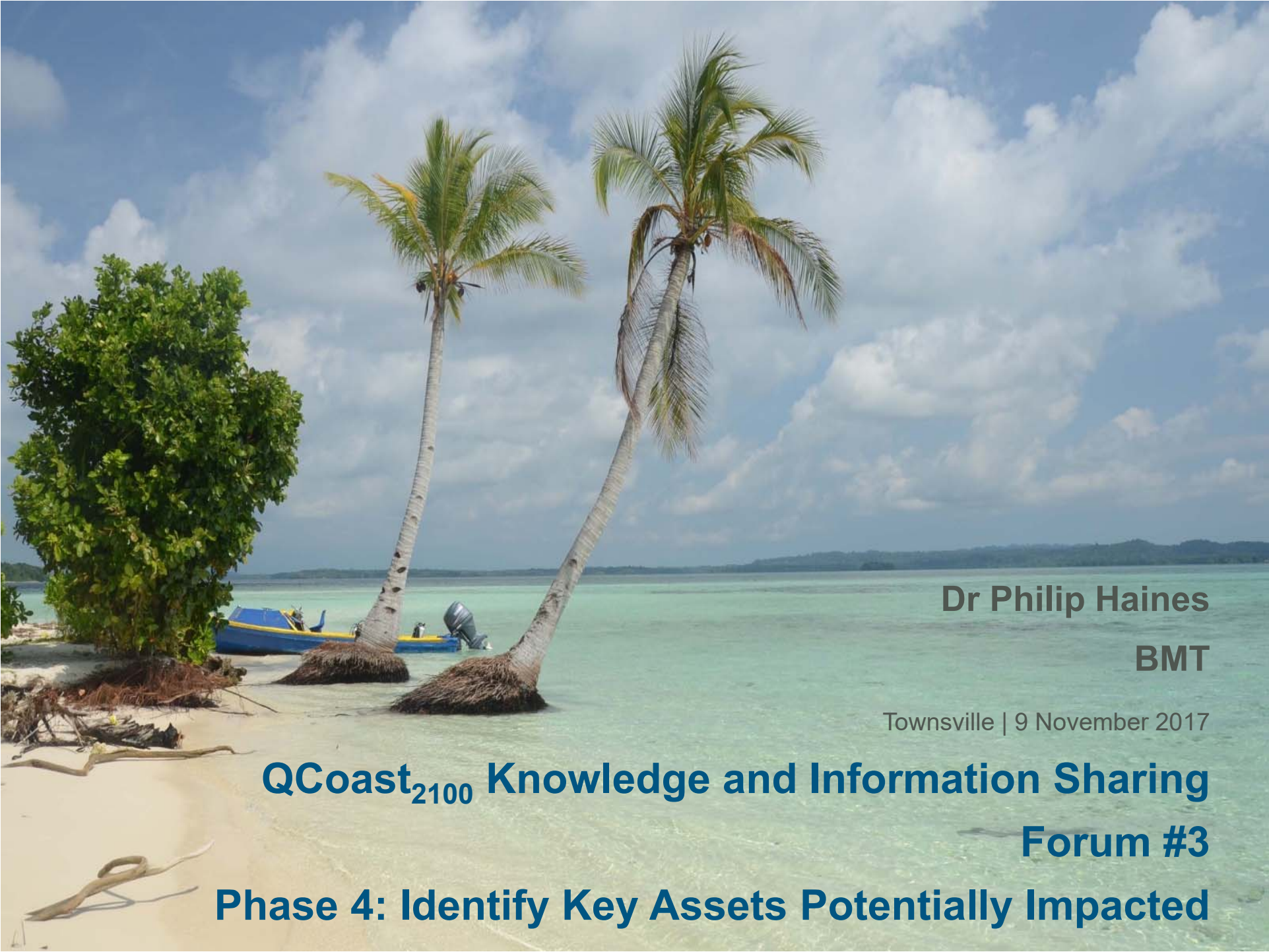




Dr Philip Haines

BMT

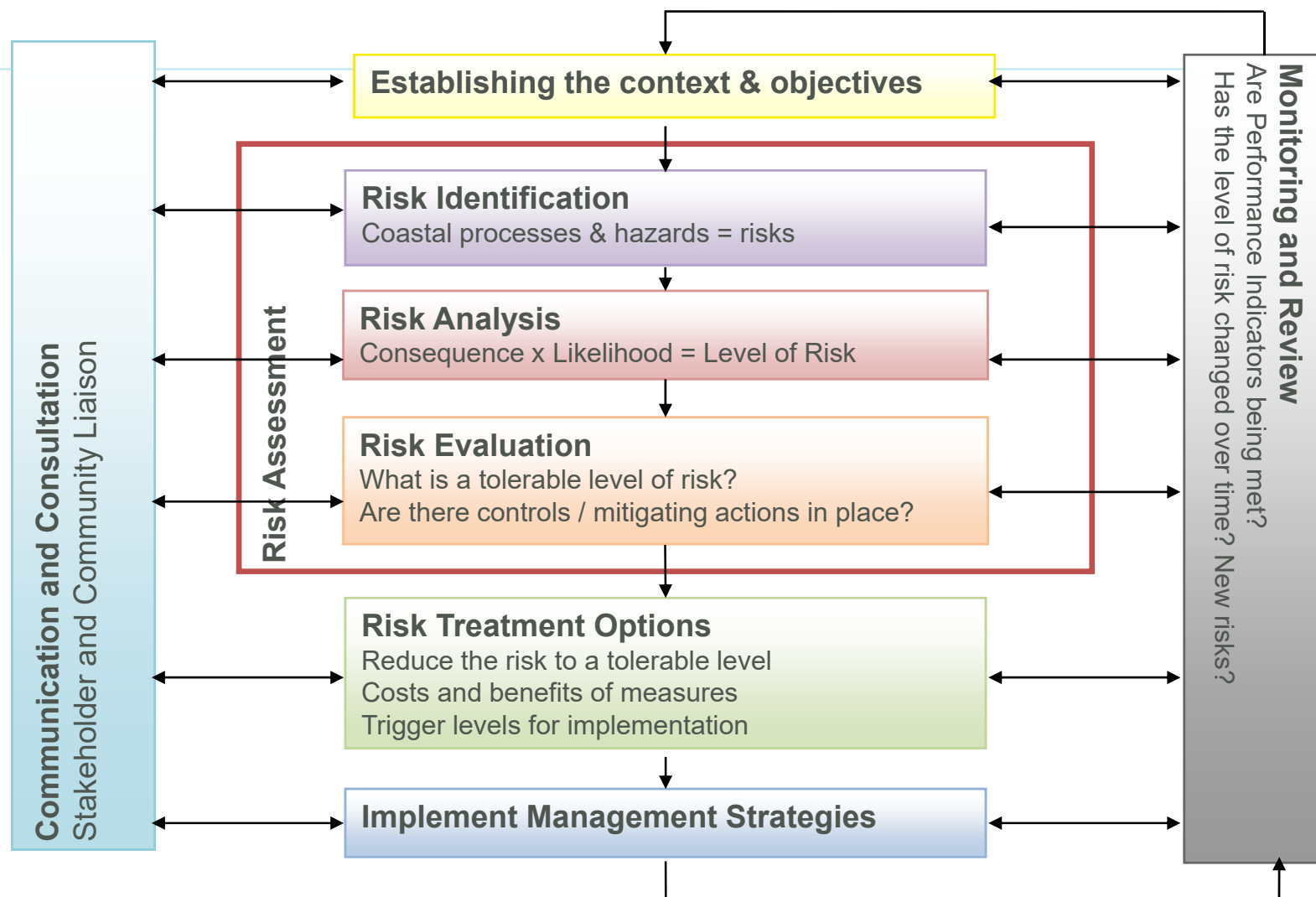
Townsville | 9 November 2017

QCoast₂₁₀₀ Knowledge and Information Sharing

Forum #3

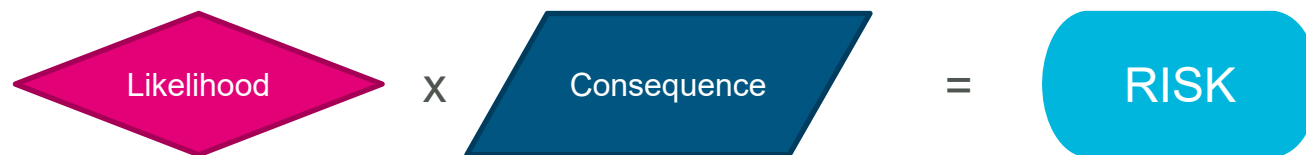
Phase 4: Identify Key Assets Potentially Impacted

Application of the ISO 31000 Risk Process to Coastal Management (Rollason, Fisk and Haines 2010)



Risk-based approach to assess existing and future coastal hazards

Likelihood and consequence of coastal hazard = coastal risk



Move beyond single 'design' event condition and consider likelihood of a range of events

**Change in likelihood in the future as a result of climate change
= temporally dynamic risk profile!**

Consequence

Consequence is the relative impact to an asset in response to the event

- The 'so what' factor
- Nature of the asset – tangible, intangible (and value of the asset)
- Nature of the impact on the asset – major/minor damage, loss of use (for a time), cost of repair versus replace, more frequent maintenance
- Can be considered both in terms of existing or proposed assets
- Different consequence scales can be developed depending on if it is a built, societal or natural asset

What are the relevant Coastal Hazards (temporary impacts vs permanent impacts)

Coastal Inundation (storm tide, wave overtopping, tsunami)



Coastal Erosion (s/t) and Shoreline Recession (l/t)



Identifying assets in the coastal hazard area

•Built assets (public and private)

- Asset databases/registers
- On-ground infrastructure, maintenance/works programs
- Unimproved land

•Environmental assets

- State mapping and listings
- Local mapping, overlays etc

•Societal assets

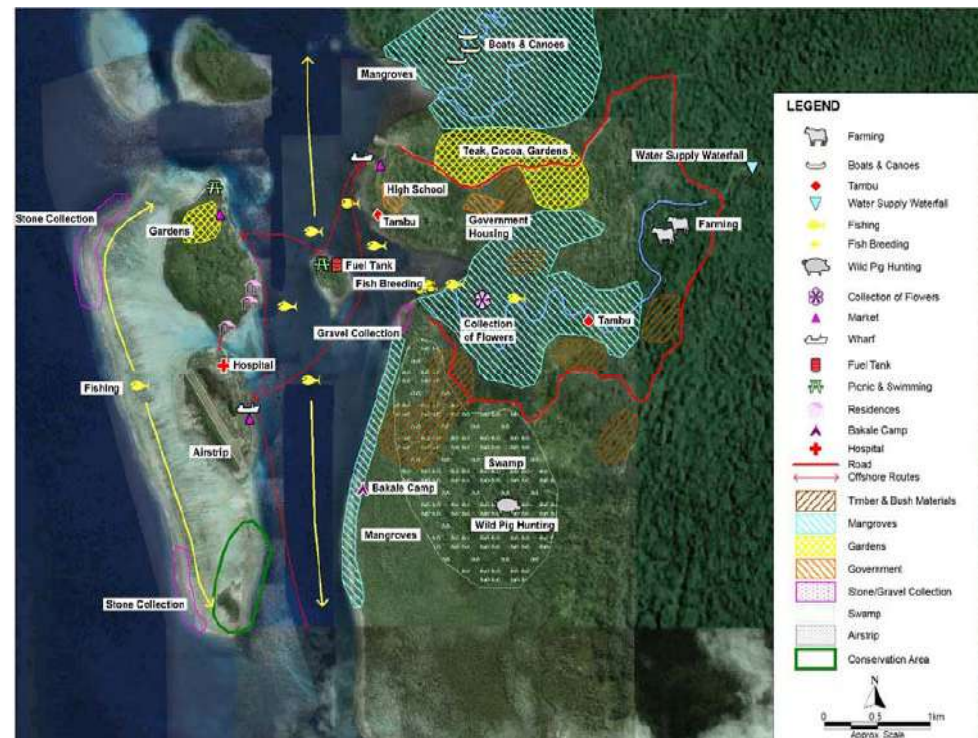
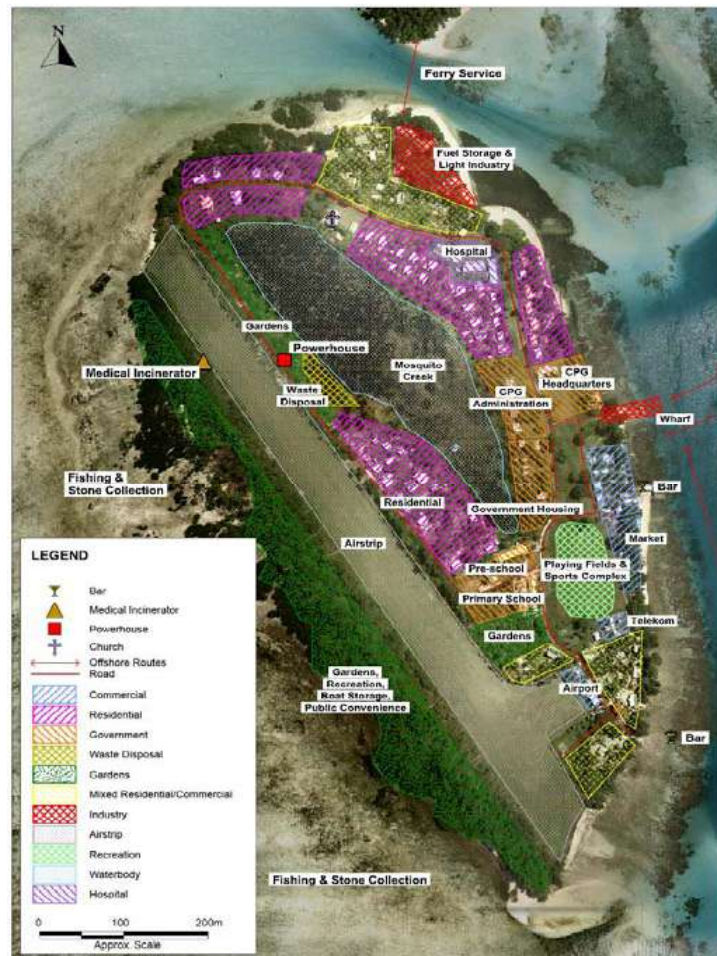
- Heritage mapping?
- Need to talk to the community
- What does the community value?

Value of asset

- What would be the impact if the asset was lost (erosion or permanent inundation)?
- What would be the impact if the asset got wet for a while (storm tide inundation)?
- What is the adaptive capacity of the asset (can it cope with future change)?
- Are there inter-dependencies of value?

Community input to valuing coastal assets

What are the functions or services of the asset that are affected?



Consequence Scale (...permanent or temporary impacts)

Consequence	Society/Community	Environment	Economy (including Council Assets)
Catastrophic	Widespread permanent impact to entire community's wellbeing or culture, with no alternative assets available.	Widespread devastating/permanent impact to ecosystem services <u>Or</u> Loss of all local representation of nationally important species or habitat with recovery unlikely	Damage to private property > \$ 5 million Very high ongoing costs to Council operating/capital expenditure budget. Asset(s) completely damaged and/or large scale engineering works required for reinstating. Significant disruption in business operation (virtually dysfunctional) and long term impacts to local economy and visitor numbers.
Major	Major permanent or widespread medium term (somewhat reversible) disruption to a local community's services (e.g. at suburb level), wellbeing, or culture with no alternative assets available.	Widespread semi-permanent impact to ecosystem services <u>Or</u> Loss of local representation of a national or regionally important species or habitat with recovery over years – decades	Damage to property, infrastructure or local economy > \$ 1 million to \$5 million Major maintenance costs and significant additional cost to operational/capital expenditure required. Extensive structural damage to the asset(s) requiring significant major repair work. Major disruption in the asset's service. Major disruption in business operation with significant loss of revenue and significant impacts to the local economy and reputation that effects visitor numbers in the short term.
Moderate	Minor long term or major short term (mostly reversible) disruption to community's services, wellbeing, or culture. (e.g. at a suburb level), with other alternative assets available nearby.	Local environmental impacts or localised changes to ecological services <u>Or</u> Widespread impacts of a temporary nature to regionally or locally important species or habitat but with recovery likely over the short term	Damage to individual properties of \$100,00 to \$1 million High additional maintenance costs and some additional operational/capital expenditure required. Moderate damage to some part of the structure of the asset(s) and which is recoverable by maintenance and minor repairs. Moderate disruption in the asset's service Considerable impact in business operation with loss of revenue, and wider-scale impacts to broader local economy that results in temporary reduction in visitor numbers.
Minor	Small to medium term (reversible) disruption to community's services, wellbeing, finances or culture (e.g. a few streets affected) or local loss, with many suitable alternative sites available.	Temporary impacts on ecosystem services at a local scale <u>Or</u> Impacts not affecting species or habitat of conservation significance or otherwise affecting local species with rapid recovery	Damage to individual private property of \$10,000 to \$ 100,000 Minor to moderate additional cost to Council maintenance budget Limited damage to some part of the asset(s) and require some small scale restoration work. Minor impact in business operation or broader local economy as disruption is temporary and can be managed through standby or alternate options.
Insignificant	Very small short term disruption to community's services, wellbeing, finances or culture (e.g. a few houses impacted) or neighbourhood level loss, with numerous alternative sites available.	Minimal very short term, temporary effects on habitat, species or ecosystem services with recovery assured.	Damage to individual private property > \$ 10,000 Little or no cost to Council budget Little disruption in service but no structural damage to the asset(s) Little to no impact in business operation or broader local economy.

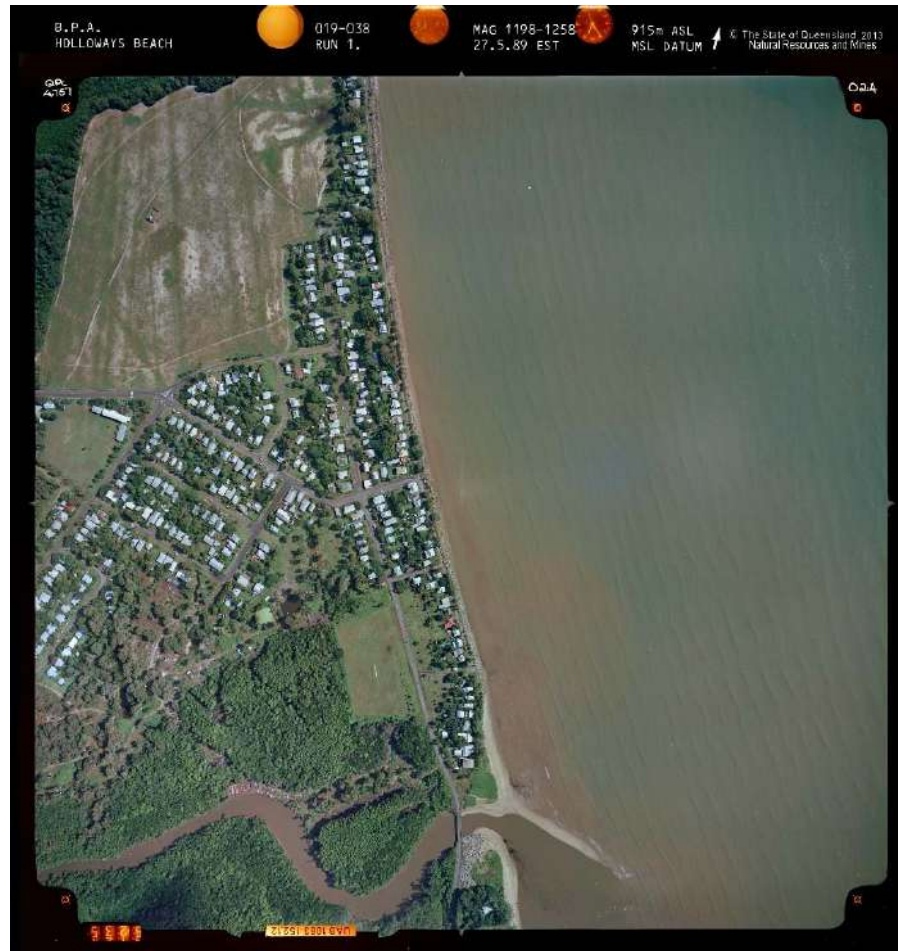
Define Consequence to Asset if Hazard Occurs

Asset Name	Asset Type	Risk Likelihood at 2100	Consequence (Erosion Risk)				Overall Risk Level Likelihood x Consequence
			Society and Community	Environmental	Economic	Combined	
Transport Infrastructure							
Minor Roads (multiple)	Minor Road	Likely	Insignificant	Insignificant	Major	Major	
Eversons Road	Access Lane	Unlikely	Insignificant	Insignificant	Major	Major	
Other Infrastructure							
Stormwater Lines	Stormwater Infrastructure	Unlikely	Minor	Minor	Moderate	Moderate	
Water Supply Lines	Water (Potable) Supply Line	Rare	Minor	Minor	Moderate	Moderate	
Sewer Lines	Sewerage Infrastructure	Rare	Moderate	Minor	Moderate	Moderate	
Community Infrastructure							
Hat Head Holiday Park	Community Facilities	Almost Certain	Minor	Insignificant	Moderate	Moderate	
Hat Head Surf Club	Community Facilities	Almost Certain	Minor	Insignificant	Moderate	Moderate	
Amenities / Block / Shed - Blueys Beach (south)	Community Facilities	Almost Certain	Major	Insignificant	Moderate	Major	
Boat Ramp	Community Facilities	Likely	Minor	Insignificant	Moderate	Moderate	
Beach Access Paths	Community Facilities	Unlikely	Minor	Insignificant	Moderate	Moderate	
Urban & Rural Development							
Residential Property (multiple)	Residential Development	Unlikely	Minor	Insignificant	Major	Major	
Rural Landscape	Rural Land	Unlikely	Minor	Insignificant	Major	Major	
Natural Assets							
Hat Head Beach	Beach	Almost Certain	Major	Minor	Major	Major	
Coastal Vegetation (Foredune)	Terrestrial Habitat	Almost Certain	Minor	Major	Minor	Major	
National Park	Parks and Reserves	Unlikely	Major	Major	Minor	Major	
Environmental Conservation Land	Environmental Land	Unlikely	Minor	Major	Insignificant	Major	
Environmental Management Land	Environmental Land	Likely	Minor	Major	Insignificant	Major	

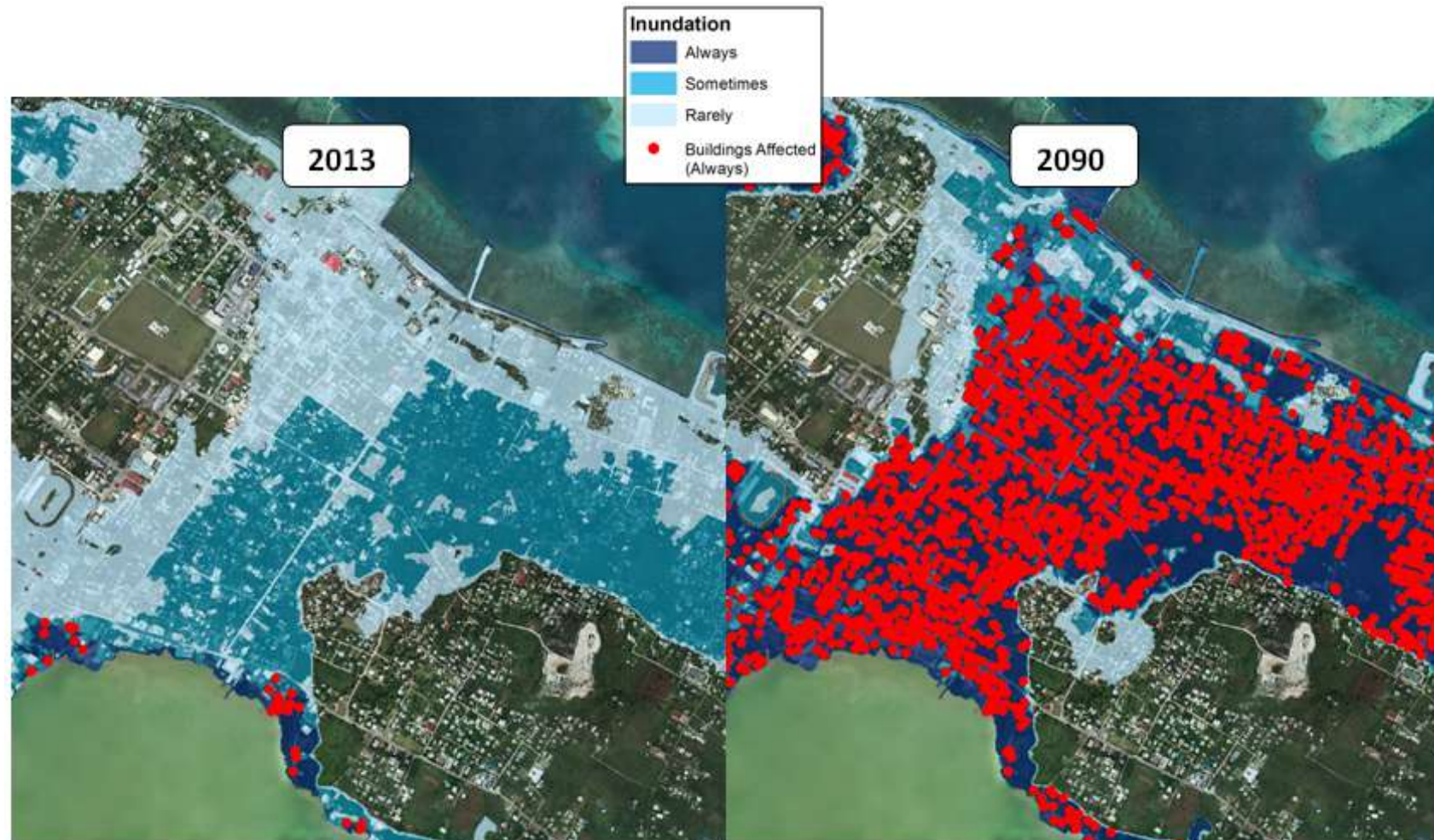
Identifying assets and values of assets



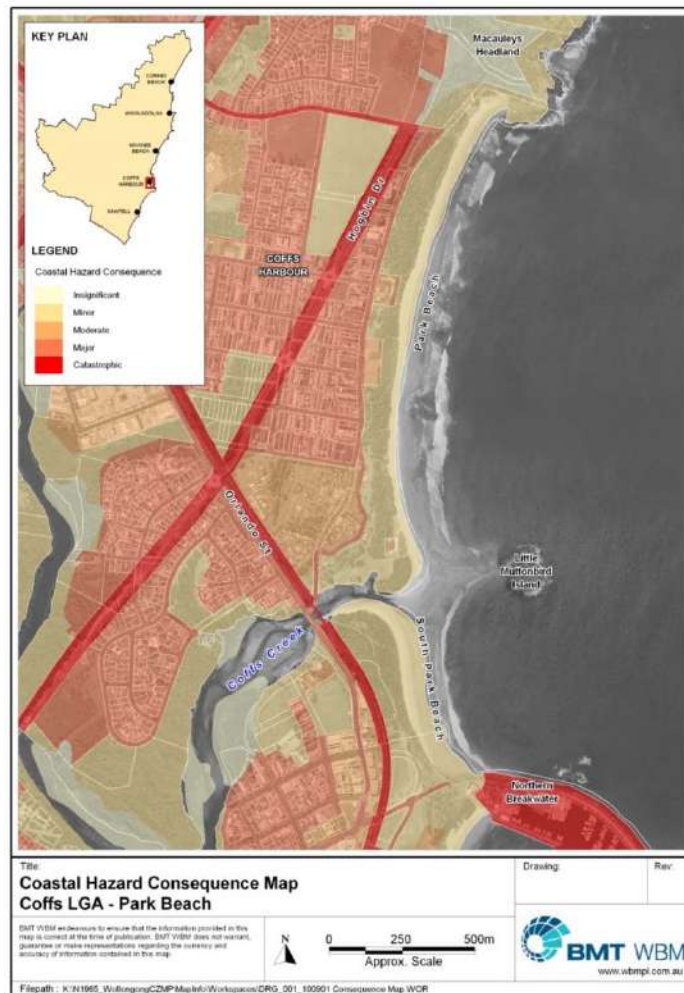
Air photos interpretation (supplemented with stakeholder data / on-ground truthing)



Air photo interpretation of assets



Land zonings (as a proxy for value/significance)

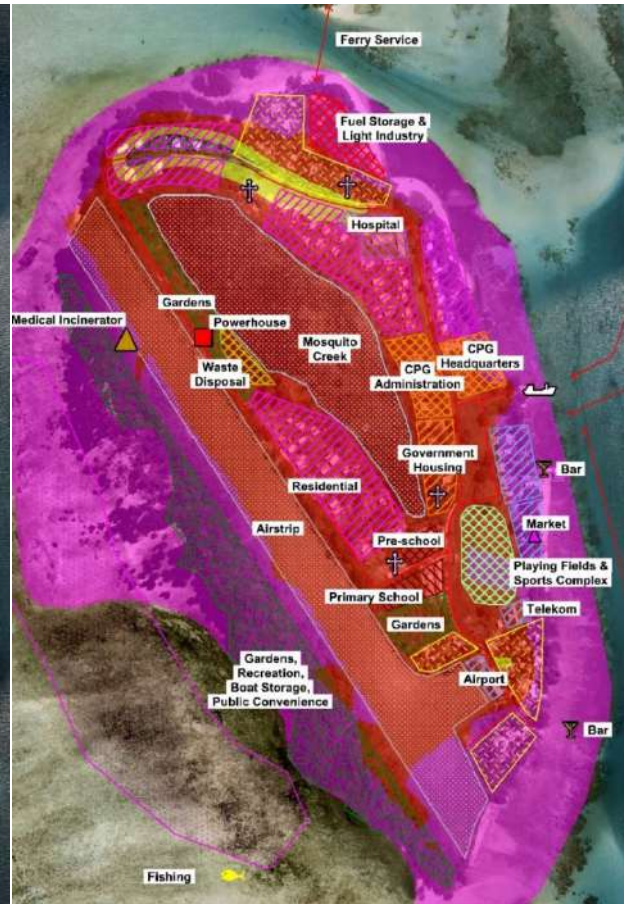


Engaging with the community

Identifying assets / valuing assets

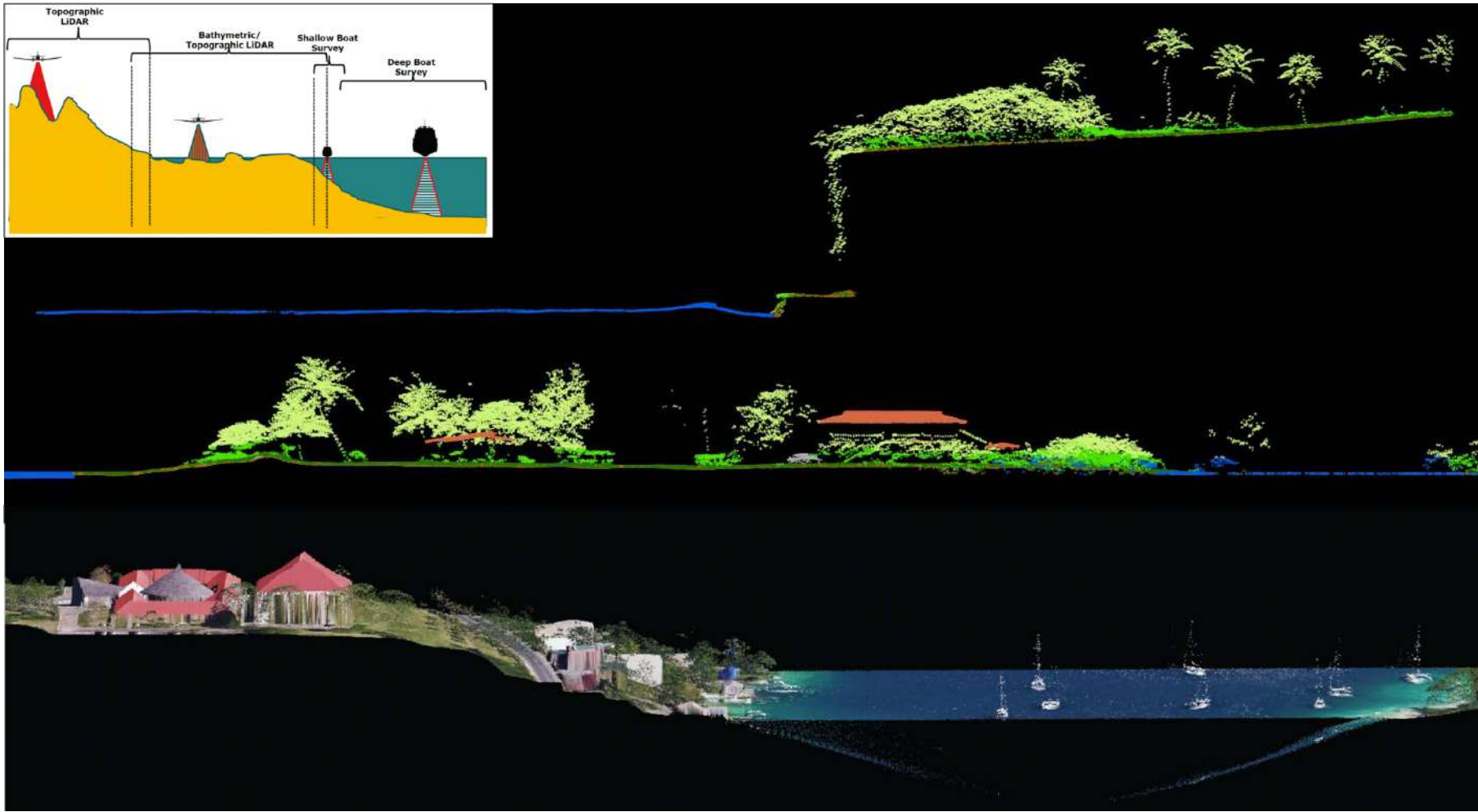
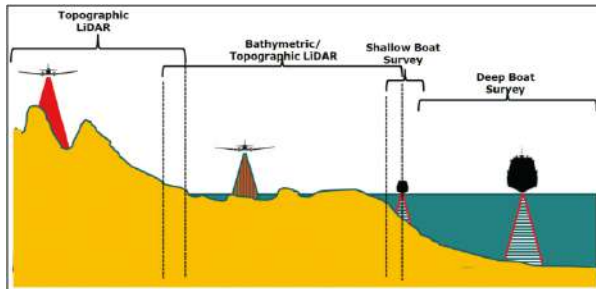


Community values exposed to coastal hazards (community prioritisation of assets)

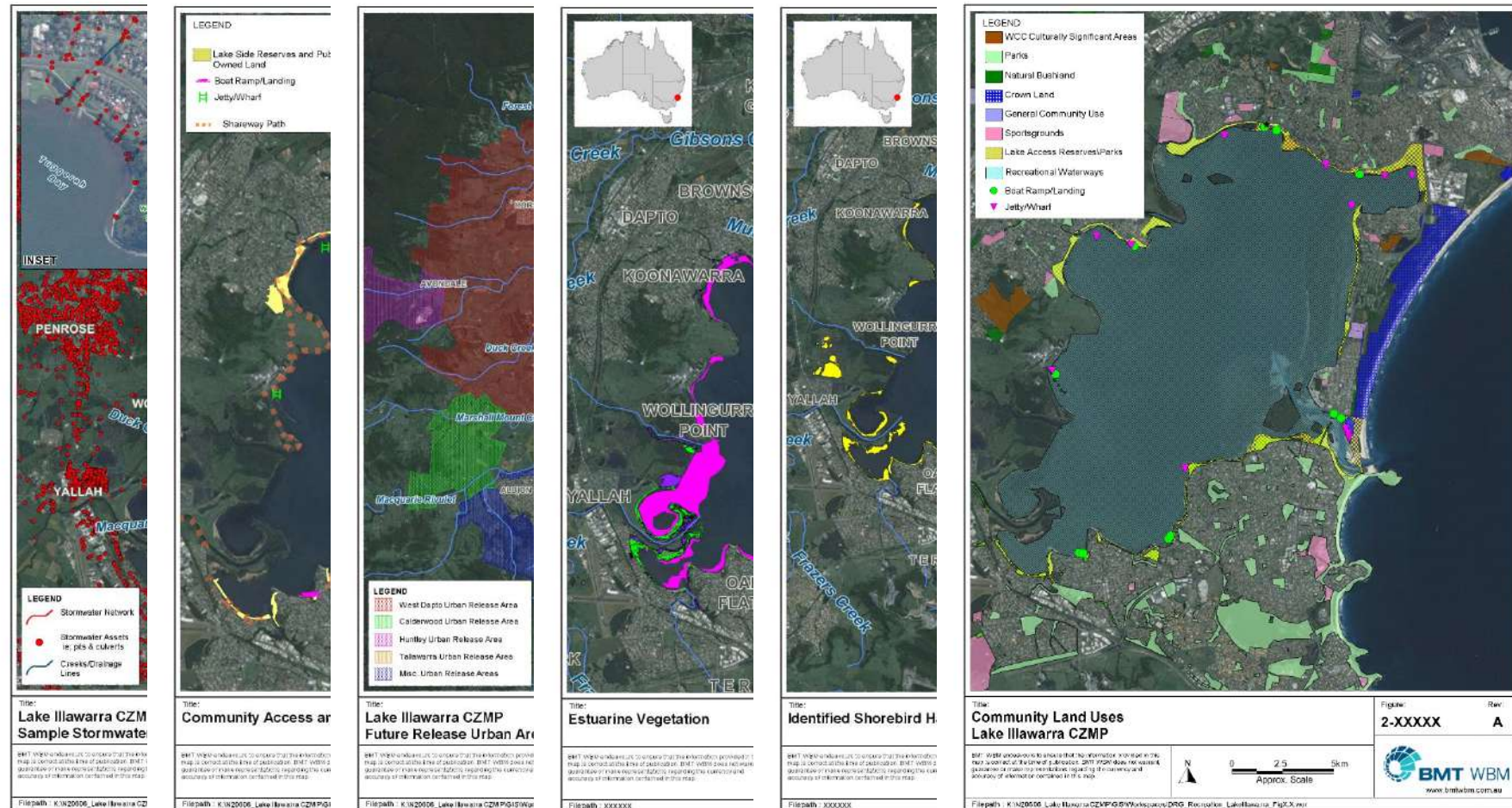


- Almost certainly impacted by 2090
- Possibly impacted by 2090
- Unlikely / rare impact by 2090

LiDAR survey – not just land form



Comprehensive mapping of tangible and intangible assets



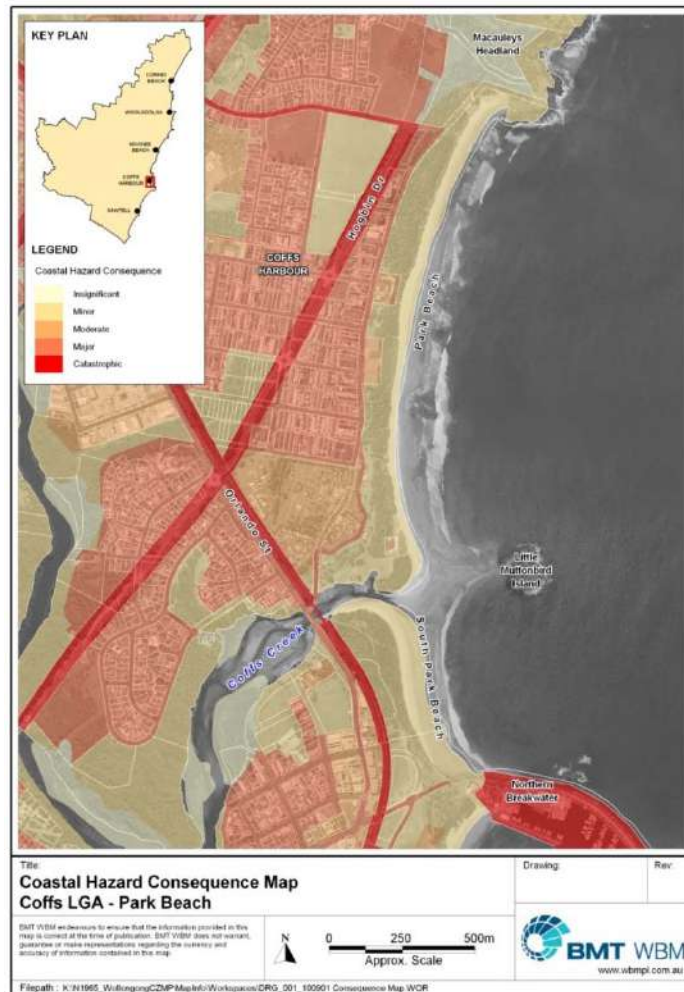
Consequence	Society/Community	Environment	Economy (including Council Assets)
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			Very high ongoing costs to Council operating/capital expenditure budget.
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Major	Major permanent or widespread medium term (somewhat reversible) disruption to a local community's services (e.g. at suburb level), wellbeing, or culture with no alternative assets available.	Widespread semi-permanent impact to ecosystem services <u>Or</u> Loss of local representation of a national or regionally important species or habitat with recovery over years – decades	Damage to property, infrastructure or local economy > \$ 1 million to \$5 million
			Major maintenance costs and significant additional cost to operational/capital expenditure required.
			Extensive structural damage to the asset(s) requiring significant major repair work. Major disruption in the asset's service.
			Major disruption in business operation with significant loss of revenue and significant impacts to the local economy and reputation that effects visitor numbers in the short term.
Moderate	Minor long term or major short term (mostly reversible) disruption to community's services, wellbeing, or culture. (e.g. at a suburb level), with other alternative assets available nearby.	Local environmental impacts or localised changes to ecological services <u>Or</u> Widespread impacts of a temporary nature to regionally or locally important species or habitat but with recovery likely over the short term	Damage to individual properties of \$100,00 to \$1 million
			High additional maintenance costs and some additional operational/capital expenditure required.
			Moderate damage to some part of the structure of the asset(s) and which is recoverable by maintenance and minor repairs. Moderate disruption in the asset's service
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			Minor to moderate additional cost to Council maintenance budget
			Limited damage to some part of the asset(s) and require some small scale restoration work.
			Minor impact in business operation or broader local economy as disruption is temporary and can be managed through standby or alternate options.
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			Little or no cost to Council budget
			Little disruption in service but no structural damage to the asset(s)
			Little to no impact in business operation or broader local economy.

Phase 5 – Bringing it together

Risk = Likelihood x Consequence

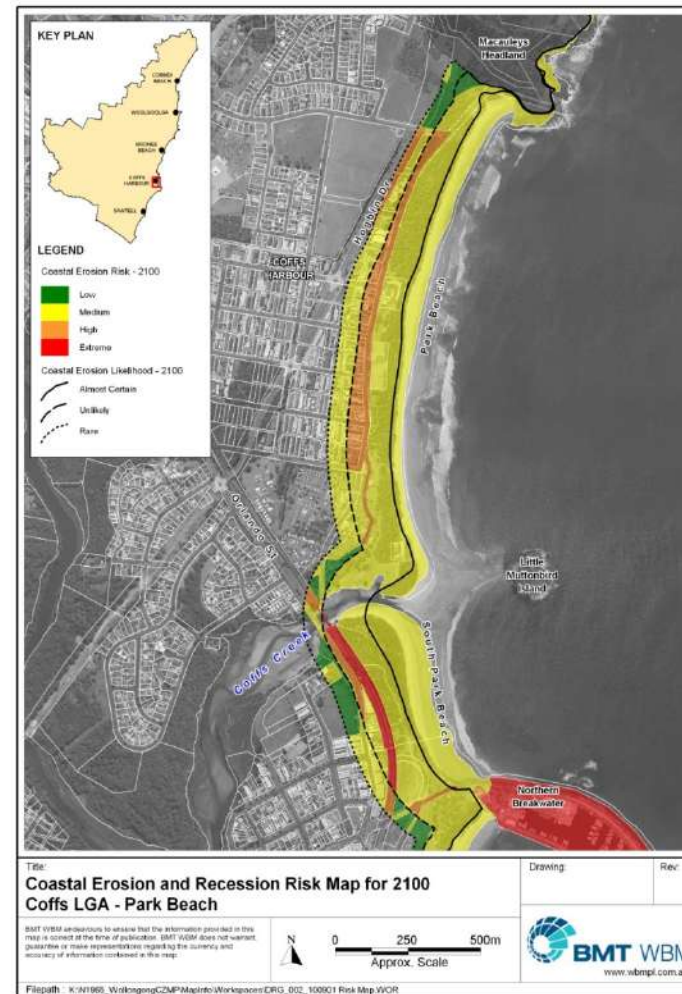
		CONSEQUENCE				
		Insignificant	Minor	Moderate	Major	Catastrophic
LIKELIHOOD	Almost Certain	Low	Medium	High	Extreme	Extreme
	Likely	Low	Medium	High	High	Extreme
	Possible	Low	Medium	Medium	High	Extreme
	Unlikely	Low	Low	Medium	High	Extreme
	Rare	Low	Low	Low	Medium	High

Consequence x Likelihood =

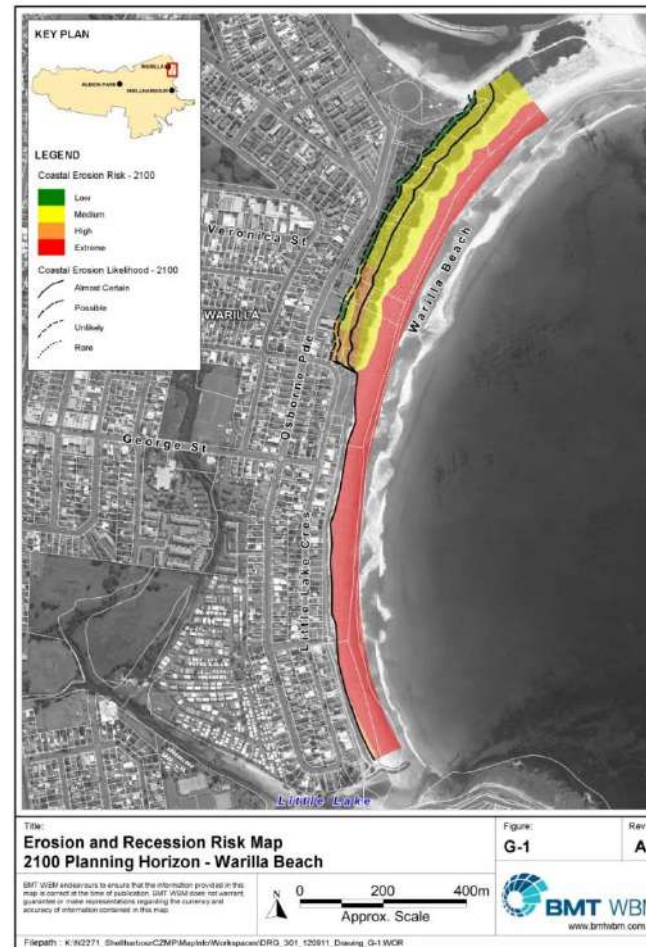
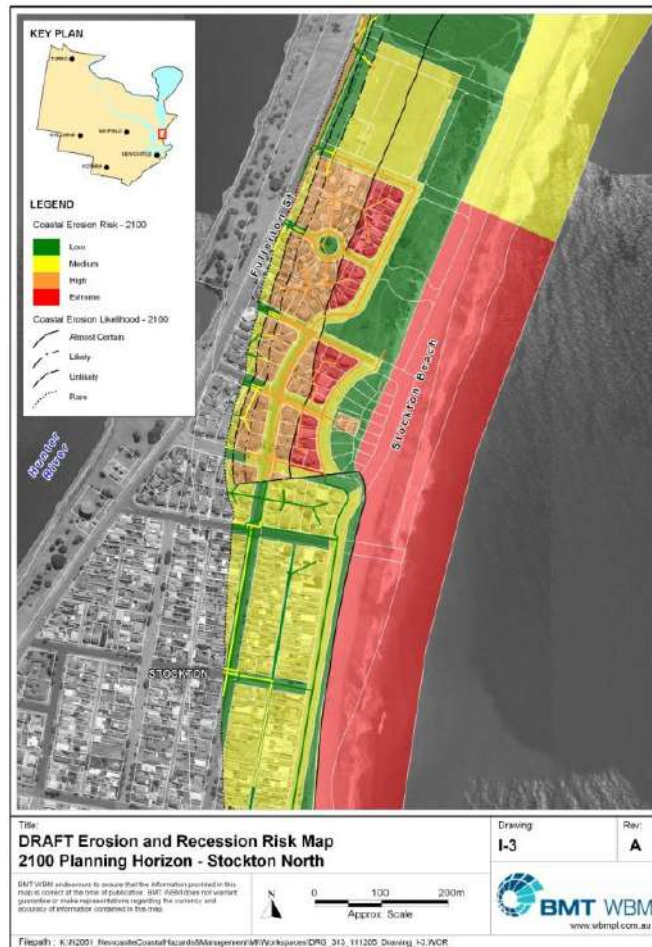


..... Risk

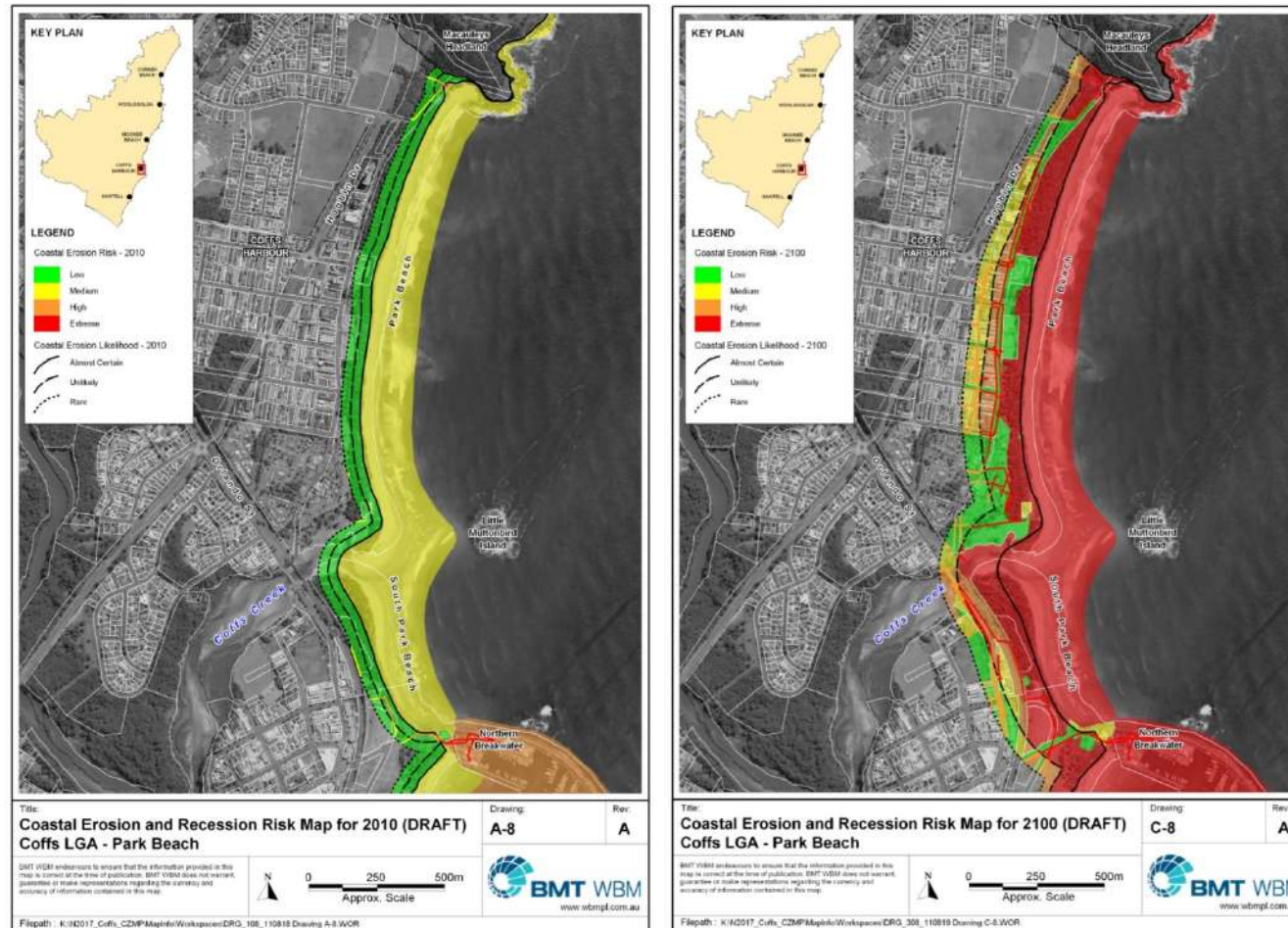
		CONSEQUENCE				
		Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
LIKELIHOOD	Almost Certain 5	low	medium	high	extreme	extreme
	Likely 4	low	medium	high	extreme	extreme
	Possible 3	low	medium	high	high	extreme
	Unlikely 2	low	medium	medium	high	extreme
	Rare 1	low	low	medium	medium	high



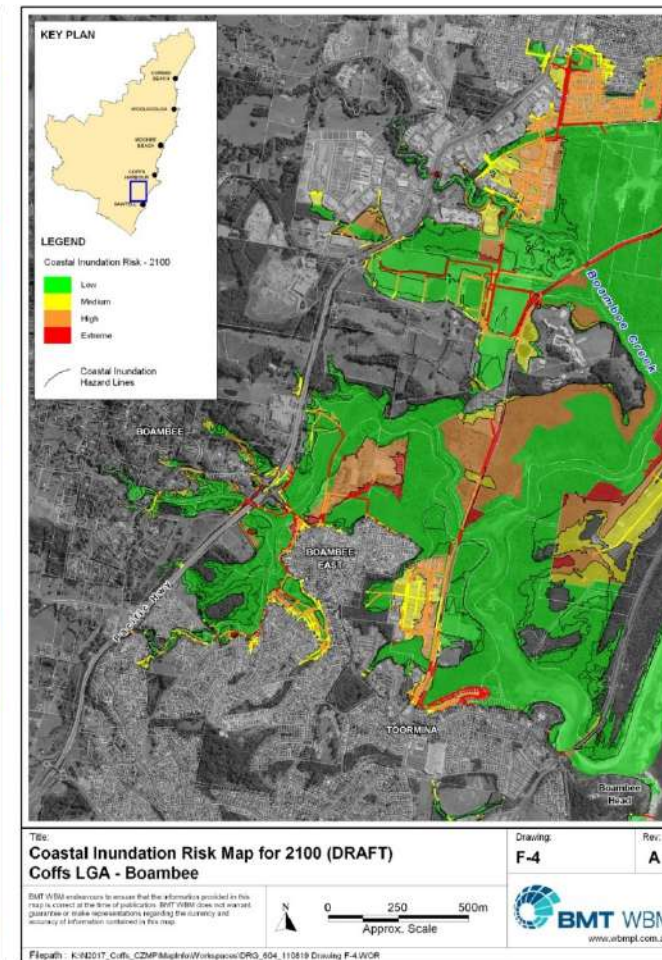
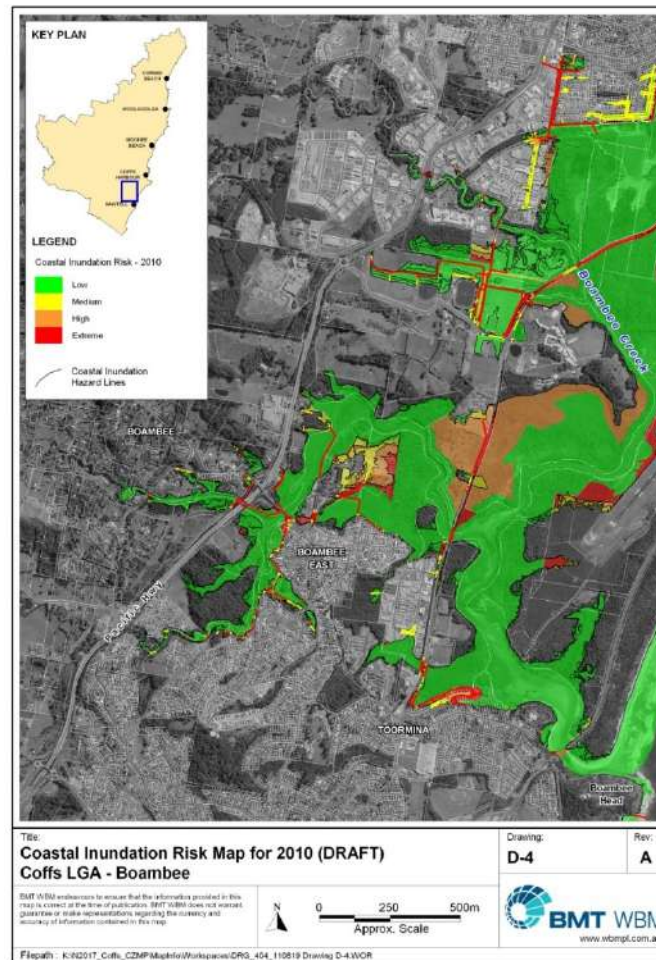
Spatial representation of coastal risk



Coastal Risk – shoreline erosion (temporal evolution of risk)



Coastal Risk – coastal inundation (storm tide) (temporal evolution of risk)



Risk Register

Shellharbour Coastal Zone Asset	Consequence of Erosion and Recession	Consequence of Wave Run Up / Occasional Inundation	Risk at 2012	Risk at 2050	Risk at 2100	2012 Inundation Risk
Beaches and Dunes						
Warilla Beach	Major	Insignificant	High	Extreme	Extreme	Low
Shellharbour North Beach, Nuns Beach	Moderate	Insignificant	High	High	High	Low
Shellharbour Boat Harbour (including heritage walls & boat ramp)	Major	Major	High	Extreme	Extreme	Medium
Shellharbour South Beach	Moderate	Insignificant	High	High	High	Low
Coastal Dunes (Warilla Northern End, Shellharbour North, Shellharbour South)	Minor	Insignificant	Medium	Medium	Medium	Low
Major Public Buildings, Facilities						
Warilla Beach SLSC	Moderate	Moderate	(1)	(1)	(1)	(1)
Shellharbour SLSC & Sea Spray Function Centre	Moderate	Moderate	Low	High	High	Low
Shellharbour Beachside Tourist Park (and pipe assets)	Moderate	Moderate	High	High	High	Low
Beverley Whitfield Pool	Moderate	Moderate				Low
Residential Properties						
Wollongong Street	Major	Major	High	Extreme	Extreme	Medium
Osborne Pde, Little Lake Cres	Major	Major	Low	Medium	High	Low
Boollwarroo Pde	Major	Major	Medium	High	Extreme	Low
Little Lake Cres behind Warilla Seawall	Major	Major	(2)	(2)	(2)	(2)
Shell Cove Road	Major	Major				Medium
Stormwater, Water, Wastewater						
Sewer pipeline, Warilla Beach (behind seawall)	Major	Major				Medium
Sewer pipelines: Osbourne Pde (Warilla)	Major	Major	Low	Medium	High	
Sewer pipelines/outlet (from STP), Shellharbour North Beach	Catastrophic	Catastrophic	Extreme	Extreme	Extreme	High
Water mains: Nuns Beach	Moderate	Moderate	High	High	High	
Sewer mains: Nuns Beach and Shellharbour Boat Harbour Foreshore	Moderate	Major	Low	Medium	High	Medium
Stormwater Outlet: Shellharbour Foreshore & Shellharbour Tourist Park (South Beach)	Major	Major	High	Extreme	Extreme	Medium

Risk Register

Value	There is a risk that.....	Existing controls	Likelihood				Consequence	Risk level			
			Present	2030	2055	2090		Present	2030	2055	2090
Taro Island CPG Headquarters	Temporary inundation of CPG headquarters by tsunami or storms causes disruption of Government services		P	P	P	P	Moderate	MEDIUM	MEDIUM	MEDIUM	MEDIUM
	Permanent tidal inundation or shoreline erosion of CPG headquarters causes loss of Government services				R	P	Major			MEDIUM	HIGH
	Temporary inundation of CPG headquarters by tsunami or storms causes loss of Government records		P	P	P	P	Major	HIGH	HIGH	HIGH	HIGH
	Temporary inundation of CPG headquarters by tsunami or storms causes diminished capacity to respond to emergency		P	P	P	P	Major	HIGH	HIGH	HIGH	HIGH
	Temporary inundation by tsunami or storms causes disruption to service	Most services provided in other locations in the province	P	P	P	P	Minor	LOW	LOW	LOW	LOW
CPG Admin	Temporary inundation by tsunami or storms causes damage to infrastructure and equipment		P	P	P	P	Moderate	MEDIUM	MEDIUM	MEDIUM	MEDIUM
	Permanent tidal inundation causes loss of service					R	Moderate				LOW
	Permanent tidal inundation causes loss of infrastructure and equipment					R	Moderate				LOW
	Temporary inundation of telecommunications equipment by tsunami or storms causes disruption to communications	Battery bank that allows communications to continue for a few hours	P	P	P	P	Major	HIGH	HIGH	HIGH	HIGH
Telecommunications	Permanent tidal inundation or shoreline erosion of telecommunications equipment causes loss of telecommunications					P	Catastrophic				EXTREME
	Temporary inundation of electricity generator by tsunami or storms causes disruption to communications	Battery bank that allows communications to continue for a few hours	P	P	P	AC	Major	HIGH	HIGH	HIGH	EXTREME
	Permanent tidal inundation or shoreline erosion of electricity generator causes loss of communications				P	AC	Catastrophic			EXTREME	EXTREME
	Temporary inundation by tsunami or storms causes disruption to Provincial medical services/administration	Evacuation to higher ground on Taro Island or to mainland (e.g. school)	R	R	R	P	Catastrophic	HIGH	HIGH	HIGH	EXTREME
Hospital	Temporary inundation by tsunami or storms causes diminished capacity to respond to emergency and provide care for patients	Evacuation to higher ground on Taro Island or to mainland (e.g. school); Referral to other Provincial clinics	R	R	R	P	Catastrophic	HIGH	HIGH	HIGH	EXTREME
	Temporary inundation by tsunami or storms causes loss of equipment and medicines	Evacuation to higher ground on Taro Island or to mainland (e.g. school)	R	R	R	P	Moderate	LOW	LOW	LOW	MEDIUM
	Permanent tidal inundation causes loss of full medical services and administration functions					R	Catastrophic				HIGH
	Permanent tidal inundation causes loss of infrastructure, equipment and drugs					R	Major				MEDIUM



Simplistic risk register

<i>Assets at High or Extreme Risk From Erosion</i>	<i>Present Day</i>	<i>2060</i>	<i>2100</i>
Beaches	All	All	All
Dunes and Dune Vegetation	All	All	All
Roads	4 minor, 2 major	5 minor, 3 major	7 minor, 3 major
Stormwater - Outlets and Pipes	3 + 1 unknown	10 + 1 unknown	11 + 1 unknown
Water Infrastructure (MCW)	2 pipe sections	4 pipe sections	7 pipe sections
Littoral Rainforest (SEPP26)	2 remnants	2 remnants	3 remnants
Residential Development	11 lots	22 lots +	68 lots +
Boat Ramps	1 unknown	2 + 1 unknown	2 + 1 unknown
Car Parks	1 unknown	4 + 1 unknown	8 + 1 unknown
Beach Accessways (pedestrian, 4WD)		All beaches	All beaches
Surf Clubs		1	3
Sewer Infrastructure (MCW)		5 pipes	9 pipes, 1 pump station
Tourist Parks		2	3
Walkway / Cycleway		1 section	5 sections
Rural Zoned Land			1

Questions?

