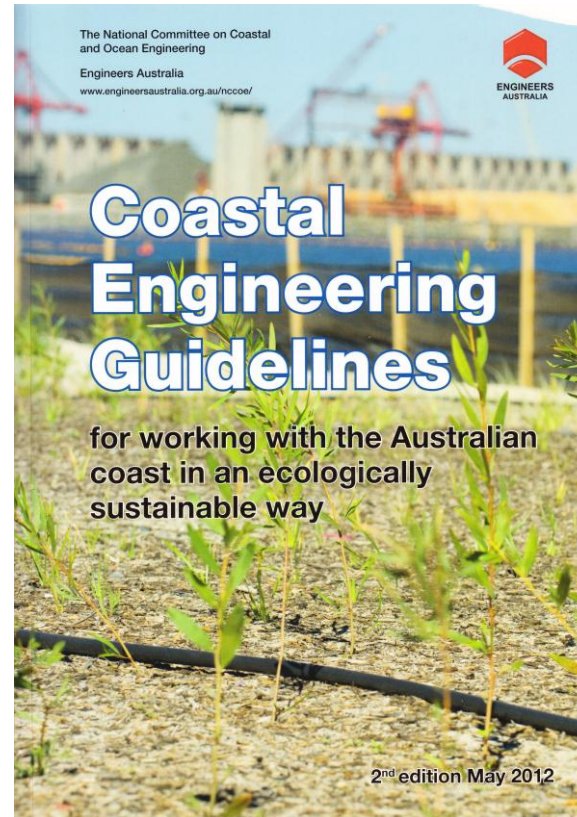
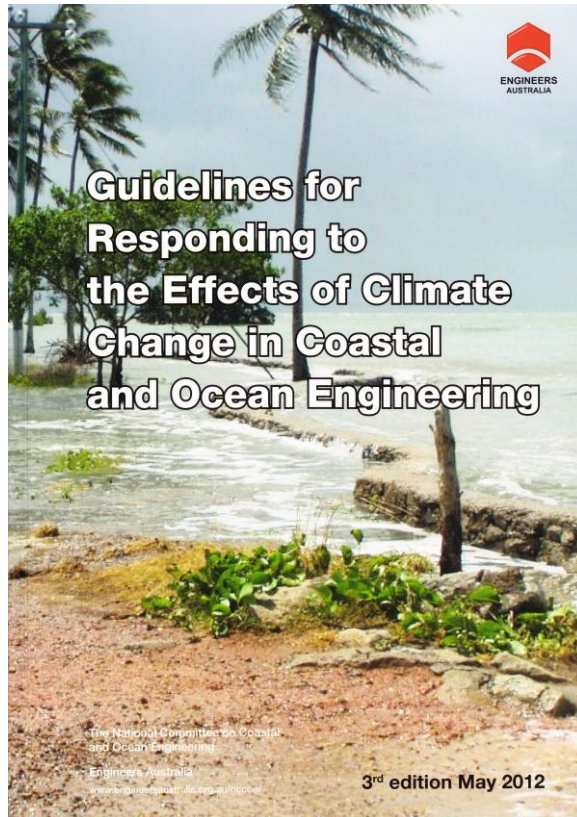
Recent publications

Sydney Coastal Councils Group CSIRO



Recent publications

Institute of Engineers Australia



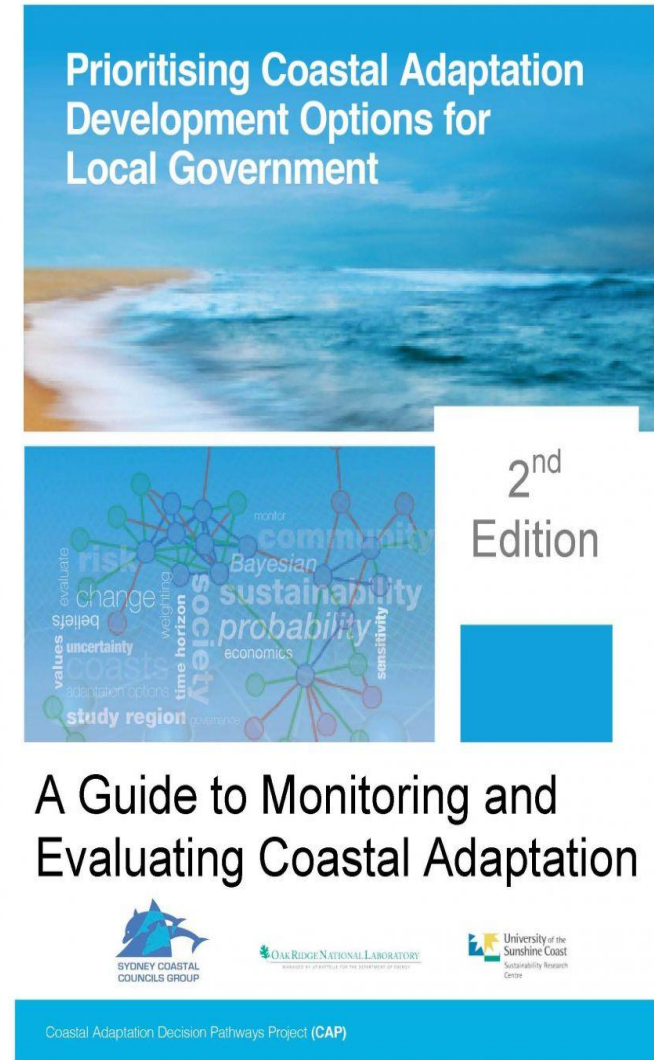
Recent compilations

Prioritising Coastal Adaptation Development Options for Local Government...

University of Sunshine Coast, CCRI Oak Ridge National Lab, Sydney Coastal Councils Group

- ▶ Thomsen et al, *A Guide to Monitoring and Evaluating Coastal Adaptation* (2nd ed, 2014)
- ▶ Preston et al, *A Multi-Criteria Analysis of Coastal Adaptation Options for Local Government (Final Report, 2013)*
- ▶ Mangoyana et al, *Literature Review of Adaptation to Climate Change in the Coastal Zone* (2012)

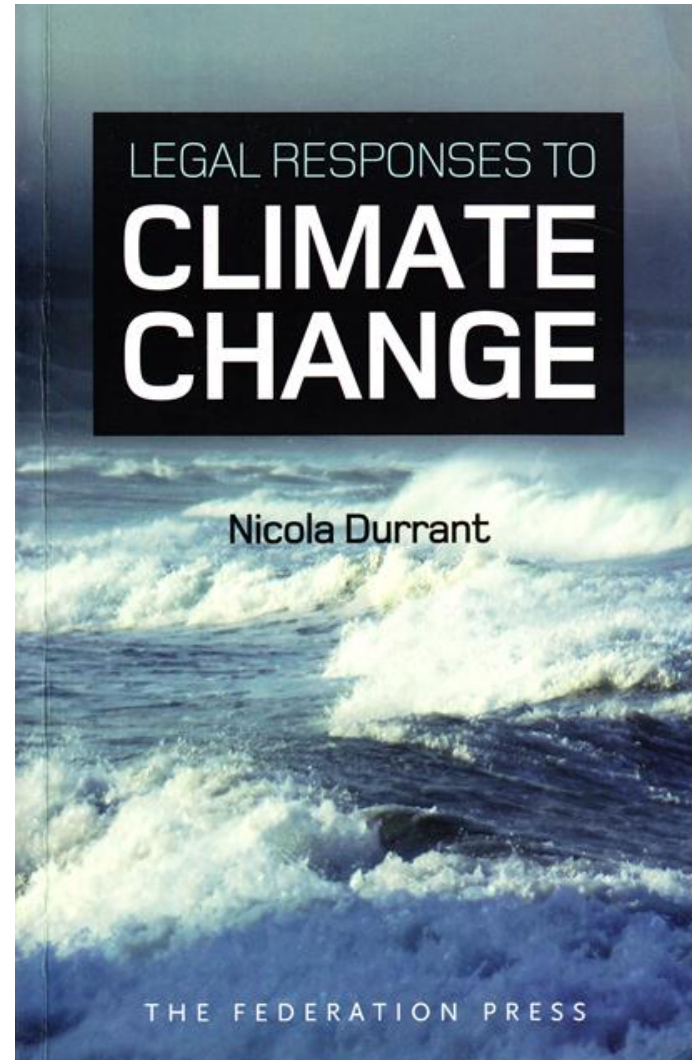
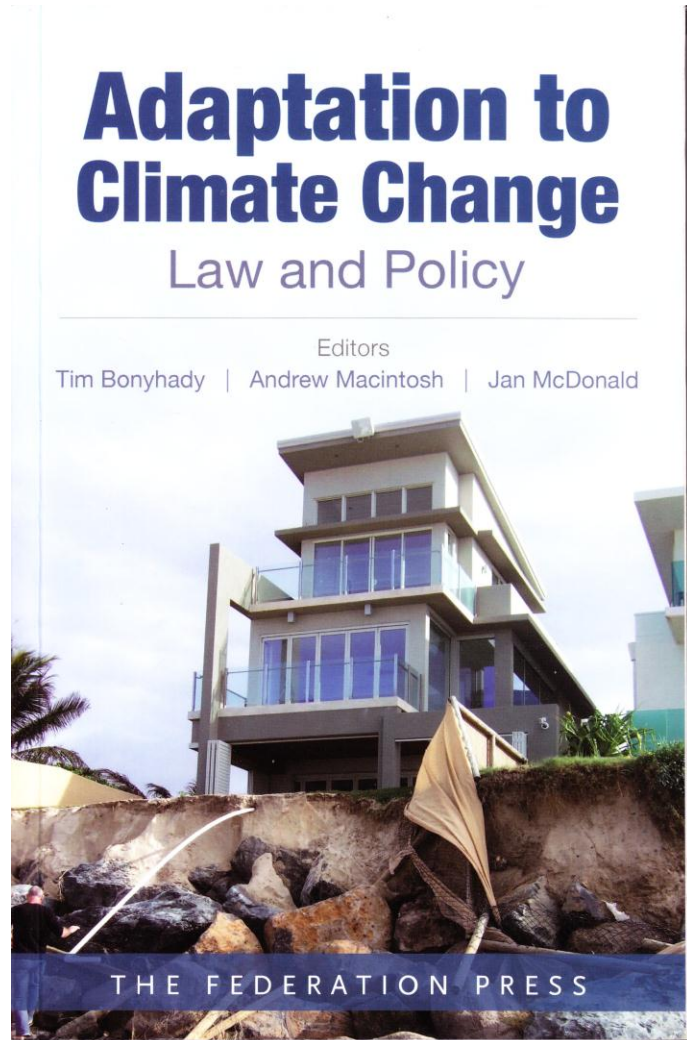
http://www.sydneycostalcouncils.com.au/Projects/prioritising_coastal_adaptation



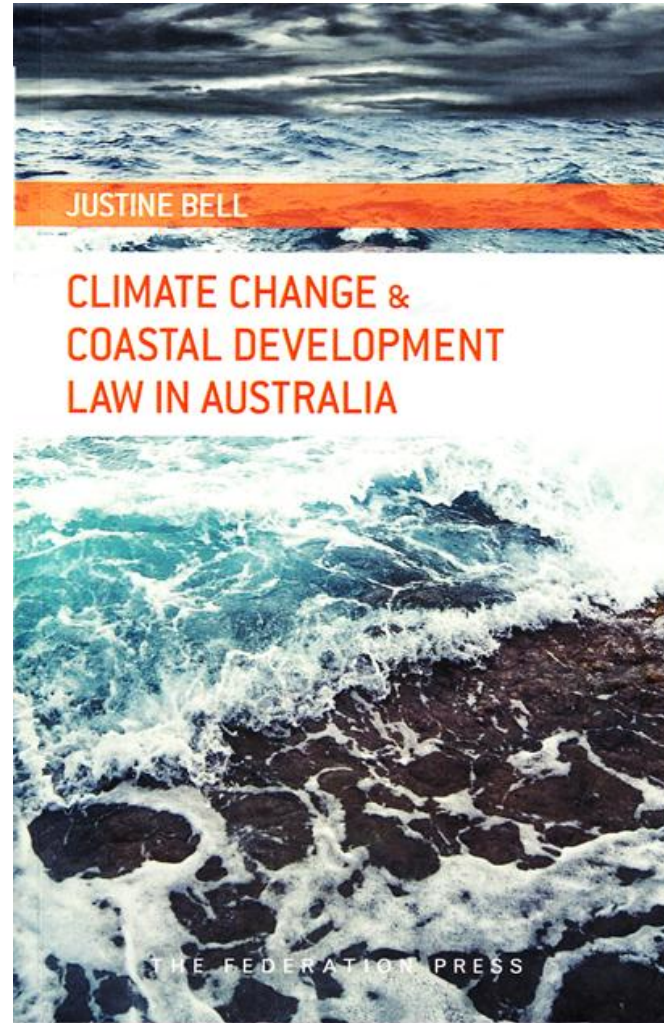
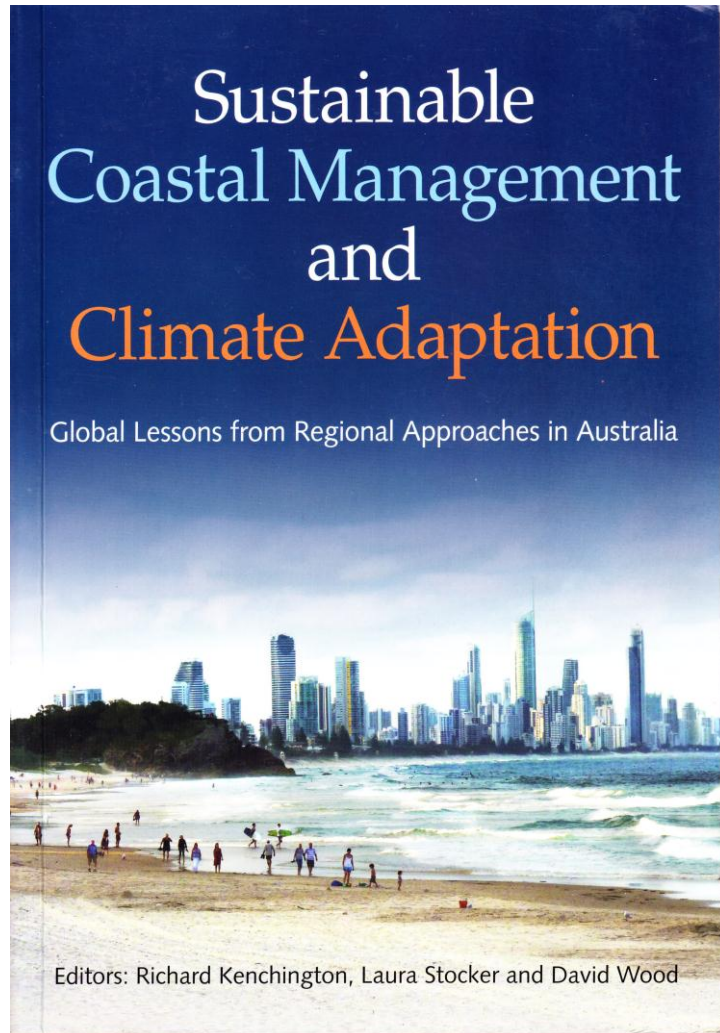
Relevant texts

- ▶ Tim Bonyhady, Andrew Macintosh and Jan McDonald (eds), *Adaptation to Climate Change: Law and Policy* (Federation Press, 2010)
- ▶ Nicola Durrant, *Legal Responses to Climate Change* (Federation Press, 2010);
- ▶ Richard Kenchington, Laura Stocker and David Woods (eds), *Sustainable Coastal Management and Climate Adaptation - Global Lessons from Regional Approaches in Australia* (2012);
- ▶ Justine Bell, *Climate Change & Coastal Development Law in Australia* (Federation Press, 2014)

Relevant texts ...



Recent texts ...



Relevant articles

- ▶ Nick Abel et al, 'Sea Level Rise, Coastal Development and Planned Retreat: Analytic Framework, Governance Principles' (2011) 14(3) *Environmental Science & Policy* 279
- ▶ Richard J Lazarus, 'Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future' (2009) 94 *Cornell Law Review* 1153-1233.
- ▶ Australian Public Service Commission *Tackling Wicked Problems: A Public Policy Perspective* (Australian Government, 2007) see http://www.apsc.gov.au/__data/assets/pdf_file/0005/6386/wickedproblems.pdf
- ▶ Kelly Levin, Benjamin Cashore, Steven Bernstein and Graeme Auld 'Playing it Forward: Path Dependency, Progressive Incrementalism, and the "Super Wicked" Problem of Climate Change' (2010)
http://environment.research.yale.edu/documents/downloads/0/2010_super_wicked_levin_cashore_bernstein_auld.pdf

Relevant articles

- ▶ JAG Cooper, and J McKenna, ‘**Social justice in coastal erosion management: The temporal and spatial dimensions**’ (2008) 39 *Geoforum* 294-306
- ▶ Sorell E Negro, ‘**Built Seawalls: A Protected Investment or Subordinate to the Public Trust?**’ (2012) 18 *Ocean and Coastal Law Journal* 89.
- ▶ Dana C Thomsen, Timothy F Smith and Noni Keys ‘**Adaptation or Manipulation? Unpacking Climate Change Response Strategies**’ (2012) 17(3) *Ecology and Society* 20 - 28
- ▶ Tayanah O’Donnell, and Louise Gates, ‘**Getting the balance right: A renewed need for the public interest test in addressing coastal climate change and sea level rise**’ (2013) 30 *Environmental and Planning Law Journal* 220.

Decision making on response options ...

- ▶ *Coastal Zone Management Plans* provide the framework;
- ▶ must be informed by good science and expert knowledge;
- ▶ needs well briefed officers and elected decision makers;
- ▶ wide public consultation needed, not just beach residents;
- ▶ need to consider short, medium and long term options;
- ▶ should employ an agreed and understood process;
- ▶ probably requires an adaptive, iterative approach.

Decision making models ...

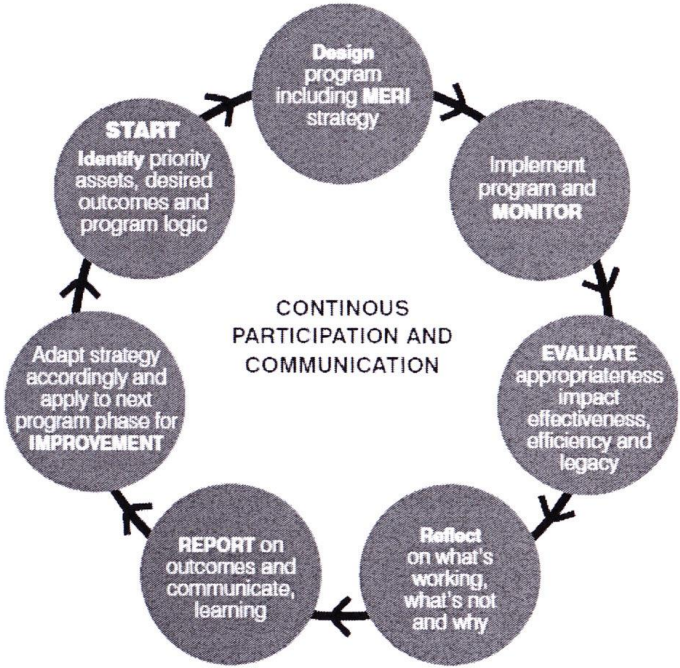


Figure 4 Program improvement and adaptive management (Australian Government 2009)

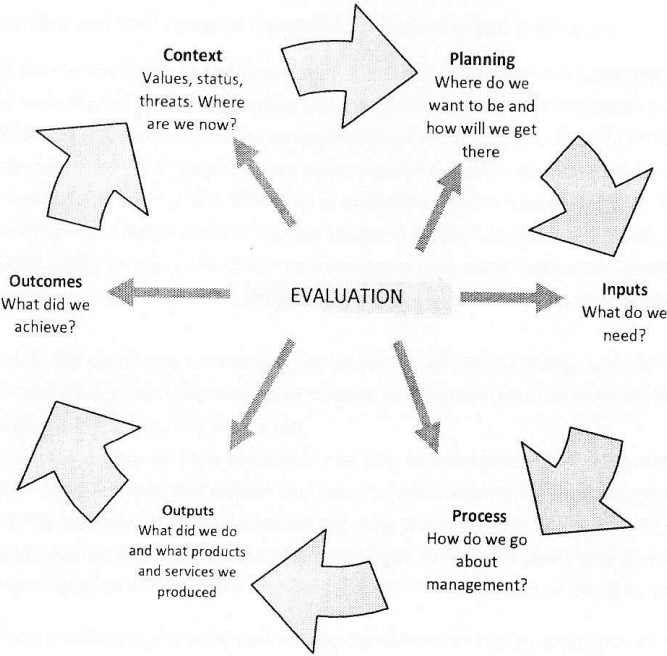


Figure 5 Framework for assessing management effectiveness (Walker et al. 2009 after Hockings et al. 2006).

Key concepts to consider....

- ▶ appreciate that sea level rise will continue for centuries, with impacts which last for millennia;
- ▶ think of climate change as a ‘wicked problem’;
- ▶ beware the dead-end of ‘mal-adaptation’;
- ▶ recognise the danger of a false sense of security;
- ▶ costs increase when decisions, actions are delayed ;
- ▶ horses for courses - one solution will not fit all!

Conclusions ...

- ▶ **climate change is real ... let's get ready to act!**
- ▶ **every part of estuary coast poses its own challenges;**
- ▶ **a framework (CZMP) exists for considering 'options';**
- ▶ **a range of materials are available to assist processes of option design and selection within CZMP;**
- ▶ **urgent progress in plan implementation is needed;**
- ▶ **State Government funding/ support will be required.**

Thank you.

I would welcome your feedback on this presentation.

Email < johnr.corkill@gmail.com >

Questions? Comments?



Cape Byron (back left) and rubble rock seawall at Belongil beach (mid right),
Byron Shire 2013