The Tide is High: Evaluating Climate Change Adaptation and Disaster Resilience at the Local Level

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Abstract: There is increasing concern about climate change and its impacts on both the natural and built environment. Climate change considerations, although still not fully integrated, have become an important part of disaster risk management worldwide. Australia has witnessed many extreme weather events in the past and will witness more in the future as the climate changes. While some mitigation strategies to cut greenhouse gas emissions are in place, climate change adaptation has broadly been neglected by all levels of government and treated separately from disaster risk management. Coastal cities such as Queensland's Gold Coast and Sunshine Coast are located in low-lying flood prone areas, providing highly sensitive case studies. They are also amongst the fastest growing cities in Australia with volatile economies that are heavily reliant on tourism and supporting industries such as retail and construction. This paper reviews the institutional context of the Gold and Sunshine Coasts in addressing urban resilience to climate-related disasters. The focus of the policy review is at local level climate change strategies, planning schemes, and disaster management plans as integral parts of managing the risks of natural hazards. The aim is to understand how the concepts of urban resilience and adaptation are reflected through policies at local level of government.

1. Introduction

With climate change there will be an increase in the frequency, intensity and/or duration of extreme weather-related events (Intergovernmental Panel on Climate Change (IPCC) 2014). Climate change imposes significant challenges for local governments globally. This includes the difficulty of embedding relevant strategies within different policy priorities (Carmin et al. 2012). The linkages between land-use planning, climate change and disaster management are crucial for building community resilience (Bajracharya et al. 2011) and integrating adaptation and resilience at the local level can be achieved through well-designed policies (Romero Lankao 2007). This can be done by modifying existing plans/frameworks to embed adaptation and resilience or forming complementary standalone climate strategies (Bierbaum et al. 2013; Bulkeley & Tuts 2013). What is important is the level of interaction between policies in supporting the desired outcomes (Urwin & Jordan 2008) as well as consistency and the collective performance of policies and plans.

Australia is particularly vulnerable to climate-related disasters because 85% of its population lives along the coast (Australian Academy of Science 2015; Department of Climate Change (DCC) 2009; IPCC 2014). Within Australia, the South East region of Queensland has been identified as a particular hotspot (Burton 2014; Hennessy et al. 2007; IPCC 2014) including the Gold Coast and the Sunshine Coast that are amongst the fastest growing cities in Australia with much of their development taking place in vulnerable areas (DCC, 2009; Gold Coast City Council (GCCC) 2009; Infrastructure Australia Major Cities Unit 2010; IPCC, 2014; Sunshine Coast Regional Council (SCRC) 2010a). Despite the existing efforts to embed resilience and adaptation into policies/plans at all government levels in Australia (Howes & Dedekorkut-Howes 2012), the national, state and local political context for climate change has been in a state of flux.

This paper compares three key polices and plans to identify the overall ability of local governments in shaping integrated responses to adaptation and disaster risk management. Similar studies to date have focused on single type of policies (see: Boswell et al. (2011); Zeppel (2012)) and there is a lack of studies that evaluate a combination of policies across different cases. This research takes a holistic approach and examines main policies of the Gold Coast and the Sunshine Coast to see how much they intend to do collectively to increase disaster resilience and adaptation. An analytical framework have been developed to highlight the main strengths and areas of weaknesses in policy focus, which is outlined in the first section. We then analyse the policies of the Gold Coast and the Sunshine Coast and discuss the main points relevant to each theme in our framework to provide an overall evaluation

of the two cases. We conclude that even in similar biophysical, socio-economic and political contexts, local governments can still make a difference in building urban climate resilience.

2. Analytical Framework

While there have been many attempts to delineate resilience in the urban context (see Mayunga 2007; Tyler & Moench 2012), we define urban resilience as the ability of the physical systems, agents and institutions to deal with extreme weather events before (anticipation, avoidance, and resistance), during (accommodating and/or absorbing) and after disasters (recovery and transformation) (Torabi et al. 2014). Land-use planning and disaster risk management are important contributors to the resilience of cities (Howes et al. 2013). Berke et al. (1989), identified seven useful planning tools:

- Development regulations (zoning, subdivision, and setbacks);
- Building standards and codes;
- Planning;
- Land and property acquisition;
- Critical and public facilities;
- Taxation and fiscal policies; and,
- Information dissemination.

To reveal the ability of each local council for adaptation, disaster risk management, and resilience we gathered the relevant criteria under a framework of analysis (Table 1).

Table 1: Evaluation Framework for the Analysis of Local Adaptation and Resilience Policies

Theme	Criteria
Coverage of Adaptation	Is it part of the strategic intentions/goals?
	What are the relevant proposed actions?
Coverage of Resilience	Is it part of the strategic intentions/goals?
	What are the relevant proposed actions?
Allocated responsibilities and resources?	What are the allocated resources (human/non-human) for each action?
	Who is the responsible agency for the proposed actions?
Settlement patterns density, and disaster resilience	Is any relationship between disaster resilience and settlement patterns/density referred to implicitly or explicitly in the policies?
Planning tools [a]	• Zoning Regulations, subdivision and setbacks • Building standards • Human occupancy of hazard zone • Hazard mapping • Control over unauthorised development • Land and property acquisition • Critical and public facilities • Pull and push factors

[a] Based on Berke et al. (1989); Burby et al. (2000); Mileti (1999)

3. The Gold Coast and the Sunshine Coast Cases

The City of Gold Coast and the Sunshine Coast Council have policies/plans that are important for the analysis of the integration between adaptation, disaster risk management, and land-use planning (see Table 2). The following sections review each of these based on the criteria outlined in Table 1.

Table 2: Key Documents

	GC	SC
Climate Change Strategies	The *Gold Coast Climate Change Strategy 2009-2014 (Gold Coast Strategy)*	The *Sunshine Coast Climate Change and Peak Oil Strategy 2010-2020 (Sunshine Coast Strategy)*
Planning Schemes	The *Gold Coast Draft City Plan 2015 (Gold Coast City Plan)*	The *Sunshine Coast Planning Scheme 2014*
Disaster Management Plans	*The City of Gold Coast Local Disaster Management Plan-Version 6.1 2013 (Gold Coast Disaster Plan)*	The *Sunshine Coast Council and Noosa Shire Council Local Disaster Management Plan 2014 (Sunshine Coast Disaster Plan)*

Coverage of Adaptation

Being supported by the *Climate Change Background Study 2010-2020* and the *Peak Oil Background Study 2010-2020*, the Sunshine Coast Strategy takes a longer-term focus and provides a detailed background to the causes and effects of climate change. Climate strategies of both cases listed the key climate change projections by the IPCC and Commonwealth Scientific and Industrial Research Organisation (CSIRO). These projections are summarised in Table 3. While the Sunshine Coast Strategy takes the high end of the IPCC sea level rise scenarios into account, the Gold Coast Strategy used the medium sea level rise scenario developed by the CSIRO.

Table 3: Climate Change Projections for the Gold and Sunshine Coasts [a]

	The Gold Coast	The Sunshine Coast
Sea Level Rise by 2100	18-79 centimetres	1.1 metres
Temperature Increase	1.1° - 4.4° Celsius by 2070	6.5° by 2100
Number of days over 35°C	14 days per annum by 2070	30 days per annum by 2100
Tropical cyclones and severe storms	Increase in 1-in-100 year storm surge height by 0.35 metres	Fewer but longer lived cyclones, increase in number of severe storm by 2070
Changes to rainfall	Increase in extreme rainfall intensity for 2-hour events of 46 per cent by 2070	Reduction in average annual rainfall by 2100 along with an increase in intensity of these events

[a] These parameters and projections are subject to regular review by local governments for currency with the best available knowledge.

The Gold Coast Strategy highlighted its goal "to lead our city in response to the risks and opportunities posed by climate change to the city, the community, and Council's operations, enabling climate change resilience for our future" (GCCC 2009, p. 7). It provided separate definitions of community adaptation (reducing the vulnerability of the community while maximising the potential opportunities) and council adaptation (corporate risk management approach to manage governance, leadership and planning challenges) (GCCC 2009, p. 4). There were five key areas for action: 1) Governance and Leadership; 2) Research; 3) Advocacy and Awareness; 4) Infrastructure; and, 5) Planning and Regulation. These came with corresponding actions, estimated costs, the identification of a responsible agency (branch or department), and estimated timeframe. This strategy has not been replaced by a new policy.

The Sunshine Coast Strategy is backed by Council's *Corporate Plan 2009-2014* that also acknowledges the need to tackle climate change. There are four key policy approaches: 1) Leadership; 2) Mitigation; 3) Adaptation; and, 4) Energy transition. Adaptation is defined as "adjustments in human or natural systems, including changes in behaviour, institutional structure or policy, which are responsible to actual or expected climate changes and have long-term implications" (SCRC 2010b, p. 56). Instead of

identifying responsible agencies, however, the related institutional tools (Council's other plans and strategies) with completion dates and costs have been tied into the strategy.

Both councils have also prepared planning schemes in accordance with the *Sustainable Planning Act 2009* and the *SEQ Regional Plan 2009-2031*. The Gold Coast City Plan does not mention adaptation directly in its strategic intention but there is recognition of "gradual changes to climatic conditions" (City of Gold Coast (CoGC) 2015, p. 83). Addressing the impacts of climate change emerges in several sections of the plan such as criteria for evaluation of development application in the areas at risk of flooding (Part 8.2.7), construction operation and maintenance of city infrastructure and assets (6.9 City Plan policy), and protection of people and premises from the adverse impacts of erosion (Part 8.2.4).

The Sunshine Coast Planning Scheme has a more explicit focus on adaptation to climate change, with a discussion of the capacity of the natural environment of the Sunshine Coast to adapt impacts (SCRC 2014). This is further underpinned by the strategic outcomes linked to different policy themes such as: "Settlement Patterns" (Theme 1); "Natural Environment" (Theme 5); and, "Natural Hazards" (Theme 8). It also proposes tools such as: the Coastal Protection Overlay Code (Part 8.2.5); Flood Hazard Overlay Code (Part 8.2.7); Stormwater Management Code (Part 9.4.6); Works, Services, and Infrastructure Code (Part 9.4.11).

Both councils have provided information on arrangements, coordination, and management of emergencies and disasters. Being action based, neither the Sunshine Coast Disaster Plan nor the Gold Coast Disaster Plan have a particular focus on adaptation in their strategic goals. There is no mention of adaptation in the Gold Coast Disaster Plan while the Sunshine Coast Disaster Plan considers it as a part of its "Prevention and Disaster Management" strategies and lists relevant actions (Sunshine Coast Council & Noosa Shire Council 2014).

Adaptation Actions

The Gold Coast Strategy outlines leadership activities (such as hosting a Climate Change Summit), commits to research (mainly related to risk assessments), proposes awareness raising (by training council workers and undertaking public education), that will result in some adjustments to plans and regulations. There is a similar but more comprehensive list of activities in the Sunshine Coast Strategy supported by more actions.

Overall there is also a greater level of detail in the Sunshine Coast Planning Scheme with policy tools (codes, guidelines, policies) that have climate change considerations in their content. Overlay codes relevant to coastal erosion protection and flood hazard are common policy tools in both plans. However, these codes in the Sunshine Coast Planning Scheme have been supported by other tools such as different planning scheme policies. An important issue to consider is the existence of many local plans in the Sunshine Coast such as the Maroochydore Principal Regional Activity Centre Structure Plan (Part 10.2) and the Palmview Structure Plan (Part 10.3) that address adaptation and resilience of communities to climate change whereas all the previous local plans are excluded from the Gold Coast City Plan.

The Sunshine Coast Disaster Plan sets out actions to address adaptation as developing a climate change strategy; climate change infrastructure risk assessment; undertaking corporate carbon accounting and management project; and establishing an energy transition reference group (SC 2010, p. 73).

Coverage of Resilience

Resilience to the impacts of climate change is addressed in the Gold Coast Strategy under "Infrastructure" theme but it does not provide a definition of the term. Resilience in the Sunshine Coast Strategy is defined as: "the ability to absorb disturbances, to be changed and then to reorganise and still have the same identify (retain the same basic structure and ways of functioning)" (SCRC 2010b, p. 59). Resilience in the Sunshine Coast Planning Scheme is addressed by key concepts and strategic outcomes across themes such as "Natural Environment" (Theme 5) and "Natural Hazards" (Theme 8). Similarly the Gold Coast City Plan addresses resilience as a part of its strategic intention in relevant strategic themes such as "Living with Nature" and "A Safe, Well Designed City". It also focuses on the economic dimensions of resilience and outlines resilience under the theme of "Strengthening and Diversifying the Economy" but does not propose any specific actions.

The Sunshine Coast Disaster Plan has greater focus on community resilience to disasters compared to the Gold Coast Disaster Plan. It is defined here as "a measure of how quickly a system recovers from failures" (Sunshine Coast Council & Noosa Shire Council 2014, p. 18). The Gold Coast Disaster Plan only mentions the term "community resilience" twice but does not provide a definition of the term.

Resilience Actions

The Gold Coast Strategy seeks to: review and progressively amend design standards and development of management plans; identify and prioritise critical Council infrastructure and assets in areas at risk; and review the maintenance requirements for Council's recreational facilities. Resilience in the Sunshine Coast Strategy is addressed by actions including: engaging/empowering the community; defending natural landscapes; and, reducing impacts on waterways.

Actions on resilience in the Gold Coast City Plan relate to stormwater, waterways, open spaces, erosion and sediment control. The Sunshine Coast Planning Scheme offers actions via codes on biodiversity, waterways, and wetlands (Part 8.2.3) and flood hazard (Part 8.2.7). Unlike the Gold Coast City Plan, this planning scheme takes into account communities and highlights the importance of enhancing and maintaining disaster resilience of community infrastructure such as aged care and retirement facilities. While there are no references on how to spatially increase community engagement and raising disaster awareness in any of the planning schemes, the Sunshine Coast Planning Scheme notes the preferred approach for enhancing disaster resilience is always to avoid the development of community infrastructure in high risk areas (Part 9).

The Sunshine Coast and the Gold Coast Disaster Plans both detail strategies relating to prevention, preparedness, response, and recovery. The Gold Coast Disaster Plan touches resilience very briefly under its "Recovery" theme in terms of identifying opportunities during recovery to enhance the sustainability, safety, and resilience of the Gold Coast community (CoGC 2013, p. 50). It mentions compliance with legislation, regulations, standards, hazard reduction programs, building codes, building use, insurance and land-use planning. The Sunshine Coast Disaster Plan also proposes appropriate building codes, planning instruments, legislation, insurance, and land-use management initiatives, but in addition promotes community awareness, public information, and warning systems by recognising that providing information on how to take care of individuals, families, households, businesses and the community during and after disasters. A *Community Resilience Strategy and Action Plan* has also been developed.

The Allocation of Resources

In terms of Councils' adaptation strategies, the Gold Coast Strategy underlines the importance of funding, dedicated resources, and capability development across the organisation. The strategy acknowledges that not all actions will require their own funding and additional funding might be required. Similarly the Sunshine Coast Strategy indicates that many of the proposed actions will be undertaken using existing resources and budget allocations. Council's budget process and funding through the Environment Levy are the other options that are available and the implementation of efficiencies can produce long term financial savings. Neither of these strategies allocate specific funding to resilience building. The planning schemes also do not mention the specific resources to be allocated to resilience or adaptation and no responsible agents or institutions are identified.

The local disaster management plans do not make a reference to any financial resources. The Sunshine Coast Disaster Plan underscores the importance of appropriate support and resources from state and district disaster management group to assist the local government in carrying out disaster operations. With a strong focus on coordination of different groups before, during, and after disasters both the plans identify and list the main agents and institutions that are key to managing emergencies and disasters in the area. These agents and institutions are diversified across a broad range of stakeholders at different levels from the local councils and local disaster coordination centres/groups to district and state disaster groups and a range of departments.

Settlement Patterns and Density

Both the climate strategies highlight the need to integrate the impacts of climate change in their strategic land-use, coastal management, and transport planning decisions. The Sunshine Coast Strategy, however, also focuses on disaster management plans and requires appropriate transport routes, services, and infrastructure available in the event of emergency to protect existing and planned settlements. Both the planning schemes underline the importance of avoiding high risk areas for future

development and provide guidelines to control development to be flood resilient. However, there is an underestimation of the future impacts of climate change and much of city's future development is still taking place at areas at high risk of climate-related disasters. The Gold Coast Disaster Plan recognises the high exposure of the eastern portion of the city to storm surge and tsunami. It also highlights the differences between densities across the city by considering Surfers Paradise having the highest density with significant numbers of high rise buildings, some of which have in excess of 80 floors. Notwithstanding the high exposure of the Gold Coast to disasters and variations between densities, the Gold Coast Disaster Plan does not propose any specific actions to address disaster resilience within these areas. Unlike the Gold Coast, the Sunshine Coast Planning Scheme applies a height limit of maximum 45 metres in all its local Height of Buildings and Structures Overlay Maps. Most of these areas are designated as flooding areas and the planning scheme provides guidelines to manage the risks of flood hazard in these areas. In general, despite outlining the biophysical and socioeconomic vulnerabilities of the regions, neither of the disaster plans propose any specific strategies that are tailored to address disaster resilience. The Sunshine Coast Council, additionally provides guidelines to embed resilience into existing and new developments.

Other Relevant Planning Tools

The main policy instruments in addressing the risks of water and wind-related disasters (which consequently contribute to urban climate resilience) in the planning schemes are:

- Zoning regulations, buffers, and setbacks;
- Floor level rules;
- Mitigation structures;
- Stormwater management infrastructure and,

The limited development zone codes in both the planning schemes aim to identify land known to be significantly affected by one or more development constraints (such as flooding). The Coastal Erosion Hazard Overlay Code of the Gold Coast City Plan requires buildings and structures are set back from the ocean beach to ensure the protection and maintenance of the foreshore seawall (boulder wall); protect beachfront properties from erosion and other coastal hazards; and, ensure unimpeded access through to neighbouring properties for seawall maintenance by providing setback requirements (8.1 metres from seawall line) including appropriate building footing levels. The Coastal Protection Overlay Code of the Sunshine Coast Planning Scheme sets out guidelines to protect people and property from coastal hazards considering the predicted effects of climate change, avoiding new development in erosion prone land, and minimising the impacts of existing developments by setback requirement of 6 metres from seaward property boundary (building line). The building line creates appropriate setbacks from coastal impacts for new development, where the impacts on existing development are managed through tools such as building codes and minimum floor level. The design and location of public open scape networks resulting in high quality parklands that enable the retention of significant vegetation, wetlands, waterways and other habitat areas that provide for stormwater and flood management are also important actions in both planning schemes.

Both documents provide policy tools to regulate development in high risk areas and adapt to the impacts of climate-related disasters. One important tool is the minimum floor level requirement which provides a height limit (considering the impacts of sea level rise) above which all buildings and habitable rooms should be constructed. While the previous *Queensland Coastal Plan* set this level at 800mm above the sea level, the Newman Liberal National Party Government (2012-15) removed this requirement. This plan is currently under review by the Palaszczuk Labor Government. This accepted level was reduced to 300mm in the Gold Coast City Plan and with the relevant amendments a new level have not been introduced yet (see Appendix A). The Sunshine Coast Planning Scheme considers higher levels associated by rarer flood events for its minimum floor level requirements for different land-uses (especially commercial, sewage plants, and community infrastructure land-uses. Neither of the documents provide any regulation for evacuation of people from residential zones aside from the flood-free access requirement. However, they both have measures in place for preparation of emergency evacuation plans for public infrastructure and open spaces.

Protective barriers such as dams, levees, seawalls, and dykes are among the key infrastructure in managing disasters. Although not specifically mentioned in the context of climate change adaptation, disaster resilience, or as a part of the flood hazard overlay codes, these protective barriers mitigate the impacts of climate-related disasters and therefore can contribute to the resilience of the city against

these events. In both documents issues relevant to seawall construction have been addressed under codes relevant to coastal protection and coastal hazards, city plan policies (such as Land Development Guidelines and Coastal Dune Management) and local plans (in Sunshine Coast). The Water Resource Catchments Overlay Codes of both these planning schemes is designed to protect water resources and their quality from the adverse impacts of development. The Sunshine Coast Planning Scheme specifies this code to water supply catchments (dams), while the Gold Coast City Plan provides more detailed information such as minimum horizontal separation distances for flood immunity and upper flood margin level for urban water storage under this code. This plan also takes the impacts of stage 2 of raising the Hinze Dam into account in determining the planning requirements for the Nerang River catchment.

Finally, protecting stormwater infrastructure from flooding and storm surge events is an important consideration of both the planning schemes that contributes to the resilience of urban infrastructure. Managing stormwater infrastructure in face of climate-related disasters is addressed through a number of codes and land development guidelines in both these documents. Based on these regulations the design, construction, operation and maintenance of drainage infrastructure must ensure that the infrastructure mitigates the occurrence, severity and duration of flood events. The focus of both documents is mainly on stormwater systems and resilience of other systems such as energy, is out of the focus of these planning schemes. Considering all the policy tools in resilience building discussed in this section, it is obvious that the impacts of implementing measures such as protective barriers and upgrading stormwater management systems can highly be undermined by other tools such as zoning regulations that promote future development and densities in areas at high risk of climate-related disasters. Upgrading the city infrastructure after disasters is very costly and usually takes a lot of time, whereas strategies such as zoning regulations can be much more efficient in terms of building disaster resilience.

Overall Evaluation of the Gold Coast and the Sunshine Coast Policies

A summary of the main review points is presented in Appendix B. This analysis demonstrates that overall, the policies of the Sunshine Coast Council place greater emphasis on the issues of climate change and disaster resilience than those of the City of Gold Coast. The Sunshine Coast Planning Scheme, for example, includes disaster resilience in the planning of residential care and aged care facilities. Similarly the Sunshine Coast policies focus on more diverse dimensions of resilience, taking into account the resilience of government, the community and the businesses. Economic resilience was mentioned in the Gold coast City Plan's strategic goals but no specific actions proposed.

The policies of the Sunshine Coast are also better integrated than those of the Gold Coast, in part by making reference to each other and other policy tools. This integration is underpinned by: more detail in the attention given to climate change and resilience; the explicit definition of core concepts; the application of best available knowledge for future projections (i.e. IPCC's high end sea level scenario); the identification of relevant impacts; and, most importantly, the identification of specific actions. This issue is even clearer in planning for resilient settlement patterns with the height limits and minimum floor level requirements that are applied to high risk areas by the Sunshine Coast Planning Scheme. In terms of managing the risks of flooding, however, the Gold Coast City plan provides more detailed specifications for erosion control and flood immunity along its waterways and considers the impacts of raising the Hinze Dam. Although these measures do not directly mention resilience, they are designed to address the impacts of climate change and managing disasters.

These differences in the policies/plans of the two cases can be explained by political factors and the institutional consideration of climate change. Since the local council elections of 2012 there has been a noticeable divergence between the Gold Coast and the Sunshine Coast councils with regards to climate change policy. While the Sunshine Coast has continued to follow up on its policies and plans regarding climate change adaptation, the Gold Coast has largely withdrawn from the field. The team dealing with climate change was disbanded and the new mayor has indicated that climate change is not a priority for his administration (Howes & Dedekorkut-Howes in press). Such actions were encouraged by the Newman Queensland state government 2012-15 (Solomons & Willacy 2014).

This review shows that local councils can improve urban resilience to some extent using their existing resources. This can be done explicitly through adaptation and resilience strategies that are supported by the necessary levels of funding and staffing. It can also be done more subtly by the modification of related policies and plans. The case studies above indicate that both approaches can be followed simultaneously, but there needs to be reasonable coordination across the various strategies, polices

and plans. Clearly defining common goals and concepts, such as urban resilience or climate change adaptation, can be a useful first step. Planning tools are certainly important, but there also needs to be effective community engagement and empowerment so that people can contribute to building their own resilience. This is something that the Sunshine Coast Council has done but appears to be lacking in the approach taken by the City of Gold Coast.

4. Conclusion and Future Research

There is a need for better integration of climate change adaptation and disaster risk management at the local level of government, particularly for highly vulnerable low-lying coastal communities. Both types of policy are aimed at building bio-physical and socio-economic resilience, which provides some opportunity for better integration. This paper evaluated three key polices/plans for two local government regions in the state of Queensland, Australia: the Gold Coast and the Sunshine Coast. These cases were selected as they are highly vulnerable in terms of their bio-physical and socio-economic characteristics. The focus has therefore been on the local climate change strategies, planning schemes, and disaster management plans of the two case studies. Overall the policies/plans of the Sunshine Coast have a greater emphasis on building resilience to both climate change and disasters such as floods. This was evident in their more comprehensive definition of terms, more detailed strategic goals, and number of specific actions. The exact resources committed by both councils, however, is unclear as many of the actions are contained within the broader budget.

The differences in adaptation and resilience policy between the two case studies could be traced back to the socio-political issues and mainly the differences in political standing of the two local councils on climate change. Although there has been considerable policy reversals in national, state and local planning context for climate change adaption in Australia, local governments can still make substantive difference in adaptation planning and governance. This was particularly the case in the two study areas with councils' divergence on climate policy being reflected through a higher level of consistency and integration within adaptation and resilience polices in the Sunshine Coast. Both the City of Gold Coast and Sunshine Coast Council (being located in the same country, state, and region) received the same level of support and direction from higher levels of government regarding climate change policy and made adaptation plans/policies around the same time, however, Sunshine Coast Council demonstrated a higher level of commitment to adaptation and resilience. The integration between different polies at local level can contribute to overall resilience of cities in face of climate-related disasters. This can be achieved by creating a common understanding of resilience and addressing its different dimensions across corresponding policies. One area for future research would be to follow-up with an evaluation of any on-the-ground changes that have actually been implemented to increase urban resilience.

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Appendix A

Table 4: Minimum Floor Level Requirements for Different Land-Uses

	SC	GC [a, b]
Emergency/disaster management facility	0.2% Annual Exceedance Probability (AEP) + 0.5m or historical + 1m	0.2% AEP + 0.5m freeboard
Shelter/places of refuge	0.2 % AEP + 0.5m or historical + 1m	0.5 % AEP + 0.4m freeboard
Hospitals	0.2% AEP + 0.5m or historical + 1m	0.2% AEP + 0.5m freeboard
Major switch yards and substations	0.5 % AEP + 0.5m or historical + 1m	0.2% AEP + 0.5m freeboard (Electricity Substations: 0.5% AEP + 0.4m freeboard)
Fire/police stations	0.5 % AEP + 0.5m or historical + 1m	0.5 % AEP + 0.4m freeboard
Power station	0.2% AEP+ 0.5m or historical + 1m	0.2 % AEP + 0.5m freeboard
Water treatment plants	0.5 % AEP + 0.5m or historical + 1m	0.2% AEP + 0.5m freeboard
Sewage treatment plant	0.01% AEP or historical + 1m	0.5 % AEP + 0.4m freeboard
Business/commercial	1%AEP + 0.5m or historical + 0.6m	1%AEP
Residential	1%AEP + 0.5m or historical + 0.6m	1% AEP + Freeboard [c]
Industrial	1%AEP + 0.5m or historical + 0.6m	Light industrial: 1% AEP
Community (child care or educational establishments)	0.5 % AEP + 0.5m or historical + 1m	Home for aged: 0.5% AEP + 0.4m freeboard Educational Facilities: 1% AEP + Freeboard

[a] The Gold Coast City Plan is currently under review.
[b] The Designated Flood Level for Broadwater is 1% AEP storm surge level + 0.27m to account for sea level rise resulting from climate change.
[c] Including camping ground caravan parks and relocatable homes.

Appendix B

Table 5: Summary of the Gold Coast and the Sunshine Coast Policy Focus on Climate Change and Resilience

Theme & Criteria		Gold Coast			Sunshine Coast		
		Climate Change Strategy	Planning Scheme	Disaster Plan	Climate Change Strategy	Planning Scheme	Disaster Plan
Climate Change Adaptation	*Coverage*	Short-term (2009-2014), Sea Level Rise (0.18 - 0.79 m)	2015	2013	**Long-term** (2010-2020), **Sea Level Rise (1.1 m)**	2014	2014
	Strategic Intentions	Yes	No	No	Yes	**Yes**	No
	Proposed Actions	Governance and Leadership, Research, Advocacy and Awareness, Infrastructure, Planning and Regulation	Flood Overlay Code, Land Development Guidelines, Coastal Erosion Hazard Overlay Code	-	Leadership, and Adaptation	**Settlement Patterns, Natural Environment, and Natural Hazards.** Coastal Protection Overlay Code, Flood Hazard Overlay Code, **Storm water Management Code**, **Works, Services, and Infrastructure Code, Planning Scheme Policies**	**Prevention and Disaster Mitigation**
Resilience	*Strategic intentions/ goals*	Yes -	Yes -	Yes -	Yes **Definition**	Yes -	Yes **Definition**
	Proposed Actions	Infrastructure	Living with Nature, A Safe , Well Designed City **Economic resilience**	Recovery Theme	**Leadership and Adaptation: empowering the community; defending natural landscapes; and,**	Theme 5: Natural Environment, Theme 8: Natural hazards, **Overlay Codes**: Biodiversity, Waterways, and Wetlands Overlay Code, Flood	**Preparedness: community awareness, public information**

Theme & Criteria	Gold Coast			Sunshine Coast		
	Climate Change Strategy	Planning Scheme	Disaster Plan	Climate Change Strategy	Planning Scheme	Disaster Plan
		Planning Scheme Policy for Land Development Guidelines		**reducing impacts on waterways.**	Hazard Overlay Code, **Local Plans,** **Residential Care Facility and Retirement Facility Code**	
Allocated Resources (human/non-human)	Council's existing resources, partnerships	-	**State Disaster Relief Arrangements (SDRA) and the Natural Disaster Relief and Recovery Arrangements (NDRRA)**	Council, existing resources Additional funding through **the Environment Levy.** Public and private collaborations	-	**Roles and responsibilities**
Responsible Agency/ Institution	Relevant branch and department Planning Scheme, Disaster Management Plan, SEQ Regional Plan, Council's other plans,	Sustainable Planning Act 2009 SEQ Regional Plan	All agencies **Insurance Council of Australia** Planning Scheme, Disaster Management Act 2003, **SEQ Regional Plan**, Building Act 1975, Sustainable Planning Act 2009, State Planning Policy 1/03, Coastal Protection and Management Act 1995, **Gold Coast Corporate Plan,**	Planning Scheme, Disaster Management Plan, SEQ Regional Plan, **Queensland Coastal Plan**, Other corporate plans **Climate Change Background Study and Peak Oil Background Study, Corporate Plan 2009-2014**	Sustainable Planning Act 2009 SEQ Regional Plan	All agencies **Planning Scheme (detailed codes), Climate Change Strategy** Disaster Management Act 2003, Building Act 1975, Sustainable Planning Act 2009, State Planning Policy 1/03, Coastal Protection and Management Act 1995, **Queensland Reconstruction Authority Act 2011,**
Settlement Patterns, Density, and Disaster Resilience	Planning and Regulation and Research: Integration of climate change to strategic land-use	No height restrictions **Encouragement of developers** to consider hazard reduction	-	Integration of climate change to strategic land-use, **Disaster Management plans (evacuation infrastructure)**	**Height limit,** **Avoid intensification of development in coastal erosion prone land**	**Age structure of the region**

Theme & Criteria	Gold Coast			Sunshine Coast		
	Climate Change Strategy	Planning Scheme	Disaster Plan	Climate Change Strategy	Planning Scheme	Disaster Plan
Planning Tools Addressing Disaster Resilience	Vulnerability assessment, hazard mapping	Zoning, Erosion Setbacks, **Building Footings** (erosion-prone land), **Seawall**, Building Standards: Minimum Floor level, Human occupancy of hazard zone, Hazard mapping (Flooding), flood-free access requirement, **Minimum horizontal separation distance for flood immunity**	-	Vulnerability assessment hazard mapping	Zoning, **Erosion Setbacks**, Seawall, design and location of public open space networks, Building Standards: **Hazard mapping (flooding and storm tide events), Minimum floor level** (600mm above the designated flood level), Flood-free access requirement	-