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Towards a legal framework for coastal adaptation: Assessing the first steps in Europe and Australia

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Abstract

In light of the urgent need for coastal adaptation policies and the impediments to their implementation, this article examines the early experience with coastal adaptation policies in the EU and Australia, with a view to identifying the important features of a regulatory framework for coastal adaptation. We conclude that an integrated approach to coastal adaptation law is currently needed to lay the foundations for the required long term strategy. Such an approach would establish processes by which adaptation objectives are agreed for each part of the coast; ensure land use planning that can accommodate future change and does not expose new communities to risk; integrate coastal adaptation with biodiversity and coastal zone policy; allocate regulatory responsibility in a way that promotes subsidiarity and consistency; and ensures that funds are available for future measures.

1. Introduction: the impact of climate change on coasts and adaptation

Responses to the impact of climate change on coastal areas is one of the most debated elements of adaptation policy and law. This is not surprising, given the expected effects of climate change on the coasts and coastal populations. The Intergovernmental Panel on Climate Change (IPCC) projects an accelerated sea level rise of up to 0.6 m or more by 2100, or more if the potential breakdown of the West Antarctica and Greenland ice sheets is taken into account, with levels continuing to rise for many centuries beyond 2100.² Storms temporarily exacerbate higher water levels, by 20-110 centimetres³ and increasing storm intensity and larger storm surges as a result of climate change will combine with rising sea levels to cause more coastal erosion and inundation of low lying areas.

The situation is further aggravated in some parts of the world by a range of local factors, such as soil subsidence. In north western Europe, subsidence is a legacy of the last glacial period ending 10,000 years ago. By 2100, the Netherlands, for example, will, locally along the coast, have experienced soil subsidence of 1.0 m on today's level.⁴ The combined effect of sea level rise,

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² IPCC Fourth Assessment Report, Climate Change 2007: Impacts, Adaptation and Vulnerability, p. 317.

³ Taking the North Sea area as an example, see IPCC, p. 325 (Figure 6.4).

⁴ Delta Committee 2008, Working with water, p. 34. The report is available from the committee's website at http://www.deltacommissie.com/doc/deltareport_full.pdf. Locally, additional subsidence is caused by groundwater extractions, gas extractions and peat decomposition. Gippsland, in coastal Victoria, Australia, is already struggling with a 2 meter subsidence, see University of New South Wales Connected Waters project,

storm surge and subsidence in the Netherlands will be equivalent to a relative sea level rise of over 1.3 m by 2100 and 2-4 metres by 2200.⁵

Close to one quarter of the world's population lives within 100 km zone of the coast.⁶ The coastal population is projected to grow from 1.2 billion people in 1990 to 1.8-5.2 billion people by the 2080s, depending on assumptions about migration.⁷ The value of the economic assets within 500 m of the European coastline alone is estimated at € 500-1000 billion. Over one third (€ 3.5 trillion) of the total GDP of the 22 coastal member states of the EU is generated within 50 km of the coast.⁸ Many of these areas are already just above or even below the current sea level and are protected from the sea by man-made sea defences. In Europe, the North Sea region in particular depends heavily on coastal defence works.⁹ Some of these have been in place for centuries and most are vulnerable to the impacts of climate change.¹⁰ European cities like London and Rotterdam, as well as major Asian coastal cities like Tokyo and Shanghai depend almost entirely on engineered coastal fortification to protect them from coastal processes.¹¹

Many densely populated coastal areas are estuaries or deltas. The majority of the biggest cities in the world are located on estuaries, including New York City, Sydney, Calcutta, Hong Kong, Shanghai, and Buenos Aires.¹² These areas not only face sea level rise, but are also confronted with altered precipitation and run-off under climate change¹³ which may lead to freshwater estuarine flooding. Most deltas are also undergoing soil subsidence that results in accelerated rates of relative sea-level rise above the global average.¹⁴ The combination of all of these factors (high river water levels, a storm at sea and increased relative sea level) makes deltas particularly vulnerable to the impacts of climate change.

In light of these projected impacts, the IPCC concludes that effective adaptation is urgently required, and argues that adaptation and disaster response measures should be integrated into coastal management plans.¹⁵ The IPCC defines adaptation as 'the adjustment of natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities'.¹⁶ It recognises that adaptation can be anticipatory or reactive, planned or autonomous, public or private,¹⁷ and categorizes coastal adaptation measures as follows according to the objectives of protection, accommodation or retreat.

Subsidence in Groundwater Basins, online publication at

<http://www.connectedwaters.unsw.edu.au/resources/articles/subsidence.html> (last visited 30 May 2011).

⁵ Delta Committee 2008, p. 25.

⁶ IPCC, p. 319.

⁷ IPCC, p. 317.

⁸ Policy Research Corporation, The economics of climate adaptation in EU coastal areas, Summary Report, Luxemburg 2009, p. 3.

⁹ European Commission, European Atlas of the Seas, online application,

http://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas/#theme=themeSecurityAndSafety.CDW&extent=17_32_37.7_56.2&=null (last visited 26 May 2011).

¹⁰ IPCC, p. 333.

¹¹ IPCC, p. 333.

¹² The IPCC reports that nearly 300 million people inhabit a sample of 40 deltas globally and that much of this population is at risk through coastal erosion and land loss as a result of decreased sediment delivery by the rivers and of sea-level rise, IPCC, p. 327.

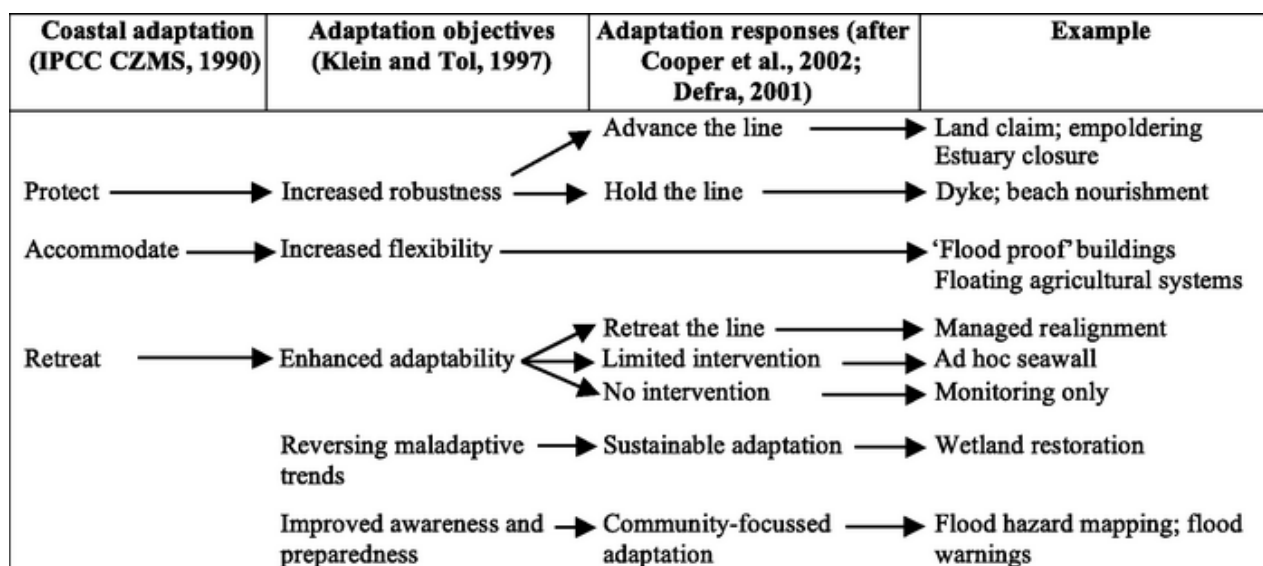
¹³ IPCC, p. 317.

¹⁴ IPCC, p. 327.

¹⁵ IPCC, p. 340.

¹⁶ IPCC, p. 750.

¹⁷ IPCC, p. 720.



Taken from IPCC 2007, p. 342: Figure 6.11. Evolution of planned coastal adaptation practices.

In many places, some options will be technically impossible or economically unviable. Even where technical solutions are feasible, all of these measures face institutional and legal challenges because of different views of the stakeholders involved in coastal development issues.¹⁸ Societal opposition to adaptation measures varies enormously because of individual community preferences, priorities and values and the different costs, impacts and implications of each option.¹⁹ Opposition may focus on seawalls because of the associated destruction of existing coastal ecosystems. Wetland restoration and floodplain creation may face opposition as well, because of its perceived increase in flood risks when existing fixed structures are replaced by more natural flood defences.²⁰ In Australia, coastal property owners have already challenged adaptation policies aimed at coastal retreat,²¹ and there is public debate over those aimed at building sea walls.²²

In addition to the technical, financial and political constraints on coastal adaptation options, fragmented and ineffective institutional arrangements and weak governance also constitute important barriers to developing and implementing coastal adaptation policies.²³ In many places, it is difficult, if not impossible, to garner the cooperation of all landowners, and local and regional authorities so as to develop coherent new or improved coastal defences.

In light of the urgent need for coastal adaptation policies and the impediments to their implementation, this article examines the early experience with coastal adaptation policies in the EU and Australia, with a view to identifying the important features of a regulatory framework for coastal adaptation. Our focus is on regulation because previous research on coastal adaptation law has shown that the judiciary has neither the jurisdiction nor the capacity to respond proactively or systematically to meet new policy challenges. While judicial decisions can drive

¹⁸ IPCC, p. 340.

¹⁹ W.N. Adger, J. Barnett, Four reasons for concern about adaptation to climate change, (2009) *Environment and Planning A*, 41(12):2800–2805, <http://dx.doi.org/10.1068/a42244>.

²⁰ J. Verschuuren, the Case of Transboundary Wetlands under the Ramsar Convention: Keep the Lawyers Out! *Colorado Journal of International Environmental Law and Policy* 19:1 (2008), p. 101.

²¹ *Byron Shire Council v Vaughan*, Land and Environment Court of New South Wales, 40342 Of 2009 and 40344 of 2009, Consent Order dated 1 February 2010.

²² As apparent from media coverage, for instance of sea wall construction at Portsea beach, see <http://www.abc.net.au/news/2010-12-16/continuing-anger-over-portsea-beach-erosion/2375968>

²³ IPCC, p. 341 (table 6.9).

policy change, they can only ever respond to specific disputes and the outcome of such cases binds only those parties to the dispute.²⁴ Furthermore, while voluntary or autonomous adaptation may be appropriate in some cases, the interconnectedness of coastal and other impacts demands a planned response in order to minimise adverse impacts arising from the implementation of particular policies.

This analysis compares EU, in particular the Dutch and English,²⁵ and the Australian experiences with coastal adaptation. Both the Netherlands and Australia have a heavily populated coastline, and England, especially the greater London area, is vulnerable to the consequences of sea level rise. All three countries initiated early coastal adaptation policies,²⁶ but these policies have differed markedly in approach. In 2011, the Netherlands redesigned large parts of its existing laws and adopted new legislation specifically aimed at increased coastal adaptation efforts because of climate change. These measures responded to both the deeply rooted memory of the 1953 inundation of the south western coast that killed 1,835 people, and the 1995 high water event during which 250,000 people had to be evacuated from their homes and extensive floods were only just prevented.²⁷ The new laws partly follow from EU Directives in the field of water and marine law, so an examination of the Netherlands reforms also serves as a lens through which to consider the EU's approach to coastal adaptation. In contrast to the Netherlands' heavily centralised strategy for coastal adaptation, recent reforms in the UK adopt comprehensive coastal adaptation policies using a more localised approach. In Australia, adaptation policies to date have tended to lack legislative authority, preferring policy statements and planning instruments. Courts have had to deal with an increasing number of cases involving coastal erosion and local authorities' action or inaction in response to that erosion.²⁸ Although this legislative inertia is heavily criticized by some Australian scholars,²⁹ the evolving practices of planning courts and tribunals do bring to light further elements for the model regulatory framework that is the goal of our study.

The article is organised into four remaining parts. Part Two outlines the current international and regional frameworks for adaptation in general and coastal adaptation in particular, including the UN Framework Convention on Climate Change (UNFCCC)³⁰ and EU law. Part Three sets out the policy, legislative and judicial responses to coastal adaptation in the Netherlands, England, and Australia. Elements of the international and domestic frameworks that are considered essential for effective adaptation are identified and discussed in Part Four. Part Five presents our conclusions.

²⁴ B.J. Preston, *The Role of Courts in Relation to Adaptation to Climate Change*, in: T. Bonyhady, A. Macintosh, J. McDonald (eds.), *Adaptation to Climate Change. Law and Policy*, The Federation Press, Sydney 2010, p. 200.

²⁵ In the UK, coastal adaptation rests with the four devolved administrations, England, Wales, Scotland, and Northern Ireland.

²⁶ Already in 1989, three years before the UNFCCC was signed, an interdepartmental committee in Queensland advised the government to immediately take coastal adaptation policies, particularly through the management of land use. The 1989 discussion paper referred to the Netherlands to underpin its statement that early action would be much more cost effective than delaying action. For an account of these early adaptation attempts, see T. Bonyhady, *Swimming in the Streets. The Beginnings of Planning for Sea Level Rise*, in: Bonyhady/Macintosh/McDonald (eds.), *supra* n. 24, p. 85-86. Bonyhady concludes that that first policy ideas 'went nowhere'.

²⁷ Parliamentary documents 2009-2010, 32 304, no. 3, p. 1-2.

²⁸ These differences between the two countries are partly connected to differences in predominant political views over the past ten years or so, partly to having a civil law system, primarily relying on government legislation (The Netherlands), and a common law system, with a greater emphasis on the role of the judiciary (Australia), and partly to the constitutional background which allows for greater (The Netherlands) or less (Australia) central involvement into local or regional policy and law.

²⁹ For instance Bonyhady, *supra* n. 26.

³⁰ (1992) 31 ILM 849.

2. The international legal framework for coastal adaptation

Both the UNFCCC and the Kyoto Protocol³¹ contain provisions relating to adaptation. Article 4(1) of the UNFCCC lists the adaptation commitments of the Parties, including implementing national and regional programmes, integrating adaptation measures in the relevant social, economic and environmental policies and actions, promoting and cooperating in research, exchanging information, and promoting and cooperating in education, training and public awareness. Article 4(1)(e), provides that Parties to the UNFCCC shall

cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods;

Article 4(8) obliges all Parties to focus on the specific needs and concerns of developing country Parties arising from the adverse effects of climate change and the impact of the implementation of response measures. Small island countries and countries with low-lying coastal areas, that is, countries that are especially vulnerable to sea level rise, are particularly mentioned here. The Adaptation Fund was established in 2001 under the Kyoto Protocol to provide financial assistance to such countries.³² Its aim is to finance concrete adaptation projects in developing country parties to the Kyoto Protocol. The first adaptation project - an adaptation project to coastal erosion due to sea level rise in Senegal³³ - was funded in 2010, almost ten years after the decision was taken to establish an adaptation fund. There is growing recognition of the need for enhanced international frameworks for adaptation, particularly to assist developing countries: the 2009 Copenhagen Accord and the 2010 Cancún conference of the parties both addressed the importance of adaptation financing, and identified the need for institutional and technical infrastructure to support adaptation efforts.³⁴

Within other international legal frameworks, there is growing attention on coastal adaptation. Coastal and riverine wetlands are considered to be important in any coastal adaptation policy because they offer natural sea defences (mangroves, dunes and others) or can be used as natural floodplains or water storage areas in high water situations.³⁵ In 2002, the *Ramsar Convention* Conference of Parties adopted a resolution on adaptation to climate change and wetlands, in which the Parties are called upon to reduce the risk of flooding and drought by promoting wetland and watershed protection and restoration.³⁶

Attention is also being paid to coastal adaptation measures under the Convention for the Protection of the Marine Environment of the North-East Atlantic (the *OSPAR Convention*). In a 2009 Report, the OSPAR Commission reviewed the national adaptation policies of its member

³¹ (1998) 37 ILM 22.

³² The Adaptation Fund was established during COP7 of the UNFCCC in Marrakesh in 2001, but it operates under the Kyoto Protocol, see Decision 10/CP.7, FCCC/CP/2001/13/Add. 1, p. 52.

³³ Information on the projects funded under the Adaptation Fund is available from the AFB's website at <http://www.adaptation-fund.org>.

³⁴ Decision 2/CP.15, Report of the Conference of the Parties on its Fifteenth Session, Copenhagen, 7-19 December 2009, FCCC/CP/2009/11/Add.1 (30 March 2010) (Copenhagen Accord), at [8]-[10]; Decision 1/CP.16, Report of the Conference of the Parties on its Sixteenth Session, Cancún, 29 November – 10 December 2010, FCCC/CP/2010/7/Add.1, (Convention Agreement), at [20] and [95]-[112].

³⁵ See already the 1999 report by G. Bergkamp, B. Orlando, *Wetlands and Climate Change*, IUCN background document, 1999, available at http://www.ramsar.org/cda/en/ramsar-activities-wetlands-and-climate/main/ramsar/1-63%5E21076_4000_0__

³⁶ Resolution VIII.3, adopted at COP8, Valencia, November 2002.

states and urged states to integrate adaptation measures into Integrated Coastal Zone Management (ICZM) and marine spatial planning, as facilitated by both the OSPAR Convention and the EU's Marine Strategy Framework Directive and the Water Framework Directive.³⁷ The report specifically mentions Dutch and UK examples of coastal adaptation measures and policies, detailed in Part 3 below. In addition, coastal adaptation is one of the key issues integrated in the North-East Atlantic Environmental Strategy, adopted at the 2010 OSPAR ministerial conference.³⁸ Also in 2010, the UN General Assembly encouraged states to develop means of marine and coastal adaptation under the UN Convention on the Law of the Sea (*UNCLOS*) and other relevant international frameworks.³⁹ The *UNCLOS* secretariat itself produced a general document on oceans and climate change, in which some attention is paid to adaptation by stating that the resilience of coastal ecosystems such as mangroves, salt marshes and sea grasses should be enhanced, that integrated conservation and management measures to protect marine species should be adopted and that the vulnerability of coastal communities, particularly in developing countries, should be reduced by capacity building and transfer of technology.⁴⁰

There are other examples of multilateral organisations in which similar developments are taking place especially those dealing with regional river basins or regional seas,⁴¹ but it is fair to say that the legal impact of these efforts so far is relatively low with the exception of the EU.

The EU's adaptation policy is generally not well developed because of the EU's focus on climate change mitigation, but it has adopted binding legislation forcing its member states to develop coastal and estuarine adaptation law. These requirements stem from the 2000 Water Framework Directive (WFD),⁴² the 2007 Floods Directive,⁴³ the 2008 Marine Strategy Framework Directive (MSFD),⁴⁴ as well as a series of non-legally binding policy documents in which member states are urged to incorporate adaptation in their coastal management.⁴⁵

The WFD provides a holistic legal framework for all water issues, i.e., water quality and water quantity issues, both of surface and ground waters, as well as coastal waters. It sets the institutional framework through river basin districts, river basin management plans and programmes of measures. Only the Floods Directive was explicitly adopted to address increased inland and coastal floods caused by climate change. The Floods Directive largely uses the institutional framework offered by the WFD, although it also allows for separate authorities to be appointed to address coastal floods.⁴⁶

³⁷ OSPAR Commission, Assessment of climate change mitigation and adaptation, London 2009, p.22-28, available at <http://www.ospar.org>.

³⁸ The North-East Atlantic Environment Strategy, Strategy of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic 2010–2020 (OSPAR Agreement 2010-3), Annex 25, available at <http://www.ospar.org>.

³⁹ Resolution 64/71 (114), A/RES/64/71, Distr.Gen. 12 March 2010.

⁴⁰ Division for Ocean Affairs and the Law of the Sea of the UN, Oceans and Climate Change, 2010, available at http://www.un.org/Depts/los/oceans_climate_change/oceans_climate_change_7_september_2010.pdf.

⁴¹ Among the many examples are for instance the Baltic Marine Environment Protection Commission (see <http://www.helcom.fi>), the International Commission for the Protection of the Danube River (see <http://www.icpdr.org>), and the Mekong River Commission (see <http://www.mrcmekong.org>).

⁴² Directive 2000/60/EC establishing a framework for Community action in the field of water policy, OJ L 327.

⁴³ Directive 2007/60/EC on the assessment and management of flood risks, OJ L 288.

⁴⁴ Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy, OJ L164.

⁴⁵ Such as the 2002 Recommendation 2002/413/EC concerning the implementation of Integrated Coastal Zone Management in Europe, OJ L 148, and the 2009 White Paper 'Adapting to climate change : towards a European framework for action', COM (2009) 0147 final.

⁴⁶ Art. 3(2)(b).

The Floods Directive advises member states to integrate flood mitigation measures into river basin management plans and programmes of measures.⁴⁷ It introduces three steps that are to be taken to address increasing flood risks. Firstly, a Preliminary Flood Risk Assessment (PFRA) must be carried out for each river basin district, based on past floods, but taking into account long term developments as a consequence of climate change.⁴⁸ The assessment must include maps of areas prone to flooding, as well as an assessment of the potential adverse consequences for human health, the environment, cultural heritage and economic activity.⁴⁹ All assessments must be completed by December 2011. The second step is to draft Flood Hazard Maps and Flood Risk Maps.⁵⁰ Flood Hazard Maps cover potentially flooded areas according to various scenarios (low-high probability, extreme events). For each scenario, Flood Hazard Maps must indicate the flood extent, water depths or water levels and the flow velocity. Flood Risk Maps show the potential negative consequences for each of the scenarios, i.e. the number of people affected, the type of economic activity affected, the industrial installations affected (because of pollution that may spread as a cause of flooding), and the areas where sediments, debris or pollution might end up. Both sets of maps are due in December 2013. Based on the PFRA and the maps, the third step involves adoption of Flood Risk Management Plans, aimed at the “three P’s”: prevention, protection, preparedness.⁵¹ Plans must include measures leading to a reduction in the negative consequences of flooding and in the likelihood of flooding through such instruments as flood conveyance routes, flood water retention areas and areas of controlled flooding. These measures may be implemented through reforms to land use planning, nature conservation and port infrastructure laws and requirements. Measures must not simply shift flood risks upstream or downstream. Flood forecasts and other early warning systems must also be set up.⁵² Flood Risk Management Plans are due in December 2015. All of these instruments must be updated every six years.⁵³ The Floods Directive may become integrated into a wider climate change disaster management policy which is currently being developed at the EU level.⁵⁴

Like the Floods Directive, the MSFD explicitly refers to climate change, but with less focus on adaptation. The Directive makes clear that integrated coastal zone management is the prime instrument for coastal adaptation and should be developed within the EU using the MSFD’s instruments, including the marine strategy and an associated programme of measures aimed at achieving improvements in the environmental status of marine and coastal waters.⁵⁵ The MSFD does not refer to flooding or to the Floods Directive. This compartmentalization is a major shortcoming since the Floods Directive addresses both inland and coastal flooding⁵⁶ and an integrated set of measures dealing with freshwater and salt-water flooding should be integrated in integrated coastal zone management.

The discussion in this part highlights the limited scope of international legal instruments dealing specifically with coastal adaptation. The EU’s water, flood and marine conservation directives provide more specific guidance for member states, but even these lack coordinated and coherent

⁴⁷ Art. 9.

⁴⁸ Art. 4(2).

⁴⁹ Art. 4(2)(d).

⁵⁰ Art. 6.

⁵¹ Art. 7 and Annex A.

⁵² There already exists a European Floods Alert System (EFAS), but this system is only meant to inform national authorities and not the general public. The latter has to be done by the competent national authorities, which may rely on information provided by EFAS. See the EFAS website at <http://floods.jrc.ec.europa.eu>.

⁵³ Art. 14.

⁵⁴ See the Commission staff working paper, Risk Assessment and Mapping Guidelines for Disaster Management, 21 December 2010, SEC (2010) 1626 final, and Commission’s Communication of 23 February 2009, ‘A Community approach on the prevention of natural and man made disasters’, COM(2009) 82 final.

⁵⁵ Art. 3 includes coastal waters in the definition of marine waters.

⁵⁶ Supra note 46.

requirements for coastal adaptation strategies per se. The next section examines how these requirements have been operationalised in two EU states and the approach taken by a non-EU state.

3. Current domestic legal framework for coastal adaptation measures in Europe and Australia

3.1 Europe

3.1.1 The Netherlands

Nearly 9 million people live in low lying parts of the Netherlands and about 65% of GNP is generated in that part of the country.⁵⁷ Much of this land is drained marshes and lakes or land reclaimed from the sea. For 1000 years, artificial dikes have been in place to protect areas that are below mean sea level against flooding by the sea and the rivers. Without the protection of dikes, dunes, and hydraulic structures, such as storm surge barriers, approximately 60% of the country would be flooded regularly.⁵⁸ Most of the land on the coastline, particularly the sand dunes and the dikes, is owned by the state. This makes implementation of coastal adaptation measures easier than in cases where coastal property is privately owned.

This history of land reclamation means that laws have been in place for centuries aimed at stringent dune management and building, and keeping rigid sea-defence structures.⁵⁹ Since the 1990's, regulation has required that the coastline has to be maintained at its 1990 position, irrespective of future sea-level and other conditions.⁶⁰ This approach has been criticized because it may not be the optimal response to climate change, with critics instead preferring measures that work with coastal dynamics and enhancing natural processes to provide a more resilient coastline in the long run.⁶¹ This new acceptance of coastal processes is slowly entering Dutch coastal adaptation policy and law.

The Netherlands has taken a holistic approach to all water issues, in line with the EU's Water Framework Directive. The *Water Act 2009* and the accompanying *Water Ordinance 2009* covers all water law, including rules on the prevention of flooding and the development of a marine strategy.⁶² The Act and Ordinance implement all the EU Water, Floods and Marine Conservation Strategy Directives.⁶³ Water policy in general has been decentralized to water boards (based on regional weirs) and provincial authorities, but responsibility for the main dikes and embankments along the coast and along the major rivers rests with the Minister of Infrastructure and the Environment and the national water management agency (*Rijkswaterstaat*).⁶⁴ The Minister is

⁵⁷ Delta Committee 2008, supra n. 4, p. 21. The report is available from the commission's website at http://www.deltacommissie.com/doc/deltareport_full.pdf.

⁵⁸ S.N. Jonkman et al., Flood Risk Assessment in the Netherlands: A Case Study for Dike Ring South Holland, *Risk Analysis*, 28:5 (2008), p. 1358.

⁵⁹ The first regional water authorities date back to the 13th century, Association of Regional Water Authorities, *Water governance*, The Hague 2011, p 14, available online at the Association's website at <http://english.uvw.nl/water-authorisation-publications-and-brochures.html>.

⁶⁰ R.J.T. Klein et al., Coastal Adaptation to Climate change: Can the IPCC Technical Guidelines Be Applied? *Mitigation and Adaptation Strategies for Global Change*, 4 (1999), p. 241.

⁶¹ R.J.T. Klein et al., Resilience and Vulnerability: Coastal Dynamics or Dutch Dikes? *The Geographical Journal* 164:3 (1998), p. 259-268.

⁶² Act of 29 January 2009, *Bulletin of Acts (Staatsblad)* 2009, 107; Ordinance of 30 November 2009, *Bulletin of Acts (Staatsblad)* 2009, 548.

⁶³ All elements covered by the Directives are present in this Act. We will not discuss these again here.

⁶⁴ Management of the coastal waters and the main rivers has been assigned to the Minister, according to Art. 3.1 and Annex II Water Ordinance.

required to cooperate with the other authorities involved, but has far-reaching powers to either force cooperation or overrule other authorities if necessary.⁶⁵

The National Water Plan 2009-2015 articulates the nation's overarching water policies and incorporates the four river basin management plans as required under the WFD.⁶⁶ The National Water Plan is the policy framework for three programmes relevant to coastal adaptation: the National Flood Defence Construction Programme, the Sand Nourishment Programme, and the Room for the River programme. Under the National Flood Defence Construction Programme, the primary weirs, i.e., the weirs that are in direct contact with sea water, are reviewed every five years, taking climate change scenarios for the Dutch coast into consideration. Those weirs that fail to meet required standards must be reinforced immediately. In a dedicated programme, special attention is given to priority 'weak links', which have been identified along the coast. These links are currently being strengthened so that they can withstand a 1:4000 year storm by 2015.⁶⁷

The Plan's main response to sea level rise is to promote large scale beach nourishment along the entire Dutch coast in a manner that disturbs natural processes as little as possible and at a scale necessary to keep pace with the actual sea level rise.⁶⁸ Under the Sand Nourishment Programme, sand nourishment takes place along the Dutch coast to replenish eroded beaches. An innovative experimental sand nourishment project is proposed. The so called 'sand engine' project involves the dredging and positioning of a super dune of sand in the sea in such a way and in a location that enables hydrological forces to spread the sand to where it is needed. If the experiment is successful, the sand engine will replace regular artificial sand nourishment.⁶⁹

Under the Room for the River programme, water storage areas to be used for controlled flooding, are designated in land use plans and natural floodplains are expanded using a combination of land use controls and compulsory acquisition.⁷⁰ These natural floodplains were developed to deal with high water levels in the river and to simultaneously create additional wetlands under nature conservation laws.⁷¹ Most of these policies are implemented under the Water Act, but some are undertaken pursuant to the Spatial Planning Act.

The Water Act contains safety norms for dikes and embankments, which vary between a 1:250 and 1:10 000 probability that critical water levels might be reached in any given year, depending on the number of people and infrastructure protected by the dike.⁷² The specific requirements for dikes and embankments in terms of height and strength are derived from that norm. These norms are currently subject to debate as they are considered to take insufficient account of sea level rise and increased storm intensity.⁷³ A 0.7m sea level rise increases the flood risk by a factor 10, and if we include the expected soil subsidence by 2100 of 1.0m, plus an additional

⁶⁵ Art. 3.13 Water Act.

⁶⁶ The National Water Plan 2009-2015 is accompanied by a more specific policy document called 'Water safety 2009-2015'. Both documents are available in Dutch only from the national governments website at <http://www.rijksoverheid.nl/onderwerpen/water-en-veiligheid/>.

⁶⁷ Policy Research Corporation, supra (n. 8), case study The Netherlands, p. 9, available at the EU Commission's website at http://ec.europa.eu/maritimeaffairs/climate_change_en.html.

⁶⁸ National Water Plan 2009-2015, p. 7.

⁶⁹ Id., p. 139.

⁷⁰ The programme's international website <http://www.roomfortheriver.nl> contains much information on the programme, including its main implementing spatial plans.

⁷¹ Primarily the EU's Natura 2000 network, a network of protected areas instituted as a consequence of the EU's Birds and Habitats Directives, see J. Verschuuren, Climate Change: Rethinking Restoration in the European Union's Birds and Habitats Directives, Ecological Restoration, 28:4 (2010), p. 431-439.

⁷² Art. 2.2 and Annex II Water Act.

⁷³ Especially the influential Delta Committee, in its 2008 report (supra n. 4), drew attention to this issue.

0.5m sea level rise during storms, the situation is much worse.⁷⁴ Therefore, in 2008, an advisory commission advised the Dutch government to increase the safety norms by at least a factor 10 by 2013 (up to a factor 100 for some areas), and have these increased safety norms implemented before 2050.⁷⁵ It is expected that the government will present its plans to implement this recommendation by the end of 2011.

The Act contains a range of provisions aimed at protecting land against flooding, including:

- Procedural provisions on decisions to create or change coastal or river defence works.⁷⁶
- The conferral on the Minister of power to take all necessary measures in case of danger.⁷⁷ A danger is defined as 'circumstances as a consequence of which water management works are under an immediate and serious threat or can become under such a threat.⁷⁸ The Minister is even allowed to take measures that are against the law, as long as they do not infringe the constitution or international law.⁷⁹
- The obligation to organize exercises to deal with dangerous situations.⁸⁰
- The duty on property owners to allow authorised officers to enter or do works in any place that they deem necessary, and the power of authorised officers to enter a property without the owner's consent.⁸¹
- The duty on property owners in water storage areas to allow their land and other property to be flooded.⁸²
- A prohibition on property owners in a water storage area to build anything that is considered to be an obstacle for water storage.⁸³
- The possibility for property owners in water storage areas to claim compensation in respect of loss or damage suffered as a result of flooding or restrictions on land use.⁸⁴
- Compulsory acquisition of land where this is necessary for dike and embankment works.⁸⁵
- A prohibition on interfering with coastal and river defence works without a permit.⁸⁶

In 2011, three important amendments were made to the *Water Act 2009* in order to complete the regulatory framework for coastal adaptation.⁸⁷ These amendments establish a Delta Programme, and a Delta Programme Commissioner to oversee implementation of the Programme,⁸⁸ and a

⁷⁴ J. Aerts et al., *Waterveiligheid en klimaatbestendigheid in breder perspectief*, 2007, p. 11-13, report for the national research programme on climate adaptation, available from the programme's website at <http://klimaatvoorruijnte.klimaatonderzoeknederland.nl>.

⁷⁵ Delta Committee, *supra* n. 4, p. 49.

⁷⁶ Art. 5.5 - 5.13 Water Act.

⁷⁷ Art. 5.30 Water Act.

⁷⁸ Art. 5.28 Water Act.

⁷⁹ Art. 5.30 Water Act.

⁸⁰ Art. 5.29 Water Act. Sometimes, international exercises are organized as well. In 2009, the exercise 'EU FloodEx' tested international assistance during a worst credible flood scenario in the North Sea area on the Dutch coast. The exercise showed that in such a case an international response is necessary, but also that there are many shortcomings associated with poor cooperation of the various response services involved. For an account of the exercise, see R.J.J. Beerens et al., *EU FloodEx: an analysis of testing international assistance during a worst credible flood scenario in the North Sea area*, 2010, available at <http://library.wur.nl/WebQuery/hydrotheek/lang/1949028>.

⁸¹ Art. 5.20 - 5.24 Water Act.

⁸² Art. 5.26.

⁸³ This is regulated through the relevant spatial plans at provincial and municipal level.

⁸⁴ Art. 7.14 - 7.15 Water Act.

⁸⁵ Art. 5.14 Water Act.

⁸⁶ Art. 6.12 Water Ordinance.

⁸⁷ Delta Bill on Water Safety, Parliamentary Documents No. 32 304. The Bill is currently pending in Parliament (June 2011).

⁸⁸ The first Delta Commissioner and his staff are already in office since 2010. For more information, see the Delta Commissioner's website at <http://www.deltacommissaris.nl>.

Delta Fund. The Delta Programme is a new annual plan with a six year planning horizon detailing all measures necessary to combat floods and water scarcity as a consequence of climate change. The Delta Fund will provide the resources required to implement the Delta Programme. The Bill stipulates that, as of 2020, € 1 billion has to be made available annually under the Fund.

The regulatory instruments of the Spatial Planning Act are used to avoid unwanted land use developments taking place. The national *Spatial Planning Key Decision* to implement the Room for the River programme, for instance, states that a land reservation applies where land will or can be given to the River by setting the dike further back from it. This means that:

1. Land needed for measures in the basic package will be safeguarded from developments which might stand in the way of a flood defence installation;
2. land where measures are expected to be needed in the long term will be safeguarded against large-scale and/or capital-intensive developments which will seriously impede future river relief measures from being taken.⁸⁹

Provincial and local zoning plans have to be adjusted to accommodate the implementation of the national Spatial Planning Key Decision.

It can be concluded that the Netherlands has a comprehensive regulatory system in place that seems well suited to address the challenges imposed on its coasts by climate change, provided that the funds that have to be made available indeed will be allocated on time. The regulatory system relies on cooperation of all decentralized authorities involved, but with firm supervision by the competent minister at the central level.

3.1.2 The United Kingdom

Like the Netherlands, the UK has adopted new integrated water legislation: the *Flood and Water Management Act 2010*.⁹⁰ The Act is more specific in its focus on coastal adaptation than its Dutch equivalents, as its main objective is 'to make provision about water, including provision about the management of risks in connection with flooding and coastal erosion'. Unlike the Netherlands' more centralised approach to water governance, implementation of the FAWM Act rests principally with Lead Local Flood Authorities (LLFA) - newly designated local authorities that are typically established at the county level. Each LLFA must develop, maintain, apply and monitor a local flood risk management strategy for its local area and direct and coordinate other local authorities in the area in its implementation.⁹¹ The measures that can be taken to reduce flood risks are very wide and include such measures as erecting flood defence structures, removing buildings, restoring natural processes, reducing or increasing the level of water in a place, supporting or diverting river banks, carrying out shoreline protection, and a range of other statutory prohibitions, restrictions and powers.⁹²

While implementation is occurring at the local level, there is a great deal of coordination taking place at the national level, particularly by the UK Environment Agency.⁹³ The Environment

⁸⁹ Spatial Planning Key Decision Room for the River, Approved Decision of 19 December 2006, p. 16. This document is available in English through <http://www.roomfortheriver.nl>.

⁹⁰ Flood and Water Management Act 2010. The Act has not yet fully entered into effect. See <http://www.defra.gov.uk/environment/flooding/legislation/>. The Act is accompanied by a whole range of secondary legislation, see <http://www.defra.gov.uk/environment/flooding/legislation/publications-documents/>.

⁹¹ Section 9.

⁹² Section 3(3). This is only an indicative list.

⁹³ The Environment Agency is the executive branch of the Department for Environment, Food and Rural Affairs (DEFRA), see <http://www.defra.gov.uk/news/2011/03/22/ea-climate-change-adaptation/>.

Agency, through its Regional Flood and Coastal Committees,⁹⁴ must develop and maintain a national flood and coastal erosion risk management strategy.⁹⁵ The strategy must take into account the impacts of climate change in specifying the objectives for managing flood and coastal erosion risk, assessing the flood and coastal erosion risk, and detailing measures to address those risks, and how and when those measures are to be implemented.⁹⁶ The Environmental Agency also is also responsible for funding flood and coastal risk management.⁹⁷

Local strategies and practice must be consistent with the national strategy.⁹⁸ Coastal erosion risk management is not included in the local strategies; only in the national strategy. The implementation of the national coastal erosion strategy is done by coastal erosion risk management authorities, which are the coast protection authorities designated under the *Coast Protection Act 1949*. There are currently 26 coastal cells in England and Wales, in which local authorities act as coastal protection authorities. The Flood and Water Management Act 2010 has substantially altered the *Coast Protection Act 1949*, aligning coastal erosion and inland flooding management and conferring overriding powers on national authorities. The Environment Agency can, for instance, carry out coast protection works whenever it thinks that this is desirable considering the national flood and coastal erosion risk management strategy.⁹⁹ The Minister has the final responsibility and has the power to overrule local authorities. The Minister can, for instance, direct a risk management authority to exercise a flood or coastal erosion risk management function on behalf of another risk management authority that is not meeting its obligations.¹⁰⁰

The most important non-statutory instrument used for coastal adaptation planning in the UK is the Shoreline Management Plan (SMP), a strategic plan aimed at coastal defence management drafted by the relevant local authorities acting as coastal protection authorities. The SMP assesses the risks involved in the current coastal defence system and suggests integrated measures to reduce those risks, ranging from constructing or reinforcing seawalls to beach nourishment.¹⁰¹ There is a growing trend towards 'managed alignment', in which the capacity of mudflats and salt-marshes to act as a buffer and absorb wave energy is enhanced through carefully setting back artificial defences. The Environment Agency reviews all of these plans to ensure uniformity, and works with local authorities to operationalise and fund activities under the plans. As in the Netherlands, much of the implementation, such as restrictions on new buildings, is done through local land use planning instruments.

Next to this more or less structural approach through legislative and planning measures, the national Department for Environment, Food and Rural Affairs (DEFRA) assists local communities to physically upgrade their coastal defences, both with expertise and funding.¹⁰²

The City of London has been especially active in taking coastal adaptation measures because of the vulnerability of the city, with 1.25 million people living on London's rivers' floodplains. The London Climate Change Adaptation Strategy pays significant attention to coastal adaptation, as

⁹⁴ See Sections 22-26.

⁹⁵ Section 7(1).

⁹⁶ Section 7(2).

⁹⁷ Sections 16 and 17.

⁹⁸ Sections 9(5), 11(1)(a), 11(4).

⁹⁹ Section 4(1)(c).

¹⁰⁰ Section 20.

¹⁰¹ DEFRA, Appraisal of flood and coastal erosion risk management, Policy Statement 2009, available from the Defra website at <http://www.defra.gov.uk/>. An example of a recent SMP reviewing such measures is the Isle of Wight SMP, see <http://www.coastalwight.gov.uk/smp/>.

¹⁰² Policy Research Corporation, *supra* (n. 8), case study United Kingdom, p. 10, available at the EU Commission's website at http://ec.europa.eu/maritimeaffairs/climate_change_en.html.

well as adaptation to increased rainfall.¹⁰³ The planned actions relating to general flooding are aimed at

- improving the mapping of who and what is and will be at risk from all sources of flooding;
- working with the various national and local authorities to ensure that flood risk management is integrated across the city and that flood risk management actions are prioritized that target the most vulnerable communities and critical assets and infrastructure;
- raising individual and community-level awareness of flooding In order to increase the capacity to cope and recover from a flood.¹⁰⁴

As far as coastal defence measures are concerned, the draft strategy builds on the adaptation provisions of the Thames Estuary 2100 plan (TE2100). TE2100 was drafted by the Environment Agency and has a planning horizon covering the entire 21st century, split into three transition periods (2010-2034, 2035-2049, 2050-2100).¹⁰⁵ The plan considers a wide variety of different actions to protect the estuary from sea level rise, increased rainfall and increased storm intensity were considered, such as adapting the current Thames Barrier structure, developing a new Outer Estuary Barrier structure, deepening the channel, the designation of rural water storage areas, adapted land use management and spatial planning and building regulation.¹⁰⁶

The TE2100 recommends local authorities to rely on the existing Thames Barrier until 2070 (with some improvements, most importantly raising the crest level),¹⁰⁷ at which time, the existing barrier will have to be dramatically improved or a new barrier created with locks at a different location.¹⁰⁸ Other options were rejected because of a negative impact on the environment and/or shipping, or the high costs involved. The most important measure to cope with tidal floods in the Netherlands, namely designating water storage areas to help reduce extreme water levels, in conjunction with wetlands creation,¹⁰⁹ was rejected for the short term. This option remains open as a potential end of the century measure.¹¹⁰

Local adaptation options along the banks of the river mainly rely on floodplain management and improved defences. Land use planning measures aimed at avoiding unwanted development, or at having development that can be used as a flooding defence means are promulgated here. Measures like these are necessary because the Thames Barrier only protects against tidal floods. In case of fluvial floods, the barrier has to remain open to get the surplus river water out to sea as fast as possible. Obviously, the combined situation of high river water levels and a storm surge at sea is a situation in which the city will be particularly vulnerable. Computer modelling for a similar situation in Rotterdam has shown that in cases like these, multiple breaches of flood defence systems may occur.¹¹¹

¹⁰³ Mayor of London, Draft Climate Change Adaptation Strategy for London, February 2010, p. 25. The draft strategy underwent public consultation in 2010, see

<https://www.london.gov.uk/priorities/environment/climate-change/climate-change-adaptation-strategy>

¹⁰⁴ Ibid., p. 8-9.

¹⁰⁵ The TE2100 plan underwent public consultation in 2009. An implementation plan is expected to be published in March 2012. See <http://www.environment-agency.gov.uk/homeandleisure/floods/104695.aspx>

¹⁰⁶ Ibid.

¹⁰⁷ Environment Agency, TE2100 Plan - Consultation document, London, April 2009, p. 27, available at <http://www.environment-agency.gov.uk/research/library/consultations/106100.aspx>.

¹⁰⁸ Ibid., p. 29.

¹⁰⁹ The plan does opt for the creation of two intertidal habitat creation sites by 2035, but purely with a nature conservation objective, see the document that indicates the changes to the public consultation version of the plan, available at <http://www.environment-agency.gov.uk/research/library/consultations/106100.aspx>.

¹¹⁰ Ibid., p. 48.

¹¹¹ Jonkman et al., supra n. 58, p. 1357-1373.

We can conclude that, in the UK, new coastal adaptation legislation puts the basic competences at the local level, although provision has been made for national supervision. Such a local approach may make it more difficult to have an integrated coastal zone management in place to address future marine and inland flood risks comprehensively, without risks being transferred from one place to another.

3.2 Australia

As the developed country with arguably the highest vulnerability to the impacts of climate change, Australia adaptation policy and research agenda is relatively well advanced. The impacts of sea-level rise on the coastal zone have received considerable attention from Australian law-makers over the past five years and continue to dominate policy debate.¹¹² Managing these impacts has involved the interplay of land use planning, coastal management, climate change, emergency management and, in some cases, conservation laws. Regulation is split across these sectoral boundaries as well as between local, state and Commonwealth government responsibilities.¹¹³ This jurisdictional fragmentation and overlap has challenged the development and implementation of consistent adaptation law, but there are also common features of the current legislative response.

All Australian states have planning laws relating to coastal hazards. New provisions either enhance, elucidate or partially replace these existing laws with measures aimed specifically at the management of hazards exacerbated by climate change and sea level rise, albeit through the use of traditional land use planning tools.¹¹⁴ Most states and territories have adopted a planning

¹¹² House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts (2009), *Managing our coastal zone in a changing climate: The time to act is now*, House of Representatives Committee Report, <http://www.aph.gov.au/house/committee/ccwea/coastalzone/report/Final%20Report.pdf>; Department of Climate Change and Energy Efficiency (2010a), *Adapting to Climate Change in Australia - A Position Paper*, <http://www.climatechange.gov.au/en/government/adapt/~media/publications/adaptation/190210-dcc-positionpaper.pdf>, p11; Department of Climate Change and Energy Efficiency, *Developing a national coastal adaptation agenda: A report on the National Climate Change Forum*, <http://www.climatechange.gov.au/~media/publications/adaptation/developing-national-coastal-adaptation-agenda.pdf>.

¹¹³ B. Norman, Principles for an intergovernmental agreement for coastal planning and climate change in Australia, (2009) 33 *Habitat International*, p. 293-299, N. Harvey, C. Woodroffe, Australian approaches to coastal vulnerability assessment, (2008) 3 *Sustainability Science*, p. 67-87.

¹¹⁴ Department of Environment, Climate Change & Water NSW (2010a), *Coastal Risk Management Guide: Incorporating sea level rise benchmarks in coastal risk assessments*, <http://www.environment.nsw.gov.au/resources/water/coasts/10760CoastRiskManGde.pdf>; Department of Environment, Climate Change & Water NSW (2010b), *Flood Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments*, <http://www.environment.nsw.gov.au/resources/water/coasts/10759FloodRiskManGde.pdf>; Department of Environment, Climate Change & Water (2010c), *NSW Climate Impact Profile: The impacts of climate change on the biophysical environment of New South Wales*, <http://www.environment.nsw.gov.au/resources/climatechange/10171climateimpactprof.pdf>; Department of Environment, Climate Change and Water NSW (2009), *NSW Sea Level Rise Policy Statement*, <http://www.planning.nsw.gov.au/LinkClick.aspx?fileticket=ukmXcVJesYA%3D&tabid=177>; Department of Planning & Infrastructure (2011), 'Local Planning – Standard Instrument', <http://www.planning.nsw.gov.au/LocalEnvironmentalPlans/StandardInstrument/tabid/247/Default.aspx>; Department of Planning & Infrastructure (2010), *NSW Coastal Planning Guideline: Adapting to Sea Level Rise*, <http://www.planning.nsw.gov.au/LinkClick.aspx?fileticket=VYjmQirQIAk%3d&tabid=177&language=en-US>; Coast Protection Board South Australia (1991), *Policy on Coast Protection and New Coastal Development*: www.environment.sa.gov.au/files/fb3b339d-50ac.../cpb_policy_1991.pdf; Coast Protection Board of South Australia (1992), *Coastal erosion, flooding and sea level rise standards and protection policy*: <http://www.environment.sa.gov.au/files/a2ba9951-05ca-4905-8d54-9e3900ec48e1/no26.pdf>; Coast Protection Board of South Australia (2004), *Coast Protection Board Policy Document* (Endorsed 30th August 2002): http://www.environment.sa.gov.au/files/25111204-b9a7-4954-9f62-9e3900ec43d8/cpb_policy_document_2002.pdf; Department of Planning and Community Development Victoria 2008, 'General Practice Note: Managing coastal hazards and the coastal impacts of climate change',

benchmark for sea-level rise that guides building heights and set-backs from erosion and high-tide lines, and require decision-makers to consider the effects of king tides and storm surge in calculating such set-backs. The actual statutory planning benchmark differs across the country, ranging from 1.0 m above 1990 levels by 2100 in South Australia, to 0.9 m in New South Wales and Western Australia, to 0.8 m in Queensland and Victoria. The asset life of proposed development is relevant in assessing the sea-level rise benchmark that must be followed. Some frameworks recognize that certain developments will have a shorter lifespan than others, and set lower benchmark for sea level rise by dates before 2100.¹¹⁵

Areas calculated to be at high risk generally permit only very limited forms of development. This might include re-locatable or temporary dwellings or coastal infrastructure that depends on proximity to the shoreline to serve its function.¹¹⁶ While several instruments refer to the importance of retreat as an option, there is little evidence of mandatory or un-funded retreat being adopted yet. The approach currently being advocated is to allow for longer term staged retreat, by prohibiting new development or intensification in high hazard areas or only allowing development with a limited life-span.¹¹⁷

Cases in Queensland, New South Wales, Victoria, and South Australia have all grappled with how to factor future climate risks into current planning decisions in coastal zones.¹¹⁸ For the most part, these cases do not produce a single body of legal precedent because each is heavily dependent on the planning policies and laws applicable to the development in question and the attitudes and approaches of the Courts considering the matter. The Victorian Civil and Administrative Tribunal has led the country in its approach to factoring climate hazards into planning decisions. *Gippsland Coastal Board v South Gippsland SC and Ors*¹¹⁹ involved six applications for planning permits for the construction of residences on low-lying flood-affected land within a rural zone in coastal Gippsland, Victoria. The VCAT set aside the local council's approval of the proposal, and determined that sea level rise and coastal inundation caused by climate change were relevant matters to be taken into account in assessing the suitability of this land for development. The VCAT had regard to the obligation in section 60(1)(e) of the *Planning and Environment Act 1987* (Vic) to consider "...significant effects ... the use or development may

http://www.dpcd.vic.gov.au/_data/assets/pdf_file/0003/41727/Coastal_hazards_and_climate_change.pdf;

Department of Planning and Community Development Victoria (2008), *Direction No. 13 - Managing Coastal Hazards and the Coastal Impacts of Climate Change*,

http://www.dpcd.vic.gov.au/_data/assets/pdf_file/0011/43040/dir13.pdf; State Government of Victoria (2008), *Victorian Coastal Strategy 2008*, <http://www.vcc.vic.gov.au/2008vcs/home.htm>; Western Australian Planning Commission (2006), *State Coastal Planning Policy*, Statement of Planning Policy No. 2.6,

http://www.planning.wa.gov.au/Plans+and+policies/Publications/Downloads_GetFile.aspx?id=139; Department of Planning (2010), 'Position Statement - State Planning Policy No. 2.6 State Coastal Planning Policy Schedule 1 Sea Level Rise', Western Australian Planning Commission - Position Statement,

http://www.planning.wa.gov.au/Position_Statement_SPP2_6_Final_WAPC.pdf?id=2380.

¹¹⁵ Department of Environment, Climate Change and Water NSW (2009), *NSW Sea Level Rise Policy Statement*,

<http://www.planning.nsw.gov.au/LinkClick.aspx?fileticket=ukmXcVJesYA%3D&tabid=177>; Department of Environment and Resource Management (2011b), *Queensland Coastal Plan* (not yet commenced),

<http://www.derm.qld.gov.au/coastalplan/pdf/qcp-web.pdf>, p. 94; Coast Protection Board South Australia (1991), *Policy on Coast Protection and New Coastal Development*.

www.environment.sa.gov.au/files/fb3b339d-50ac.../cpb_policy_1991.pdf;

¹¹⁶ e.g. Department of Environment and Resource Management (2011), *Queensland Coastal Plan*,

<http://www.derm.qld.gov.au/coastalplan/pdf/qcp-web.pdf>, clauses 1.3-1.4.

¹¹⁷ Ibid.

¹¹⁸ *Northcape Properties Pty Ltd v District Council of Yorke Peninsula* [2008] SASC 57; *Daikyo (North Queensland) Pty Ltd v Cairns City Council* [2003] QPEC 22; *Mackay Conservation Group Inc v Mackay City Council* [2006] QPELR 209; *Charles Howard Pty Ltd v Redland Shire Council* [2007] QCA 200; *Van Haandel v Bryon Shire Council* [2006] NSWLEC 394; *Walker v Minister for Planning* (2007) 157 LGERA 124; *Minister for Planning v Walker* (2008) 161 LGERA 423; *Gippsland Coastal Board v South Gippsland SC and Ors* (No 2) [2008] VCAT 1545.

¹¹⁹ (No 2) [2008] VCAT 1545.

have on the environment or which the authority considers the environment may have on the use or development". It adopted a precautionary approach to development approval:

"rising sea levels are to be expected. The range of impacts may well be beyond the predictive capability of current assessment techniques. In the face of such evidence, a course of action is warranted to prevent irreversible or severe harm.... There is a longer term risk of intergenerational liability that can and should be avoided in the absence of no imperative or higher order need for the development that overrides these liabilities ...We consider that increases in the severity of storm events coupled with rising sea levels create a reasonably foreseeable risk of inundation of the subject land and proposed dwellings, which is unacceptable."¹²⁰

The *Gippsland* decision prompted amendments to Victoria's planning regime, requiring the application of the precautionary principle and use of a 0.8 metre by 2100 sea-level rise planning benchmark,¹²¹ and requiring 'planning and responsible authorities [to] determine if a coastal hazard vulnerability assessment is required to assist in making informed decisions about use and development proposals'.¹²² These new provisions were first considered in *Myers v South Gippsland Shire Council*, a case involving an application for subdivision of coastal land.¹²³ Applying the precautionary principle, the VCAT decided that a coastal hazard vulnerability assessment should be carried out in accordance with the guidelines in the General Practice Note before any decision could be made on the suitability of the subdivision proposal. The Assessment was considered by the VCAT in *Myers v South Gippsland Shire Council (No. 2)*.¹²⁴ The Tribunal rejected the application for subdivision on the basis that the expert evidence in the assessment suggested that the impacts of sea-level rise on the site in question would be severe.

In *East Gippsland Shire Council v Taip*, the VCAT overturned the approval of a development that was designed to be above projected flood and inundation levels under climate change. It held that protection of the individual development would be insufficient if the whole area were to become unviable – for example, due to the flooding of underground services and drainage, and the blockage of pedestrian and vehicular access.

...from the current understanding of the impacts to Lakes Entrance ... without intervention, the development will be subject to conditions that may well lead to it being unviable for occupation. The resultant economic cost would be to those future owners and quite possibly the wider community. It is hardly fair or equitable to see this as a balanced outcome for intergenerational equity.¹²⁵

The VCAT was especially concerned that the Council's planning framework for Lakes Entrance did not address climate change adaptation impacts. This decision has effectively halted any new development in the area until an adaptation strategy is developed, even where proposed development meet planning benchmarks for inundation and sea-level rise.

¹²⁰ *Gippsland Coastal Board v South Gippsland SC and Ors (No 2)* [2008] VCAT 1545, para 40-48.

¹²¹ Department of Planning and Community Development Victoria 2008, 'General Practice Note: Managing coastal hazards and the coastal impacts of climate change', http://www.dpcd.vic.gov.au/_data/assets/pdf_file/0003/41727/Coastal_hazards_and_climate_change.pdf; Department of Planning and Community Development Victoria (2008), *Direction No. 13 - Managing Coastal Hazards and the Coastal Impacts of Climate Change*, http://www.dpcd.vic.gov.au/_data/assets/pdf_file/0011/43040/dir13.pdf.

¹²² Ibid.

¹²³ *Myers v South Gippsland Shire Council* [2008] VCAT 2414

¹²⁴ [2009] VCAT 2414.

¹²⁵ *East Gippsland Shire Council v Taip* [2010] VCAT 122, para 90

4. Features of an effective coastal adaptation regulatory regime

Most coastal adaptation law around the world is still fairly recent. Practical experiences, therefore, are limited. Some case law is starting to emerge, especially where land use planning law is used to stop unwanted developments. When all of the statutes, plans and policies are fully implemented, we are likely to see a rise in such cases, as land owners object to adaptation measures that impinge on the use of their property or affect property values. In general it can be concluded that coastal adaptation law should take an integrated approach to the management of both coastal waters and coastal rivers, in which the consequences of both sea level rise and altered precipitation and river are addressed. Legal frameworks need to focus on the objective of providing a comprehensive response to increasing flood and erosion risks, whilst communicating with local communities. This is an immense organizational, procedural, and legal challenge. From our examination of nascent examples of adaptation law and policy, the following features emerge as core ingredients of a legal framework for coastal adaptation that is equipped to meet this challenge.

Clarify adaptation objectives for each part of the coast

Any coastal adaptation regime must start by clarifying the adaptation objectives for each part of the coast. Objectives will vary depending on the current land uses and the technical feasibility, economic cost and political and social acceptability of various options. They may range from a recognition of the need for eventual retreat, to commitments to defend and fortify. Adaptation policy objectives will either be embedded in the law itself, or they must be arrived at for each location, using decision-making processes that are prescribed by the legal framework. The scope of these statutory objectives or the outcomes of objective-setting processes influence every other aspect of the legal framework, so their clarity and enforceability are the most critical elements of coastal adaptation law.

Integration of coastal adaptation into coastal zone management, river basin management and biodiversity policy and law

Coastal zone and river basin management must be closely aligned, especially in deltas, in order to ensure that there is an integrated approach to fresh water management in the coastal region and the marine strategy in that region. Promoting wetland and watershed protection and restoration and coastal adaptation often go hand-in-hand. Natural floodplains can, for instance, be created to store surplus water, reduce pressure on artificial flood defence systems, and to enhance wetland related biodiversity. Coastal adaptation laws should, therefore, be well aligned with applicable nature conservation law, both in aims and processes.

Planning into the future

The enormity of the challenge to protect low lying, densely populated land against sea level rise, increased storm intensity and increased inland flooding, requires the development not only of an overarching, integrated policy vision, but also one that extends well into the 21st century, if not beyond. Policy options will have to be assessed on their effectiveness and on their environmental impact involving both the various authorities and the general public. Where fortification is the preferred strategy, as will be the case for many coastal cities, legal processes have to be developed that enable large sea defence projects to be carried out, possibly requiring lengthy and expensive expropriation procedures. Planning for a 0.6 m sea level rise is quite different from planning for a 1.0 m sea level rise, in terms of the area of land likely to be affected, and the frequency and seriousness of the impacts. The planning thus has to be well into the future, but must also leave room for manoeuvre. There is an emerging body of adaptation literature

regarding the best ways in which to maximize current productive uses while preserving future options for adaptation.¹²⁶ Use of adaptive management approaches that require monitoring, revision, and in-built flexibility of plans will provide the basics of such a basic requirement.

Distribution and clarification of competencies

Each coastal location is likely to require a different combination of technical, planning and social responses to the impacts of climate change. In this respect, much adaptation is inherently site-specific and the potential for centralised prescriptions is limited. At the same time, highly fragmented regimes lead to uncertainty and, in some cases, a level of regulatory paralysis among key decision-makers. There are advantages, therefore, in having some central institution that sets over-arching standards and coordinates efforts that require multi-level or multi-sectoral engagement.

Supervising implementation

A wide range of legal instruments at various levels of government is required for the smooth implementation of the coastal adaptation policy. Examples of these are the various provisions in the new Dutch and English legislation on flood and water management, including spatial planning, building and water law instruments. A key component of effective implementation will be effective review of planning and other decisions relating to development in vulnerable areas. The experience in Australia demonstrates the potential for local authorities and other development agencies to adopt widely differing approaches to adaptation and the critical role of the courts in assessing the appropriateness of these choices is already becoming apparent. Effective coordination and supervision at a supra local level is necessary in order to achieve the goals of an integrated coastal adaptation policy, thus avoiding the existence of weak chains in the coastal defense system.

Funding adaptation

Coastal defence works involve high costs. Whether the preferred method of protection is large-scale revegetation and beach nourishment, the construction of sea walls, or the construction of a barrier system with locks, funds must be allocated and pre-committed. Legislation has to force the authorities to set aside a fixed amount of money for the future works on a regular basis. These costs may give rise to questions of equity, especially where the number of properties likely to benefit from defences is small but the community as a whole is expected to fund the works. Mechanisms are required by which to determine the allocation of costs and then to implement that allocation over the timeframe required.

Some adaptation instruments may place a heavy burden on property owners in the affected areas. They are faced with far-reaching obligations, such as the obligation to have their land flooded periodically and the prohibition to build certain structures on their land. They may even lose their property altogether. A compensation scheme may be required to relieve at least some of the economic burden. Even the liability issue – historically left to judicial resolution - is considered to be in need of legislative clarification, because tort litigation over climate change

¹²⁶ N. Leary et al, A stitch in time: general lessons from specific cases, in N. Leary et al (eds), *Climate Change and Adaptation* (Earthscan, 2008) 1; J B Ruhl, Climate Change Adaptation and the Structural Transformation of Environmental Law, (2010) 40 *Environmental Law* p. 343; R. Ison, *Systems Practice: How to Act in a Climate Change World* (Springer, 2010); R. Kundis Craig, "Stationarity is dead" – long live transformation: five principles for climate change adaptation law, (2010) 34 *Harvard Environmental Law Review* p. 9; L. Dobes, Getting Real about Adapting to Climate Change: Using 'Real Options' to Address the Uncertainties, 2008, *Agenda*, 15(3), p. 55-69.

impacts faces formidable evidentiary challenges, leads to different results even within countries, causes regulatory paralysis because of the uncertainty associated with pending or potential litigation, and does not allow the comprehensive approach to coastal adaptation that is needed.¹²⁷

Prepare for natural disasters

With all of the above in place, the impact of natural disasters can hopefully be limited. However, risk analysis shows that we should also plan for disasters that do occur, such as extensive flooding despite measures taken. A wide variety of flood preparedness measures aimed both at the authorities involved and at local communities and individual residents are to be taken, ranging from small and large scale flood response and evacuation exercises to education.

5. Conclusion

This article examined the early experience with coastal adaptation law in the EU, with a focus on the Netherlands and the UK, and Australia, in order to identify important features of a regulatory framework for coastal adaptation. Like many countries, the Netherlands, UK and Australia face the prospect of a sharp increase in coastal hazards as a consequence of climate change. They have taken the first steps towards adapting to these changing conditions, with new policies plans and legislation, as well as early litigation over the scope and operation of these laws. Even where law reform has been prompted by developments at the EU level, the approach to coastal adaptation law has, to date, relied on traditional legal instruments for managing coastal erosion and flooding.¹²⁸

Our understanding of the consequences of climate change on coastal areas is still evolving. The nature of risks is clearer than the likely extent of change, especially given uncertainties over the effect of any collapse of the West Antarctic and Greenland ice sheets. Planning for 2100 and creating legislation that is aimed to facilitate such a long-term policy bears the risk that we simply move forward on the road laid down in that policy, using the instruments in that legislation. We may be required, fundamentally to alter the policy and adopt new legal tools if the most dire projections of sea level rise eventuate. Research into alternative coastal adaptation measures must therefore continue, and as much as possible we must retain flexibility and adaptability in the legal strategies adopted. An integrated approach to coastal adaptation law would lay the foundations for such a long term strategy. Such an approach would establish processes by which adaptation objectives are agreed for each part of the coast; ensure land use planning can accommodate future change and does not expose new communities to risk; integrate coastal adaptation with biodiversity and coastal zone policy; allocate regulatory responsibility in a way that promotes subsidiarity and consistency; and ensures that funds are available for future measures.

Incorporating these features into climate adaptation laws will help minimise the impacts of climate change on coastal communities. But some losses seem inevitable. Perhaps the greatest challenge for adaptation laws, therefore, will be how well they can address societal concerns about the limits of adaptation.

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