

# Coastal adaptation: the incorporation of climate change into coastal risk planning

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# Sea Level Rise Scenarios

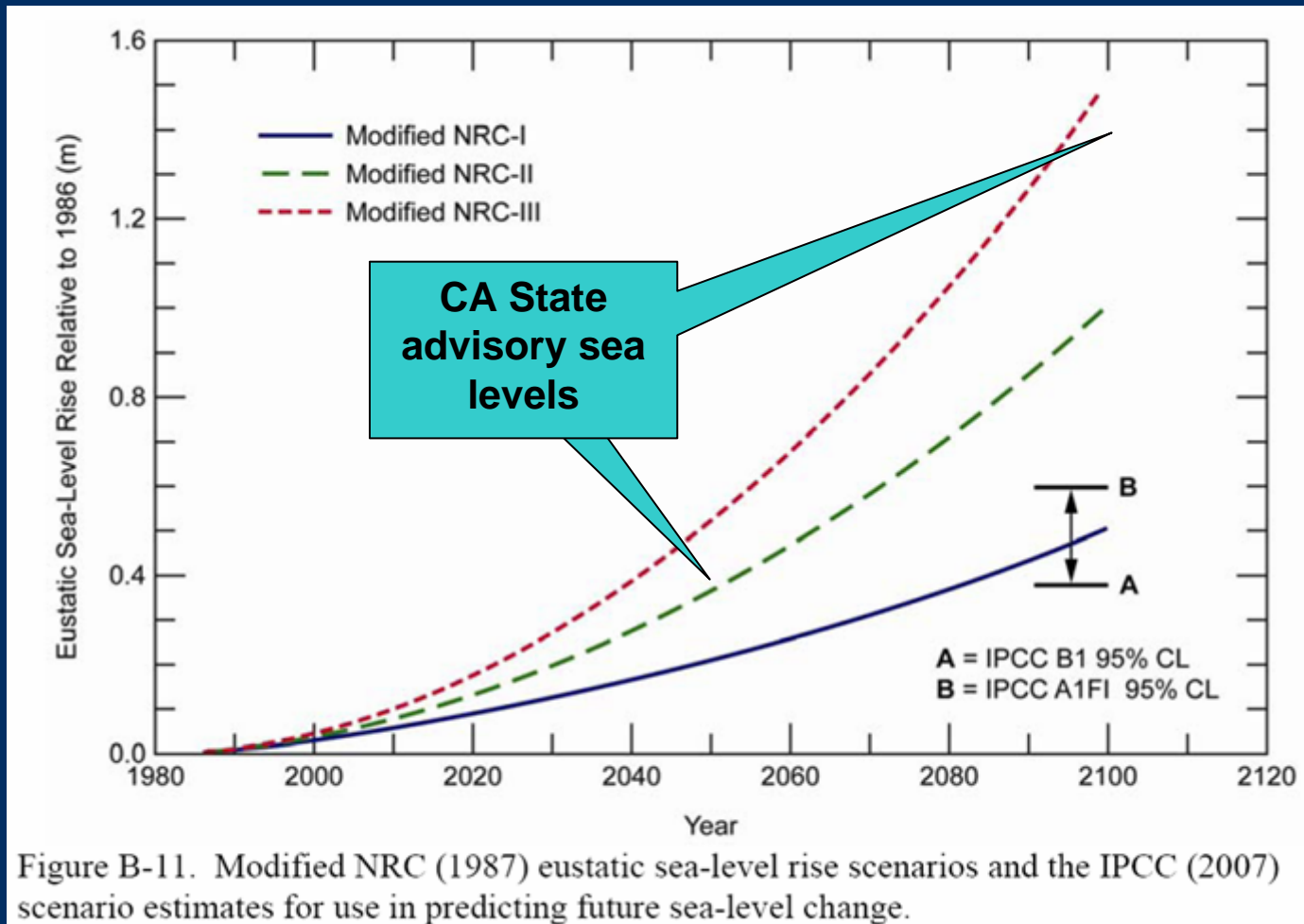
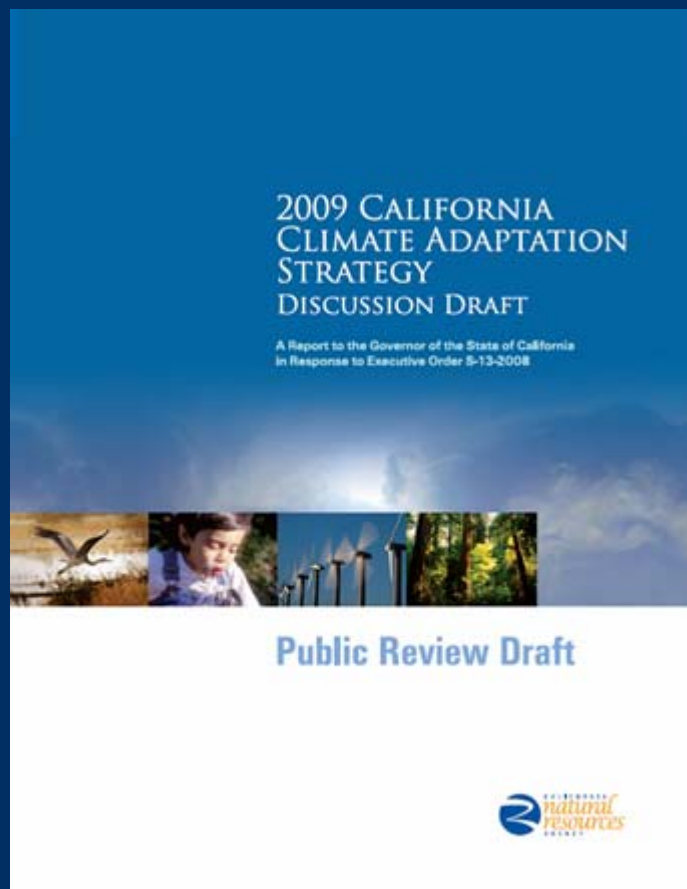


Figure B-11. Modified NRC (1987) eustatic sea-level rise scenarios and the IPCC (2007) scenario estimates for use in predicting future sea-level change.

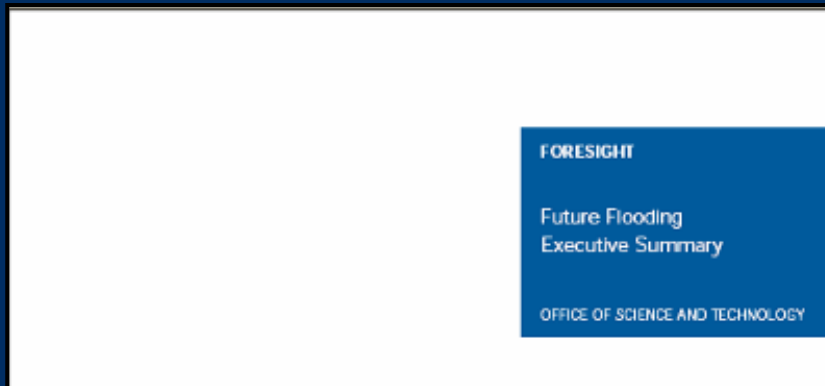
*USACE Guidance for Incorporating Sea-Level Change, EC1165-2-211, July 2009.*

# A recognized need for adaptation

- Climate science and impacts studies well established in the US
- However, application of this understanding to planning and management decisions – climate adaptation – is rare
- CA Governor's Executive Order S-13-2008 and 2009 CA Climate Adaptation Strategy (discussion draft)
- National Research Council, 'Informing Decisions in a Changing Climate' (2009): *usual decision making practices are no longer valid*
- US GAO study of climate change adaptation implementation (Oct 09) for the 'Subcommittee on Energy and Environment': *reviewed UK as international best practice*



# UK Exposure



**By 2080**

**Annual flood damages: from £1Bn to over £20Bn**

**Significant threats to low lying coastal land & habitats**

**Manage with: £52Bn (structural only) to**

**£22Bn (structural & non-structural)**

**[www.foresight.gov.uk](http://www.foresight.gov.uk)**

# Climate Change Allowances 1

Minimum sea level rise allowances (Defra, 2006):

Region	Vertical Land Movement (mm/yr)	Net Sea-Level Rise (mm/yr)			
		1990-2025	2025-2055	2055-2085	2085-2115
East of England, East Midlands, London, SE England	-0.8	4.0	8.5	12.0	15.0
South West England and Wales	-0.5	3.5	8.0	11.5	14.5
NW England, NE England, Scotland	+0.8	2.5	7.0	10.0	13.0

<http://www.defra.gov.uk/enviro/fcd>

# Climate Change Allowances 2

Other climate change factors (Defra, 2006)

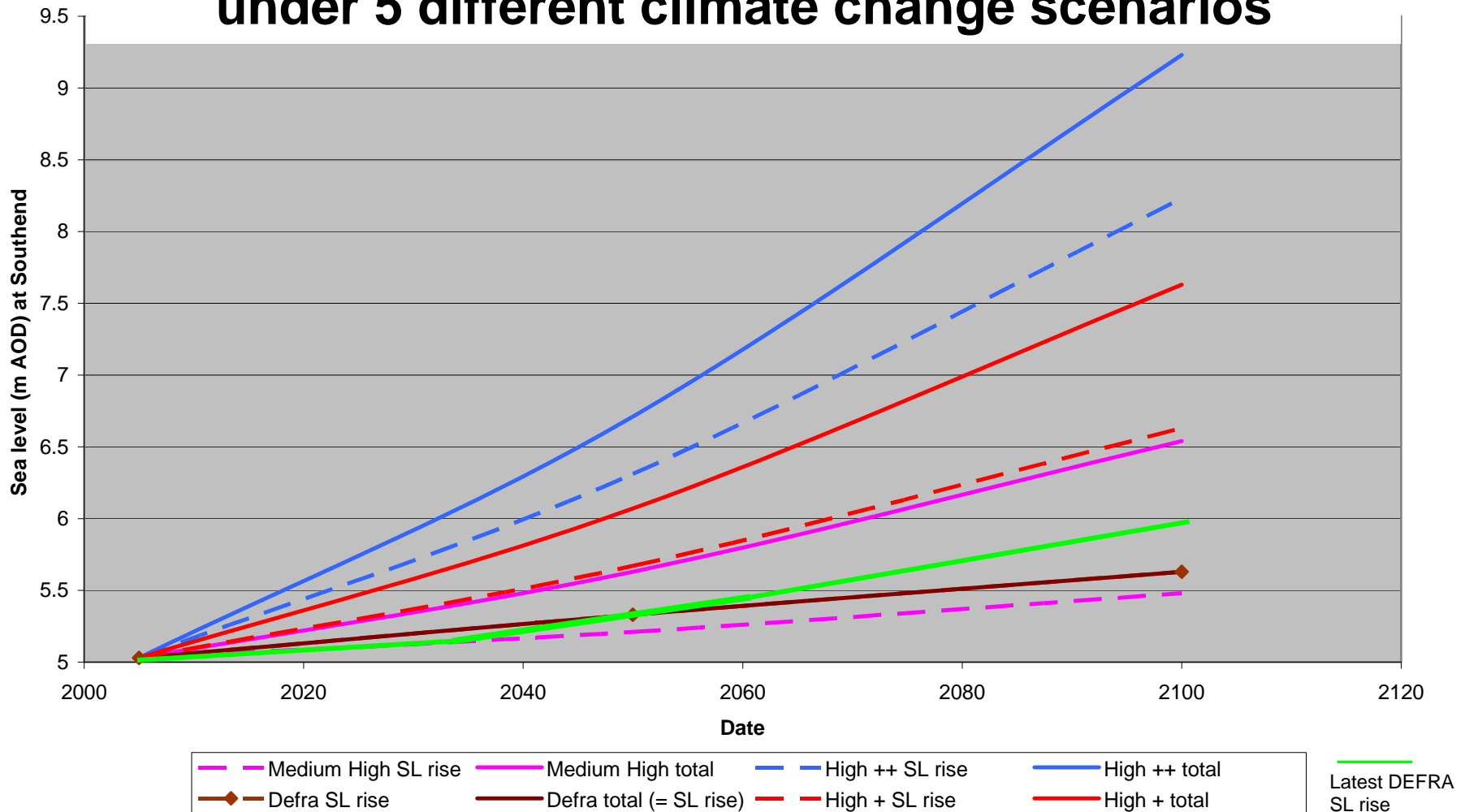
Parameter	1990-2025	2025-2055	2055-2085	2085-2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow volume	+10%	+20%		
Offshore wind speed	+5%		+10%	+10%
Extreme wave height	+5%		+10%	+10%

Precautionary approach:

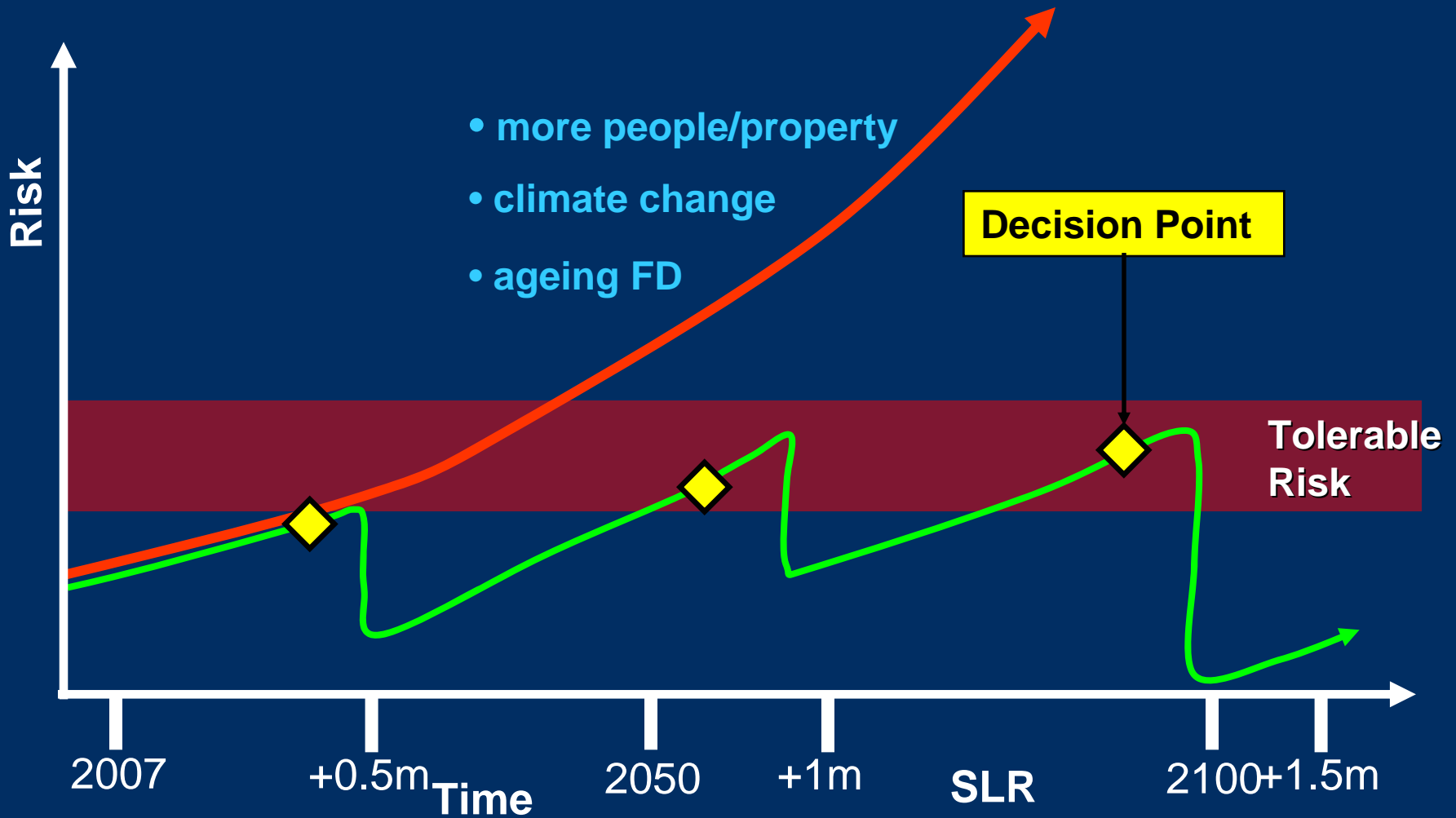
- Short-term 'no regrets' actions
- Longer-term 'adaptive approaches'

# Thames Estuary Sea Level Scenarios

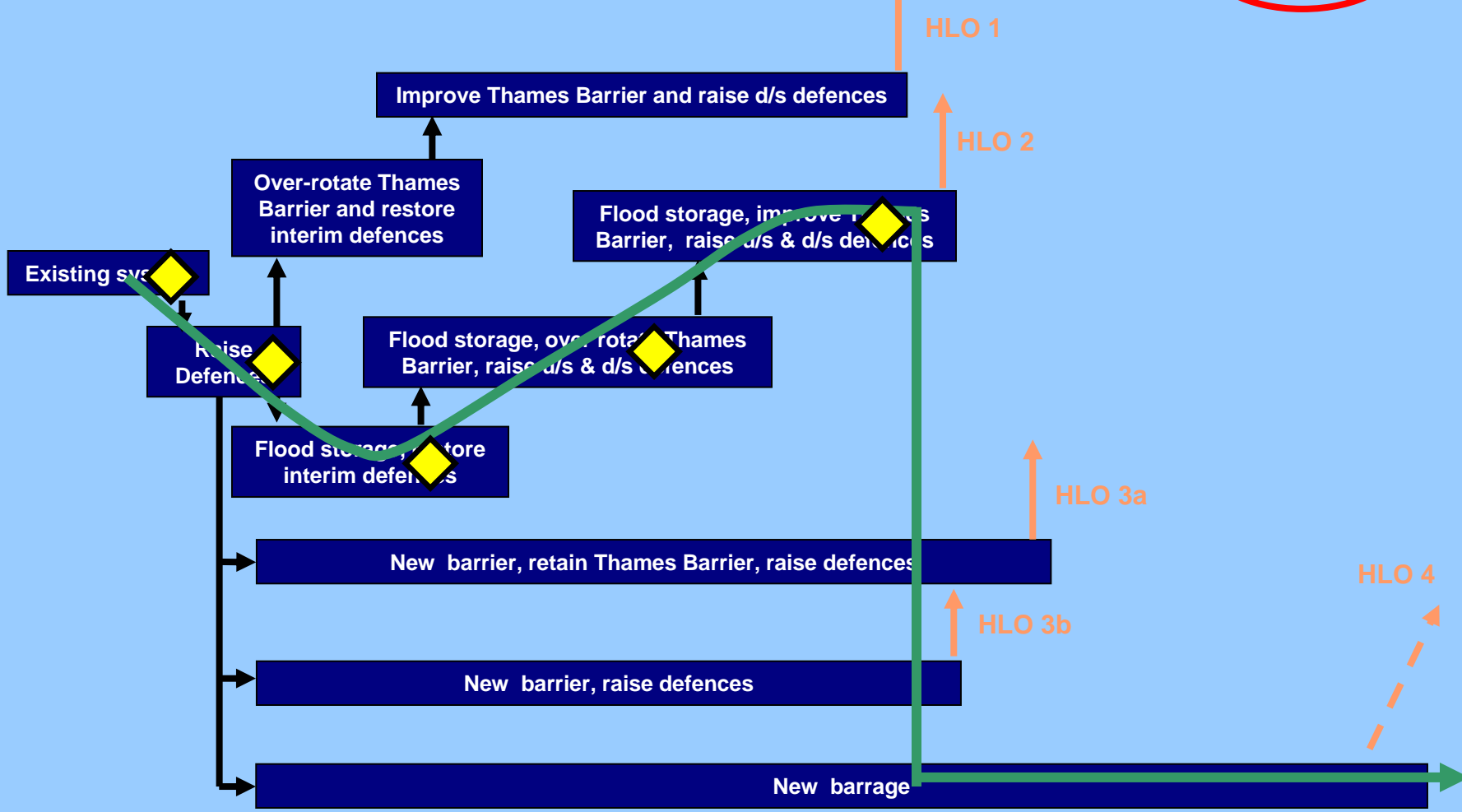
## Increases in peak 1000-year levels at Southend under 5 different climate change scenarios



# Limits to Adaptation



Max water level rise:



The final plan may be a combination of approaches

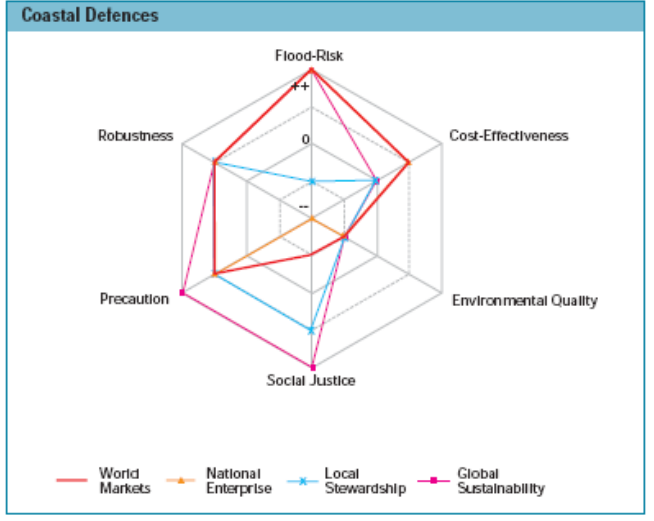
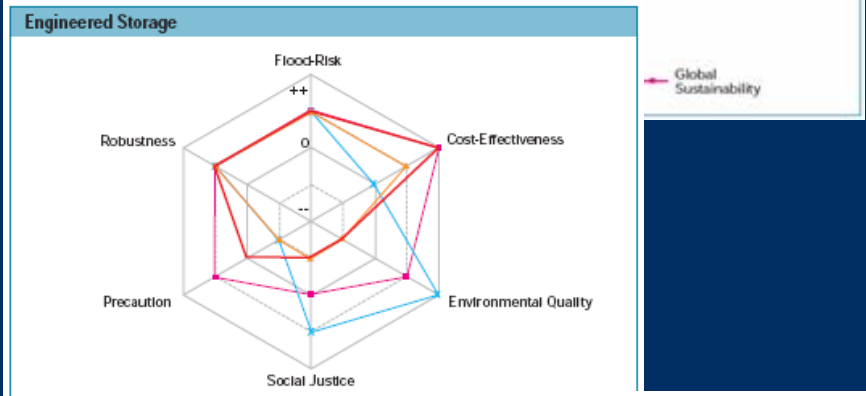
# Decision Making Criteria

## Sustainability Metrics:

- **Robustness** – performance across range of scenarios
- **Precaution** – scientific certainty of outcomes
- **Social Justice** – equitable distribution of benefits
- **Cost-effectiveness** – return on investment
- **Environmental Quality** – impacts on ecosystems, etc
- **Adaptable** – complements other options
- **Timeliness** – ability to deliver in time to meet need

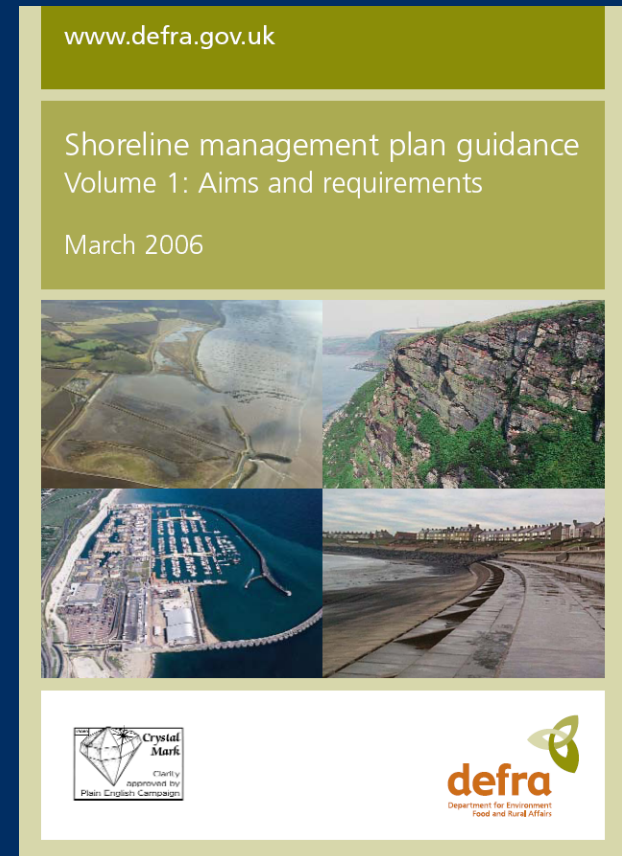
Table 2.13 Descriptors of the sustainability criteria scoring scale

Score	Robustness	Precaution	Social Justice	Cost-Effectiveness	Environmental Quality
++	The action can be implemented in all four socioeconomic/ climate scenarios, and successfully addresses flood risk.	Justifications for pursuing the response action (and alternatives), as well as its potential risks, are systematically and openly scrutinised. Although some risks associated with action are unknown, expert and local knowledge is sought to address ignorance in ongoing regulatory appraisal, including the strategic anticipation of serious events. Monitoring and hazard warning systems are in place for timely responses when concerns are identified. Values and concerns of different social groups are taken into full consideration.	The action increases the capacity to deliver improved standards of social justice (fairness in distribution of benefits and costs, and in engagement), promptly, and with associated progressive re-evaluation.	The action is highly cost effective, with substantial net benefits.	The action strongly enhances biodiversity, improves environmental quality (habitats, water quality).
+	The action can be implemented in all four scenarios.	Risk assessments for the action and some ongoing monitoring activities are carried out; regulatory appraisal is timely.	The action provides some capacity to deliver improved standards of social justice.	The action is cost-effective, with some net benefits.	The action has a positive effect on biodiversity and environmental quality.
0	The effect of implementing the action is scenario-independent.	Existing precautionary approaches are adopted unchanged. No effect on society's ability to cope with uncertainties, including those relating to climate change.	No deterioration of social justice.	The action is marginally cost-effective.	No effect on biodiversity indices or environmental quality measures.
-	The action cannot adequately be implemented under one or more scenarios; or implementing the action has a mixed effect (social, economic or environmental) depending on the scenario.	Implementation of response action is not accompanied by ongoing technological and regulatory appraisal of risks and benefits. Inadequate research into early warnings and a non-inclusive approach to information gathering restricts timely responsiveness to emerging concerns.	The action reduces capacity to deliver minimum standards of social justice.	The action is costly and benefits are very limited.	The action causes some loss of biodiversity.
--	The action is impossible to implement under one or more scenarios; implementing the action has a strongly adverse effect under one or more scenarios.	Implementation of response action has inadequate technological and regulatory appraisal of risks and benefits. Inadequate research into early warnings, limited information gathering, and failures in institutional communication means that risks are not understood until the costs and impacts are very severe.	The action strongly reduces capacity to deliver minimum standards of social justice, which causes measures of social justice to worsen.	The action is costly, and benefits are unlikely to be realised.	The action causes severe loss of biodiversity and negative impacts on habitats and water quality.



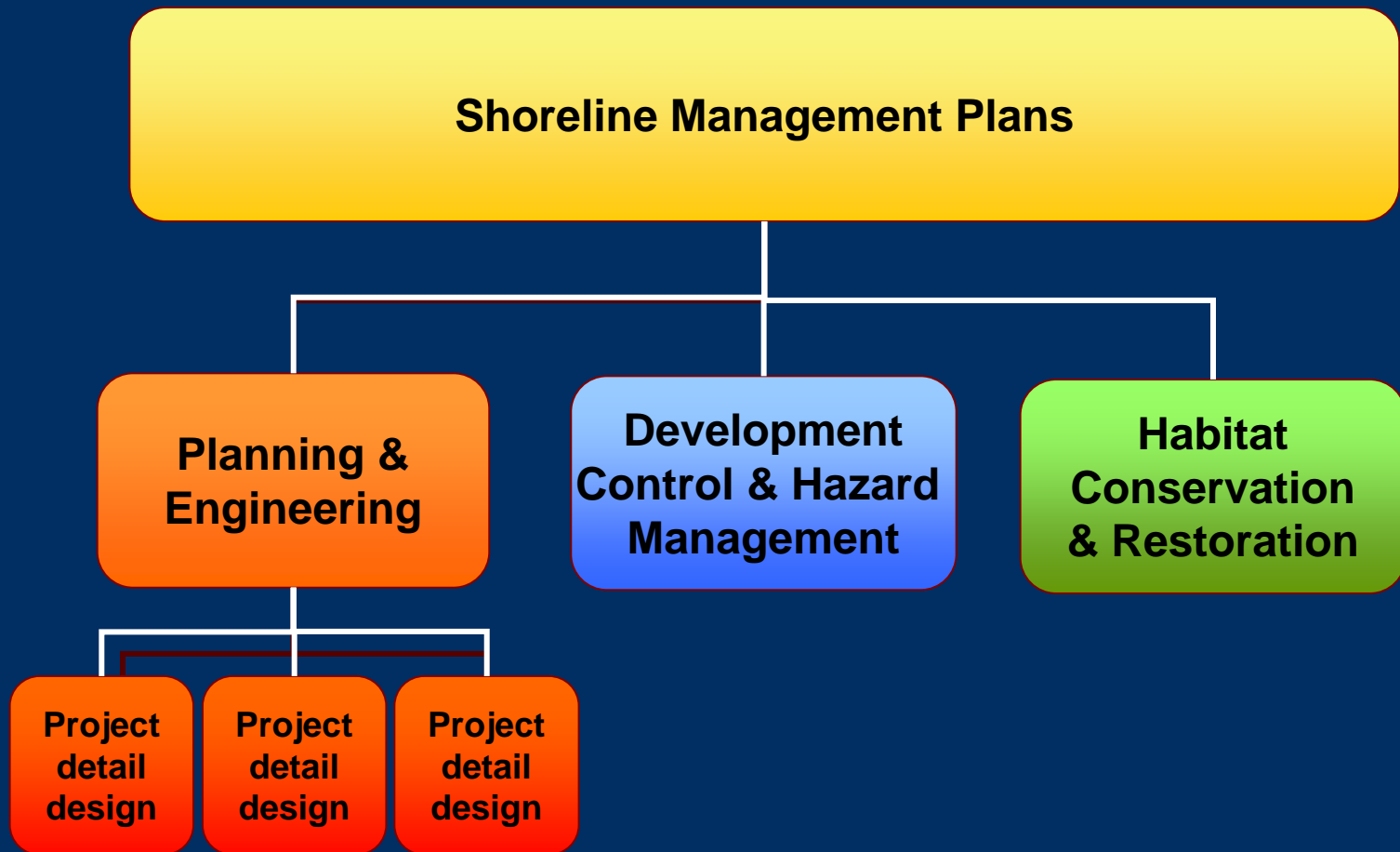
# Sustainable Risk Management Plans

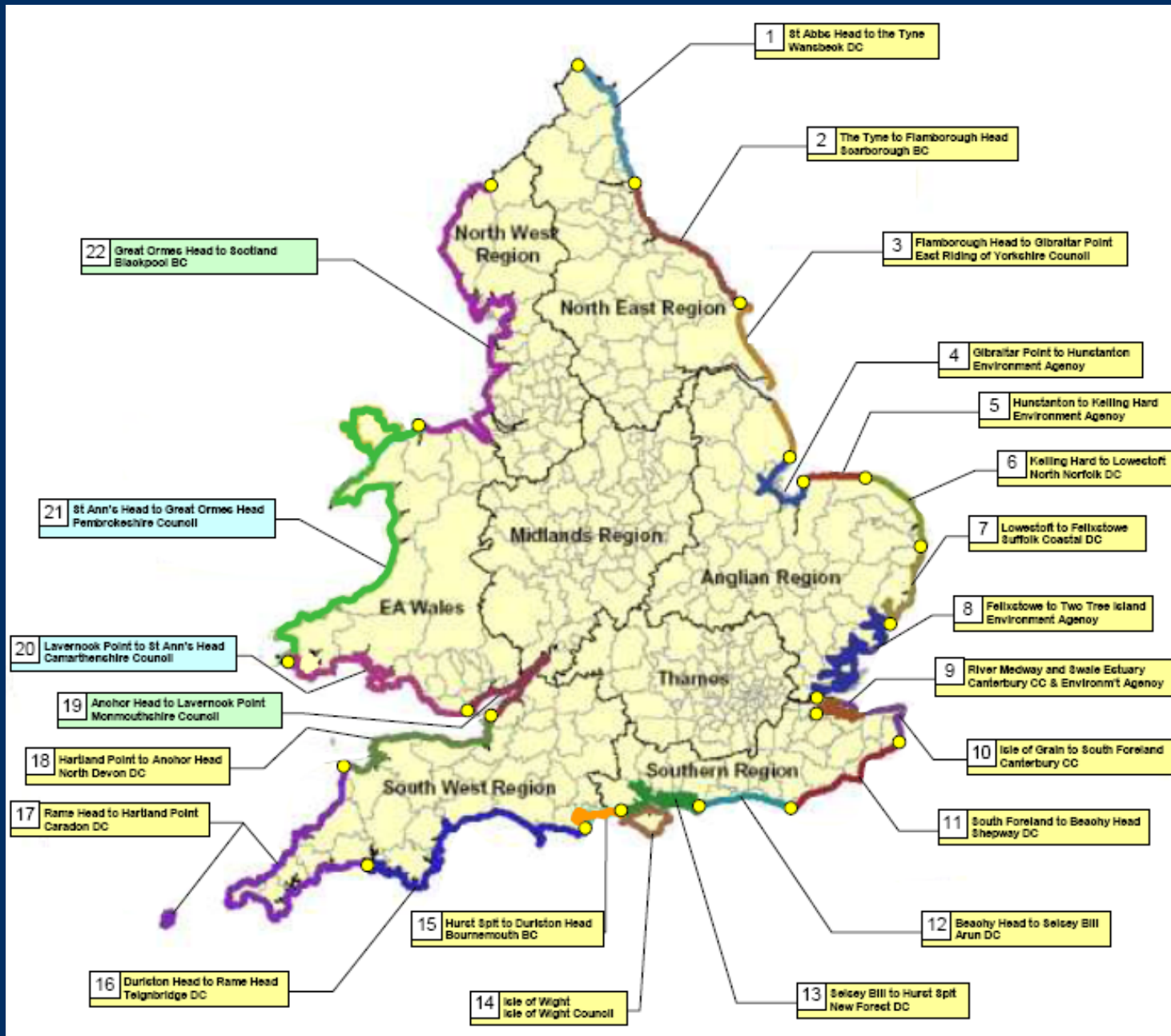
- Long-term adaptation plans for all coastal cells & watersheds
  - Identify sustainable, adaptive policies to manage risks
- Underpinned by sound science
  - Geomorphological analysis & modeling
  - 100-year evolution & hazards
- Consider 20, 50 and 100-year time steps
  - Work toward 100-year vision
- Stakeholders involved throughout
  - Elected officials group
  - Planning community
- Integration of approaches to flood risk management, including:
  - habitat conservation & restoration
  - land use
  - development planning
  - flood protection works
  - flood warning and emergency response
- Reviewed every 5-10 years



<http://www.defra.gov.uk/environ/fcd/guidance/smp.htm>

# Sustainable Risk Management Framework





# North Norfolk Shoreline Management Plan

## Short-term

- Continue with present measures
- Strategy for future change

## Long-term

- Probable loss of over 1,000 properties (up to 2,500)
- Protection of between 3,000 and 4,000 properties (compared to No Action)
- Improved sediment linkages
- Conservation of important habitats
- Avoid unrealistic commitment to uneconomic protection & relocate unsustainable assets

# Coastal Change Policy

Options to manage implementation of 'realignment' policies:

- Coastal Change Fund
- Engagement/awareness
- Community adaptation plans
- Land use planning
  - Rollback (easements), time limited consent, etc
- Property buy & lease-back
- Habitat 'corridors'

[www.defra.gov.uk](http://www.defra.gov.uk)

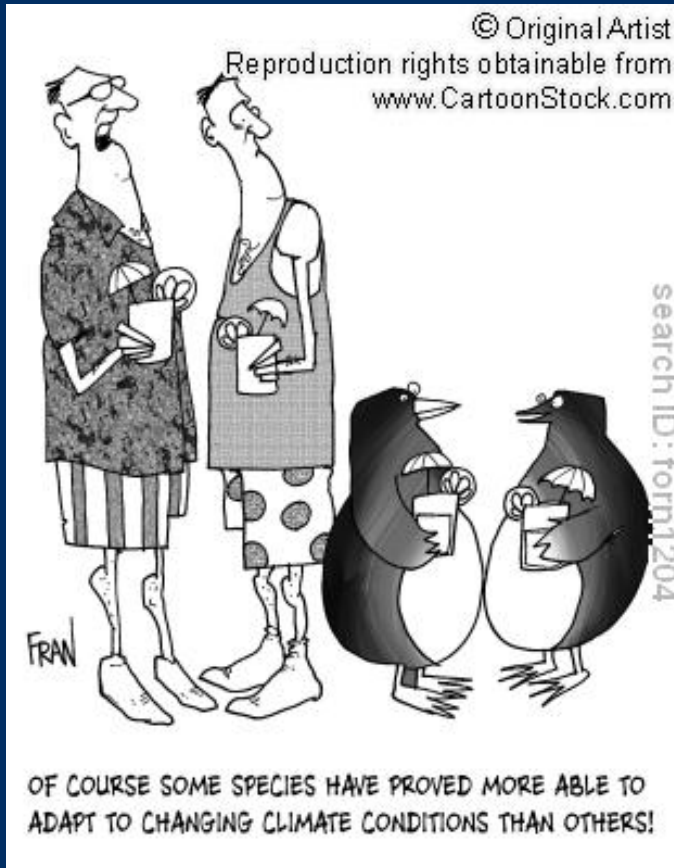
Consultation on Coastal Change Policy

June 2009



# Conclusions

- Climate change uncertainty is creating a **new 'dynamic' decision environment** ... important to use **open and transparent decision making processes** to gain stakeholder support.
- We mustn't allow uncertainty over exact levels of future changes deter us from **taking action now** ... we **must be pro-active** in identifying future challenges.
- Vital that we **build climate adaptation capacity** into today's decisions ... optimal solutions may have **long lead times**.
- Incorporate advisory climate change projections and projected impacts into all planning processes, **e.g. community plans, hazard mitigation plans, land use plans, etc**
- Determine potential future hazards/risks and appraise potential response options, **ensure we have or create capacity to achieve most sustainable options** ... incorporate into RSM Plans?



*Thank you for your time!*

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