

IMPROVING COASTAL MANAGEMENT OUTCOMES THROUGH SCIENCE AND THE LAW

Abstract

Despite the importance of scientific research to coastal management, the literature points out that the application of science to decision making is often poor. An important component to improving the use of science in coastal management decisions, but which has received little attention within the literature, is the role the law has in determining how science is used. The legislation sets out various coastal planning and management approaches, such as land zoning, development control, strategic planning and requirements for coastal protection works, generally enacted through actions of local government. The design of these mechanisms can enable knowledge of coastal environments and processes to be applied to decisions; thus law and policy may play a key role in determining the scientific basis of coastal management decisions. The project discussed in this paper aims to address the gap in the literature through an investigation into legal requirements for science based decision making in New South Wales. The project is based on case studies of local councils on the south coast, investigating how science is applied to coastal management issues through legal instruments. The results presented in this paper will help to address the need of local government for a supportive legal framework which enables the application of the best available science to coastal management decisions while providing a legal basis for their decisions. The paper concludes with an assessment of issues or constraints existing within the law and will provide recommendations of how science can be better incorporated into the NSW coastal regulatory framework to achieve improved environmental outcomes.

Introduction

It has been widely recognised that better connections between science and coastal management could occur, improving the capacity to make decisions in light of scientific understandings of the coast (Cash et al. 2002; Cash et al. 2006; Vogel et al. 2007; Bultitude et al. 2012). Options for improving the application of science to coastal management and coastal policy has been a highly discussed topic in recent years, with scientific literature providing an intricate analysis of barriers and opportunities for creating better connections between scientists and decision makers (van Kerkhoff, 2005; van den Hove, 2007; Vogel et al. 2007; Weichselgartner & Kasperson, 2010). Stocker et al (2012) discuss how achieving desired coastal outcomes is often limited by a series of failures occurring across the stages of coastal management, from problem identification to the implementation of policy and management actions. Scientists can play a role in overcoming these failures by engaging in processes to more effectively communicate scientific outcomes and implications. Engagement needs to occur from the outset of research programs to align research with the needs of coastal managers (Vogel et al 2007), and environmental policy making (Lagacé et al 2008), and to frame science research within the local socio-economic context by engaging with the community, local decision makers and other stakeholders (Nowotny et al 2001, Vogel et al 2007).

The challenge to science uptake is in part due to the complex network of organisations and individuals influential on coastal decisions, connected through multiple processes and across varying jurisdictions. These stakeholders, as groups and individuals,

contribute a range of knowledge types relevant to coastal decision making, including local knowledge, indigenous knowledge, governance, industry, and scientific. Effective coastal management requires environmental networks to integrate knowledge with respect to the relevance and reliability of each (Selman 2000). The use of knowledge, including science, within coastal management decisions is dependent on the network of individuals and organisations involved in the decision making process. Barriers to the uptake of science may occur due to network interactions, with improvements achievable by better understanding networks and whether they promote or inhibit science uptake (Vogel et al 2007).

Though the application of science to policy and decision-making is widely discussed in the literature, there is relatively little discussion regarding the role of science in law, despite the importance of law in managing the coast. The relevance of law in achieving science informed coastal management, is the ability law has to delegate responsibility to coastal decision makers as an enforceable means for implementing public policy (Bates, 2010). The law influences coastal management by setting requirements for various coastal planning and management mechanisms, generally enacted through actions of local councils (Kay & Alder, 1999), who are largely responsible for implementing coastal policy and legislative initiatives. In NSW, councils with coastal jurisdiction are responsible for strategic land use planning, management of public land and coastal protection, and preparation of coastal management plans that integrate economic, environmental and social factors. Legal requirements for the use of science within these activities enable knowledge of coastal environments and processes to be applied to decision making; thus law and policy may play a key role in determining what science is applied to decision making.

As the principal decision makers about coastal land use, it is essential that local government has a sound legal and policy framework to provide both guidance and a legal basis for decisions. Local government is reliant on the higher levels of government to provide guidance on incorporating the best available science into coastal decisions due to funding and resource constraints within local government; by circumstance staff often do not have the time or capacity to interpret new science to apply to decision making processes. A further issue relevant to this research is the concern councils have regarding risk of liability for damage to private property due to inappropriate planning or action on their part (Lipman & Stokes, 2011), and uncertainty regarding local councils responsibilities in adapting to climate change (Preston & Kay, 2010). In a report commissioned by the Australian Local Government Association to review potential climate change liability including for coastal decisions, the authors expressed the view that Councils would likely face increased climate change related litigation, creating a financial burden for local government (Forbes, 2009; Baker & McKenzie, 2011). To avoid litigation local governments require a supportive decision-making framework in which scientific information regarding climate change risks can be incorporated as a component of their criteria for coastal land use (McDonald, 2007).

In light of these concerns and the important role of councils in determining outcomes in the coastal zone, this research aims to identify how science can be better incorporated into the NSW coastal regulatory framework with consideration of the experiences of local government. This paper will present the current findings of an investigation regarding how science is applied to coastal management decisions through legal instruments. These findings are part of a Masters project that is linked to the CSIRO Coastal Collaboration Cluster, a major 3 year project completed in June 2013, which developed understandings and tools for improving the application of science to coastal management.

The current coastal legal setting in New South Wales is one of reform, with both of the key influential Acts, the *NSW Coastal Protection Act* (1979) and the *NSW Environmental Planning & Assessment Act* (1979), under review at the time of writing. It is recognised that the reforms are a key concern for coastal councils, however it is beyond the scope of this paper to provide an analysis of the reforms. The impact of the reforms on local councils will be addressed in the final Masters research project. Despite the changes which will occur to the legislation, research into the current legislative framework is relevant for several reasons. The researcher will be speaking to local councils about their experiences in managing the coast, and thus far their experiences have been under the current framework. Furthermore, with regard to councils' concern for liability, future court cases will consider the legal framework in place at the time of the decision. Thus, understanding how science is applied in the current framework provides reference for future decisions.

Methodology

The results presented in this paper are the key findings of the following components:

(a) An analysis of relevant literature and the key coastal management legislation current at this time, the *NSW Coastal Protection Act* (1979) and the *NSW Environmental Planning & Assessment Act* (1979) was carried out to identify legal requirements for the use of science in coastal management.

(b) An analysis of the use of science in NSW Land and Environment court decisions regarding coastal matters. The databases used to access published case law decisions were *New South Wales Caselaw* (<http://www.caselaw.nsw.gov.au>), and Thomson Reuters Legal Online (<http://legalonline.thomson.com.au/>). Multiple searches were performed using the following phrases: 'sea level rise', 'coast AND erosion', 'coast AND protection', 'coastal hazards'; and legislation cited: 'Coastal Protection Act', 'NSW Coastal Policy', 'State Environmental Planning Policy No 71'. Search results were manually filtered to include all cases relevant to the use of science in coastal management issues, with a total of 28 cases identified (Appendix 1). Court transcripts were reviewed to identify key issues, types of science-based evidence used, the court's decision, and basis for the decision.

Outline of science input in New South Wales coastal management legislation

Though a range of legislation must be considered by councils in managing their coastline, there are two principle pieces of legislation influencing coastal management in New South Wales, the *Coastal Protection Act* (1979) and the *Environmental Planning & Assessment Act* (1979). The science provisions pertaining to these key Acts are the major focus of this section.

Coastal Protection Act (1979)

The major purpose of the *Coastal Protection Act* is to provide a framework for the management and protection of the State's coastal zone.

Broadly, the major provisions of the Act include:

- Definition of the geographical boundaries of the coastal zone.
- Delegation of power to carry out the Act, generally including the Minister for the Environment, local councils, and the NSW Coastal Panel, which is established by the Act.
- Provides principles for the use of the coastal zone.
- Sets out instances in which development applications are to receive approval by the Minister.
- Provides requirements for local council's coastal zone management plans (CZMPs).
- Sets requirements for coastal protection works.

The analysis of the *Coastal Protection Act* identified three key provisions enabling the application of science to coastal management, including the scientific advisory NSW Coastal Panel, strategic planning requirement at the local level through coastal zone management plans, and the provisions of the Act in the development assessment process.

NSW Coastal Panel

The Act was amended to establish the NSW Coastal Panel in 2010, an advisory panel consisting of the Chair, and six members nominated by local councils and state government agencies. The major function of the Coastal Panel is to provide advice on coastal matters referred to them by the Minister, including any issues to do with the coast, administration of the Act, and to provide advice to local councils. Furthermore, the legislation states that the nominated members on the Coastal Panel “must have qualifications and experience relevant to coastal planning, coastal engineering, coastal geomorphology, coastal environmental management or estuary management”, thus providing a legal mechanism for science informed coastal management through expert coastal knowledge. Specifically, some of the actions undertaken by the Coastal Panel include:

- advisory role to the Coastal Ministerial Taskforce regarding the coastal management legislation reforms
- advice to the Minister regarding coastal erosion impacts and potential management strategies for erosion occurring at Kingscliff Beach in Tweed Shire Council, and
- review local councils draft coastal zone management plans.

The Act also provides a legal mechanism for ensuring the Coastal Panels' recommendations are applied to planning and management, stating that recommendations made by the Coastal Panel regarding changes to a coastal zone management plan are to be incorporated into a plan and resubmitted for approval. A further role of the Coastal Panel made under the State Environmental Planning Policy (Infrastructure), is consent authority for coastal protection works on all land that does not have an approved coastal zone management plan. The Coastal Panel's dual role as reviewer of coastal zone management plans, which must address the use of coastal protection works, and consent authority for land without a coastal zone management plan, provides a legal mechanisms for a co-ordinated approach to the placement of new coastal protection works across the State. The *Coastal Protection Act* also makes it possible for the Coastal Panel to be given development consent authority under the *NSW Environmental Planning & Assessment Act*. This provision has been implemented by the statutory State Environmental Planning Policy (Infrastructure), giving the Coastal Panel the role of consent authority for coastal protection works for all land that does not have an approved coastal zone management plan.

Coastal zone management plans (Part 4A)

The *Coastal Protection Act* provides a framework for the preparation of coastal zone management plans (CZMPs) by local councils. CZMPs are not legally required by all councils, however by developing a CZMP in accordance with the Guidelines and managing their coastline accordingly, councils are protected from liability for their actions under section 733 of the Local Government Act 1993 'made in good faith'.

The *Coastal Protection Act* creates a legal basis for the incorporation of science into CZMPs through two main mechanisms. Firstly, the Act sets out various 'Matters to be dealt with in a CZMP' (CP Act, Part 4A, 55C), the following of which require scientific assessments:

- "the management of risks arising from coastal hazards"
- "the management of estuary health and any risks to the estuary arising from coastal hazards"
- "the impacts from climate change on risks arising from coastal hazards and on estuary health"
- managing the impacts of proposed coastal protection works

Secondly, the Act refers councils to adhere to the Minister's Guidelines for Preparing Coastal Zone Management Plans. Though the guidelines are not a statutory document, all CZMPs are to be submitted to the Minister for approval therefore councils must make a plan according to the guidelines. Through the guidelines more specific science requirements are applied to managing coasts. For example, in addressing estuary health, the guidelines detail what a CZMP is to contain, including:

- the estuaries' current health status,
- matters effecting the estuaries health,
- a projection of climate change impacts,
- proposed actions to reduce risks to the ecosystem,
- an entrance management policy for intermittently closed and open lakes and lagoons (ICOLs),
- and an estuarine monitoring program that is consistent with the NSW Natural Resources Monitoring, Evaluation and Reporting (MER) Strategy.

Use of the coastal zone (Part 3)

Although the *Environmental Planning & Assessment Act* is the major legislation relating to development assessment on all land in the State, the outcome of coastal zone development is also influenced by the *Coastal Protection Act*. Under the *CP Act*, development consent authorities, whether local councils or the Minister, must not approve development or carry out development in the coastal zone that is "inconsistent with the principles of ecologically sustainable development" or which may adversely affect, or be affected by, the coastal environment or the sea. Decisions based on the principles of ecologically sustainable development (ESD) have been found by the NSW Land & Environment Court to include climate change considerations (*Walker v Minister for Planning* [2007] NSWLEC 741). Though this decision was successfully appealed, the court stated climate change will likely become a presumed consideration of ESD, and failure to consider them will become strong evidence in court decisions (*Minister for Planning v Walker* [2008] NSWCA22).

Environmental Planning & Assessment Act (1979)

The major purpose of the *Environmental Planning & Assessment Act 1979* is to provide a framework for a co-ordinated approach to land-use and development in the State. The objects of the Act promote social and economic welfare of communities by providing affordable housing, services, land for public use, and promote environmental protection and conservation.

Broadly, the major provisions of the Act:

- Delegates power to The Minister, Director-General, The Department, and establishes various planning and assessment committees
- Provides for the use of environmental planning instruments to promote co-ordinated planning, including State Environmental Planning Policies by the Minister and the development of Local Environment Plans by local councils, and development control plans
- Provides a framework for development assessment
- Sets requirements for assessment of a proposed developments' impact on the environment

The analysis of the *Environmental Planning & Assessment Act* identified three key provisions enabling the application of science to coastal management, including environmental planning instruments (EPIs), the process of development assessment and requirements for environmental assessments.

Environmental Planning Instruments

One provision of the Act enabling evidence informed management of the coast is environmental planning instruments (EPIs), including requirements for councils to have a local environmental plan (LEP) to guide local land-use decisions and by granting power to the Governor to create state environmental planning policies (SEPPs). Environmental planning instruments are created for various aims, with the major purpose of achieving State planning objectives.

An EPI can be used to address environmental management issues, with the legislation making provisions for EPIs to protect the environment. The Act makes specific reference to components of the environment including native animals and plants, threatened species, populations, ecological communities and their habitats, and vulnerable ecological communities (Part 3, 26). The Act also allows for EPIs to make provisions for development control by such means as development standards, providing a mechanism for controlling the type and placement of development on the coast.

At the local level, a council uses a Local environment Plan (LEP) to determine land zoning and associated development categories. A legal mechanism used by the Act which provides for the application of science through an LEP is in the form of Ministerial directions. These directions, issued under the Act, require councils to consider the NSW Coastal Policy and the NSW Coastal Design Guidelines in developing their LEP, documents which are based on scientific understandings of the coast. For example, the NSW Coastal Policy sets out the framework of goals and objectives for managing the coastal zone in the State and to provide strategic actions for achieving these goals. The NSW Coastal Design Guidelines includes design

principles and setback requirements which aim to minimise development impact on the coast and protect property. A further component of development control, but which does not require strict adherence to as it is a non-statutory document, is development control plans (DCPs). These are created by a council to achieve the objectives of the zone, and may address coastal zone development matters such as appropriate setback lines and development design.

State Environmental Planning Policies (SEPP's) are a means for the NSW government to achieve state planning objectives through a consistent approach to development planning. Science based requirements for controlling coastal development and its impacts on coastal environments are provided through SEPPs. Though they are not 'the law', they are developed by the Minister with power given by the EP&A Act and councils are therefore required to consider SEPPs when assessing development applications. The major SEPPs applicable to the coast are:

- SEPP 71 Coastal Protection
- SEPP 14 Coastal Wetlands
- SEPP 26 Littoral Rainforests
- SEPP 50 Canal Estate Development
- SEPP Major Development
- SEPP Infrastructure

Development assessment

The Act sets out matters which must be considered in assessing a development application, among which include consideration to coastal environments and processes including any adopted local Coastal Zone Management Plan, environmental consideration, and the interest of the public which has been determined through NSW case law to include climate change risks.

Environmental assessment

The Act provides for environmental assessment requirements for development applications that are likely to have a significant environmental impact, aimed at protecting vulnerable habitats and species. An interesting point is the reference to cumulative impacts with regard to environmental assessment of fishing activities, with the Act stating "the environmental assessment is to assess the likely cumulative environmental impact of the designated fishing activity carried out by all the proponents as authorised by the applicable fishing regulatory controls described in the draft strategy (Part 5, Division 5)."

Summary of NSW Coastal Case Law Study

A search of NSW court cases pertaining to coastal management in the State identified 28 relevant cases (Appendix 1). Court transcripts of these cases were analysed with the aim of identifying the types of science used as evidence and applied to court decisions. The case law analysis found that, for the most part, cases fall within two categories, with 22 of the total being either (1) an appeal against refusal of consent for development in the coastal zone, or (2) a challenge by a third party to the validity of

consent granted for development in the coastal zone. These are generally related to residential development, though there are also singular cases dealing with development applications for sand extraction, erosion protection works and for the establishment of a Bed & Breakfast within an existing dwelling. As councils have the primary role of assessing development applications, these findings highlight the risk of liability councils face. Cases outside of determining development application outcomes also involved local councils, including unauthorised coastal protection works and coastal land use and zoning disputes. In the cases identified, the only type in which councils were not involved were pollution offences brought to court by the Environmental Protection Authority. The key coastal management issues seen within the case law study include:

- Potential adverse impacts on coastal processes
- Potential adverse impacts of coastal processes acting on the development
- Inconsistency with coastal zoning objectives
- Whether a decision is aligned with the principles of ESD, including climate change impacts
- Whether shoreline setback is adequate, as per the development control
- Impacts on water quality and potential harm to marine environments
- Impacts on an endangered ecological community, threatened or endangered species, or protected wetlands under SEPP 14
- Cultural heritage issues
- Visual amenity issues and suitability of development design
- Impact of development on public access to beach

There are two key types of science-based evidence applied to these court decisions, scientific expert evidence and scientific reports or studies which establish circumstances. The importance of expert evidence is apparent, as in most cases a science and/or engineering professional provided expert evidence. The court's decision is often related directly to the accepted expert's opinion and supporting reports, studies and planning controls. The importance of councils actions in managing their coastline is highlighted by the point that many cases a councils' coastal management plan and related studies are referred to. These have been applied for several purposes, including: assessment of physical coastal processes occurring at the location, determining potential impacts of coastal processes on the development, as evidence of council planning aims and objectives, or as evidence of council's responsive action to coastal management issues. Similarly, in addressing other issues such as biological or water quality impacts, relevant scientific assessments and reports are considered as evidence. Besides these main two types of science-based evidence, scientific literature is occasionally referred to, especially seen in early climate change related cases to establish significance. Two cases used modelling results to predict the developments impact on physical coastal processes, with modelling results impacting the courts decisions. Evidence of increased erosion through historical surveys, reports and photographs has been used. Finally, the Precautionary Principle is commonly applied in court decisions.

Conclusion

The role of dealing with coastal development issues and sustainably responding to climate change impacts lies predominantly with local government, being the key decision makers about local land use in Australia. The responsibilities local government holds are significant to environmental outcomes in the coastal zone, as these planning and development decisions ultimately determine the type and

placement of development on the coast. Decisions which, if made poorly, can lead to unsustainable development and severe degradation of coastal habitats and their ecosystems. Furthermore, councils have a duty of care to make decisions to protect their communities from coastal hazards. As stated in the literature and highlighted in the case law analysis, liability for their actions is a key concern for councils. To address these matters it is therefore important that Councils have sound decision making frameworks to be provided through NSW law, policy and guidelines, and the best available science to base their decisions. The analysis of science input in NSW coastal management legislation identified the key mechanisms enabling science informed coastal management. It was found the *Coastal Protection Act* makes provisions for the scientific advisory NSW Coastal Panel, strategic planning and the use of scientific assessments through coastal zone management plan requirements, and consideration of the principles of ecologically sustainable development in determining development applications in the coastal zone. Under the *Environmental Planning & Assessment Act*, science informed decisions may be enabled by Environmental Planning Instruments, by requirements for consideration of coastal environments and a councils' coastal zone management plan in assessing development applications, and through knowledge of coastal environments gained through environmental impact assessments. Although the legislative framework provides for science informed management through these mechanisms, constraints to appropriately managing coastal environments in light of climate change exist within the NSW legal framework.

Despite the confidence held by climate change experts that sea level rise and coastal erosion will increase, creating interactions between shoreline development and the sea which will be potentially damaging and costly, there has been a slow response in Australian laws for effectively requiring coastal development proposals to be assessed with climate change consideration (Eland & Millner 2009). In 2008 the Sydney Coastal Councils Group commissioned a report to analyse climate change requirements occurring within the framework of legislation and policy pertaining to local councils in NSW. A finding from this study was that requirements for climate change consideration occur predominantly through policy, including NSW State mandated policy and subsequent local policy, such as Local Environment Plans (LEPs). However Australian and NSW legislation and regulations, which are the only instruments with true legal standing, do not explicitly outline requirements for planning for climate change. The authors make the further point that the only legislated climate change provisions occur within the objects clauses or as matters for consideration, giving no true requirements for climate change in the law.

Nicholls et al. (2007) summarize the key barriers inhibiting adaptation in the coastal zone with reference to a wide selection of scientific literature. The majority of these barriers relate to the need for further scientific research and monitoring programs to improve our knowledge about coasts, including coastal conditions, thresholds and responses to change, and appropriate management responses. The law can play an important role in providing a framework for management responses and to address key adaptation barriers, such as insufficient or inappropriate shoreline protection measures. The key barriers to adaptation also indicate the importance of governance systems which are characterised by institutional arrangements that enable strong governance, and the support for adaptation within the whole coastal governance network, particularly in the community. Within the governance system, improved application of social science to understanding the local context of decision-making combined with legal approaches informed by science are required to better enable climate change adaptation.

References

- Baker & McKenzie 2011. Local Council Risk of Liability in the Face of Climate Change, Resolving Uncertainties. A Report for the Australian Local Government Association.
- Bultitude, K., Rodari, P. & Weitkamp, E. 2012. Bridging the gap between science and policy: the importance of mutual respect, trust and the role of mediators. *Journal of Science Communication*, 11, 1824-2049.
- Cash, D., Clark, W., Alcock, F., Dickson, N., Eckley, N. & Jager, J. 2002. *Salience, credibility, legitimacy and boundaries: Linking research, assessment and decision making*, Harvard University, Faculty Research Working Papers Series, John F Kennedy School of Government.
- Cash, D. W., Adger, W. N., Berkes, F., Garden, P., Lebel, L., Olsson, P., Pritchard, L. & Young, O. 2006. Scale and cross-scale dynamics: governance and information in a multilevel world. *Ecology and Society*, 11, 8.
- Eland, A. & Millner, F. 2009. Walking away from considering climate change. *Impact! A National Journal of Environmental Law, Environmental Defenders Office Living off the Coast*, 23-26.
- Forbes, C. 2009. The effects of climate change induced coastal inundation. *National Environmental Law Review*, 4, 44-57.
- Kay, R. & Alder, J. 1999. Chapter 4: Major Coastal Planning and Management Techniques. *Coastal Planning and Management*. New York, NY: Taylor & Francis.
- Lagace, E., Holmes, J. & McDonnell, R. 2008. Science–policy guidelines as a benchmark: making the European Water Framework Directive. *Area*, 40, 421-434.
- Lipman, Z. & Stokes, R. 2011. That sinking feeling: A legal assessment of the coastal planning system in New South Wales. *EPLJ*, 28, 182-200.
- McDonald, J. 2007. A risky climate for decision-making: The liability of development authorities for climate change impacts. *EPLJ*, 24, 405-416.
- Nicholls, R., et al. 2007. Coastal systems and low-lying areas. In: M.L. Parry, et al. (ed.) *Climate Change 2007: impacts, adaptation and vulnerability. Contribution of Working Group II to the fourth assessment report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press.
- Nowotny, H., Scott, P. & Gibbons, M. 2001. *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*, Cambridge, Polity Press.
- Preston, B. & Kay, R. 2010. Managing climate risk in human settlements. In: Jubb, I., Holper, P. & Cai, W. (eds.) *Managing Climate Change: Papers from the GREENHOUSE 2009 Conference*. Collingwood VIC: CSIRO Publishing.
- Selman, P. 2000. Networks of Knowledge and Influence: Connecting Planners to the Planned. *Town Planning Review*, 71, 109-121.
- Stocker, L., Kennedy, D., Kenchington, R. & Merrick, K. 2012. Sustainable coastal management? In: Kenchington, R., Stocker, L. & Wood, D. (eds.) *Sustainable Coastal*

Management and Climate Adaptation - Global Lessons from Regional Approaches in Australia. Collingwood, VIC: CSIRO Publishing.

Sydney Coastal Councils Group & NSW Environmental Defenders Office 2008. Coastal Councils and Planning for Climate Change: An assessment of Australian and NSW legislation and government policy provisions relating to climate change relevant to regional and metropolitan coastal councils.

Van Den Hove, S. 2007. A rationale for science–policy interfaces. *Futures*, 39, 807-826.

Van Kerkhoff, L. 2005. Integrated research: concepts of connection in environmental science and policy. *Environmental Science & Policy*, 8, 452-463.

Vogel, C., Moser, S. C., Kasperson, R. E. & Dabelko, G. D. 2007. Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships. *Global Environmental Change*, 17, 349-364.

Weichselgartner, J. & Kasperson, R. 2010. Barriers in the science-policy-practice interface: Toward a knowledge-action-system in global environmental change research. *Global Environmental Change*, 20, 266-277.

Appendix 1 - NSW Coastal Case Law Study

Aldous v Greater Taree City Council [2009] NSWLEC 17
Anderson & Anor on behalf of Numbahjing Clan within the Bundjalung Nation v NSW Minister for Planning and Ors [2008] NSWLEC 120
Byron Shire Council v Vaughan, Vaughan v Byron Shire Council [2009] NSWLEC 88
Canyork Pty Ltd v Wollongong City Council and Anor [2003] NSWLEC 125
Currency Corporation Pty Limited v Wyong Shire Council [2007] NSWLEC 634
Davfast Pty Ltd v Ballina Shire Council [2000] NSWLEC 128
Druitts Developments Pty Ltd v Gosford City Council (No 2) [2001] NSWLEC 98
Elzerman v Eurobodalla Shire Council [2011] NSWLEC 1036
Environment Protection Authority v Centennial Newstan Pty Ltd [2010] NSWLEC 211
Environment Protection Authority v Nowra Chemical Manufacturers Pty Ltd [2008] NSWLEC 187
Friends of South West Rocks Inc v Machro Pty Limited and Ors [2004] NSWLEC 721
Kendall Street Developments Pty Limited v Byron Shire Council [2004] NSWLEC 227
Lane v Manly Council [2009] NSWLEC 1329
Minister for Planning v Walker [2008] NSWCA224
New South Wales Glass and Ceramic Silica Sand Users Association Ltd v Port Stephens Council [2000] NSWLEC 149
Parkes v Byron Shire Council [2003] NSWLEC 104
Parkes v Byron Shire Council [2004] NSWLEC 92 revised - 02/07/2004
Pennings G & M v Wyong S C [2004] NSWLEC 160
Port Stephens Pearls Pty Limited v Minister for Infrastructure and Planning [2005] NSWLEC 426
Pratt v Kiama Municipal Council [2005] NSWLEC 562
Prochilo v Shoalhaven City Council [2006] NSWLEC 811
Royal Motor Yacht Club NSW Port Hacking v Sutherland Shire Council [2008] NSWLEC 1126
S J Connelly CPP Pty Limited v Byron Bay Council [2010] NSWLEC 1182
Shannon Pacific v Minister for Planning [2007] NSWLEC 669
Van Haandel v Byron Shire Council [2006] NSWLEC 394.
Walker v Minister for Planning [2007] NSWLEC 741
Warringah Council V Franks & Ors [1999] NSWLEC 65
Weriton Finance v Wollongong City Council [2011] NSWLEC 1046