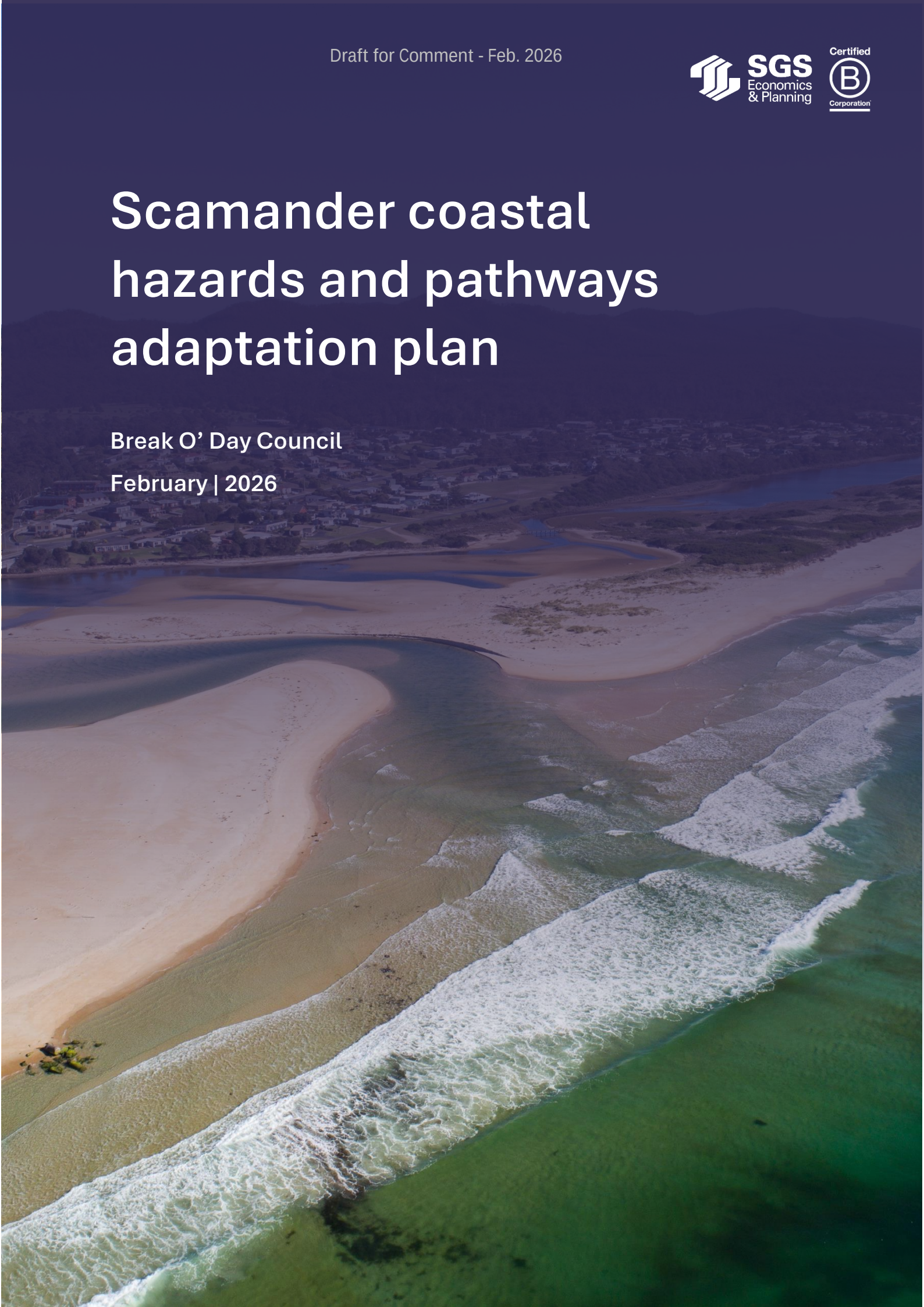
Draft for Comment - Feb. 2026

Scamander coastal hazards and pathways adaptation plan

Break O' Day Council

February | 2026



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OFFICES IN CANBERRA, HOBART, MELBOURNE, AND SYDNEY ON THE COUNTRY OF THE NGAMBRI/NGUNNAWAL/NGARIGO, MUWININA/PALAWA, WURUNDJERI, AND GADIGAL PEOPLES.

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Introduction and background

SGS Economics and Planning and Moffatt & Nichol were commissioned to develop a coastal hazards and pathways adaptation plan for the Scamander river mouth. This project responds to community concerns about the extent of hazards and impacts on their lives, livelihoods and the natural environment. The project seeks to complete the following aims:

- Better understand the coastal and estuary risks and impacts of these risks on the community, especially in light of the impacts of climate change.
- Better understand and communicate coastal processes to the community, including potential responses.
- Map and quantify the costs and benefits to the community of different options for managing risk in the Scamander river mouth.
- Provide advice on short and longer-term management solutions.

SGS led the project and performed economic and spatial analysis. Moffatt & Nichol provided expert scientific and engineering input on coastal processes, hazards and adaptation options.

Adaptation pathways are chains of actions taken in response to risk over time. A set of principles define successful adaptation planning.

- Developing risks must be actively managed. Doing nothing is not an option.
- Honest and transparent communication with the community.
- Government is not responsible for the protection of private property against natural hazards.
- There should be no subsidy to occupy hazardous locations.

Key terminology for adaptation planning includes:

- Flexibility. Options should be assessed and actions taken with a view to maintaining the flexibility of the community to respond to a dynamic external environment.
- Thresholds. The community's and individual level of tolerance for risk will have thresholds for maintaining it and triggers for action
- Triggers. Triggers are measurable milestones or markets for action on a threshold.
- Trade-offs. Trade-offs will inevitably arise where the choice of one action to preserve or increase certain values will have a negative effect on other values.

River mouth and coastal processes

Scamander River mouth can be understood as an intermittently closed and open lake or lagoon (ICOLL). This refers to lakes that naturally alternate being open and closed to the ocean, with closure defined by the existence of a dynamic sand beach barrier that separates the ICOLL from the ocean. ICOLLs are

geomorphologically complex, and key features, in particular the existence, height and width of the berm, and therefore water levels and speeds on either side, change often. Scamander River mouth is no different. Historically, the river mouth has migrated north and south along the sandy shore, with ICOLL closure and opening reflecting the balance of processes at any particular time.

Three major hazards affect the users and owners of land around Scamander River mouth

- **Coastal erosion.** Coastal erosion is the removal of coastal land by water (waves, river currents and tidal inundation), wind and general weather conditions.
- **Coastal inundation.** Coastal inundation is the natural process of flooding of land by the sea and can be either temporary or permanent.
- **River flooding.** River flooding is caused by the runoff of heavy rainfall in the upper catchment and resulting increases in river discharge, sufficient to exceed the river channel capacity and inundate floodplain areas.

A review of available data, in particular hazard bands pertaining to the level of the above hazards in the Scamander River mouth, concluded that the existing bands are a broadly accurate portrayal of risk levels, with two important qualifications **Coastal inundation** risk is considered to be underestimated for wave-exposed foreshores as it does not consider wave set up and wave run up, nor any interaction with river flooding, including barway condition. **Coastal erosion** is considered to be underestimated around Dune Street in particular. This is due to the shoreline positioning north of Dune Street during assessment, and failure to consider channel movements as contributing to erosion, such as in 2022 when the channel came very close to Dune Street. In light of this advice, for the purposes of cost-benefit analysis at Dune Street SGS has repositioned existing inner coastal erosion bands to align with the current shoreline. Some locations are exposed to each of the above hazards.

During extreme events, these hazards can occur simultaneously and interact with each other. The consequences of compounding or multi-hazard events are generally not well understood including at the Scamander River mouth, but the combined consequences are likely to be more severe than the consequences of individual hazards. This project mapped the compounded hazards (Figure ES1).

Climate change is expected to have implications for the coastal and river processes at Scamander. Of particular note are the predicted increased intensity of rainfall, sea level rise and increased intensity of coastal storms. Increased intensity of rainfall exacerbates riverine inundation, with greater volumes of water moving down the catchment. Sea level rise and increased intensity of coastal storm both intensify coastal erosion and coastal inundation, increasing the risk of damage.

Values at risk

Table ES1 outlines the values in the study area that are considered in subsequent analysis and adaptation pathways planning.

Table ES1: values at risk in Scamander River mouth

Category	Value	Count	$ value (2025) ($,000)	Key examples
Property	Private dwellings	39	$21,677	– Dune Street dwellings

Category	Value	Count	$ value (2025) ($,000)	Key examples
	Commercial	2	$1,312	– River Mouth Café
	Accommodation	15	$19,280	– Pelican Sands
	Council assets	7	$3,080	– Scamander Recreation Reserve
	Community	1	$470	– Scamander SLSC
Roads	Roads	5km	$2,574	– Dune St – Hodgman St
Natural environment	Existing beach	n/a	$1,169	– Steels Beach adjacent to river mouth
	Estuaries	n/a	$1,134	– Hind dune marsh
	Wetlands	n/a	$21,233	– Hind dune marsh – Upper Scamander River
	Saltmarsh	n/a	$195	– Scamander River
	Dunes	n/a	$1,719	– Access pathways to Steels Beach
	Bird habitat	n/a	$12	– Threatened bird nesting on Steels Beach and barway
	Playspace/recreational area	1	$17	– Scamander Recreation Reserve
Water infrastructure	Water mains	2km	$2,640	– Reticulation mains beneath Dune St, Scamander Ave
	Upper Scamander Reservoir	1	$1,300	n/a
	Upper Scamander BPT (break pressure tank)	1	$1,060	n/a
	Sewer mains	2km	$600	– Sewage mains beneath Scamander Recreation Reserve
	SPS (sewerage pumping station)	3	$608	– Pelican Sands SPS – Dune St SPS

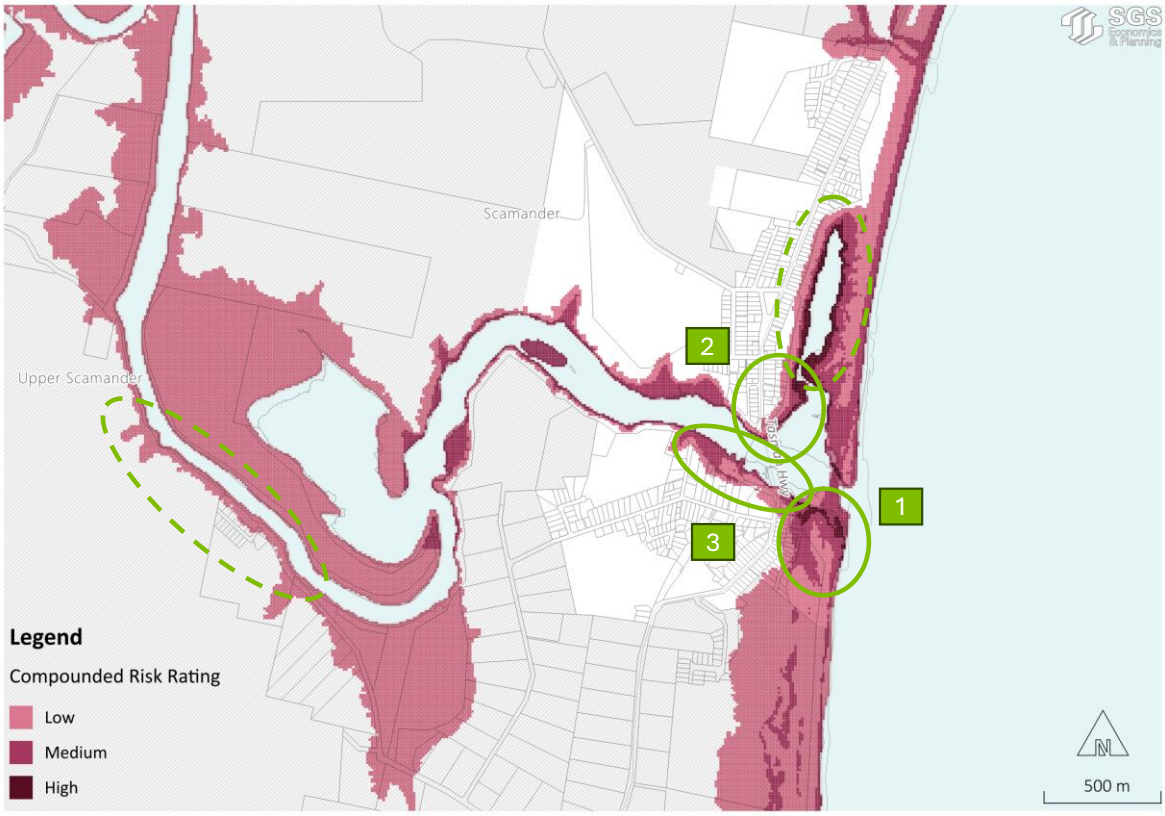
Category	Value	Count	$ value (2025) ($,000)	Key examples
Visitor economy	Estimated visitor spend	50,000	$12,951	– Tourist visitation to Steels Beach and local caravan parks
Total			$93,023	

Source: SGS Economics and Planning 2026

Hazard management and hotspots

The balance of coastal hazards and values at risk differs between points on the Scamander River mouth. The locations are detailed in Figure ES1 below.

Figure ES1: hazard management hotspots in Scamander River mouth



Source: SGS Economics and Planning 2025

Cost-benefit analysis of adaptation pathways at Dune Street between 2025 and 2100 was completed, recognising that Dune Street is especially exposed to coastal hazards. Cost-benefit analysis is an approach to evaluate the merits of different interventions and seeks to quantify their respective impact, whether they be social, economic or environmental, on the community. It does this by identifying the impact of different options in terms of their deviation from the 'base case' of no action,

where costs and benefits otherwise proceed along their existing paths. The costs and benefits included in this analysis are outlined in Table ES2.

Adaptation pathways consist of a range of interventions and actions that will be implemented simultaneously and consequently over time as risk levels evolve.

In terms of costs and benefits, adaptation typically involves costs in terms of building protection works, vegetation management and changes to planning and building requirements. The benefits encompass a range of avoided damages, amenity, use and ecological changes and these vary by the type of intervention.

Table ES2: costs and benefits of adaptation to coastal hazards in Scamander River mouth

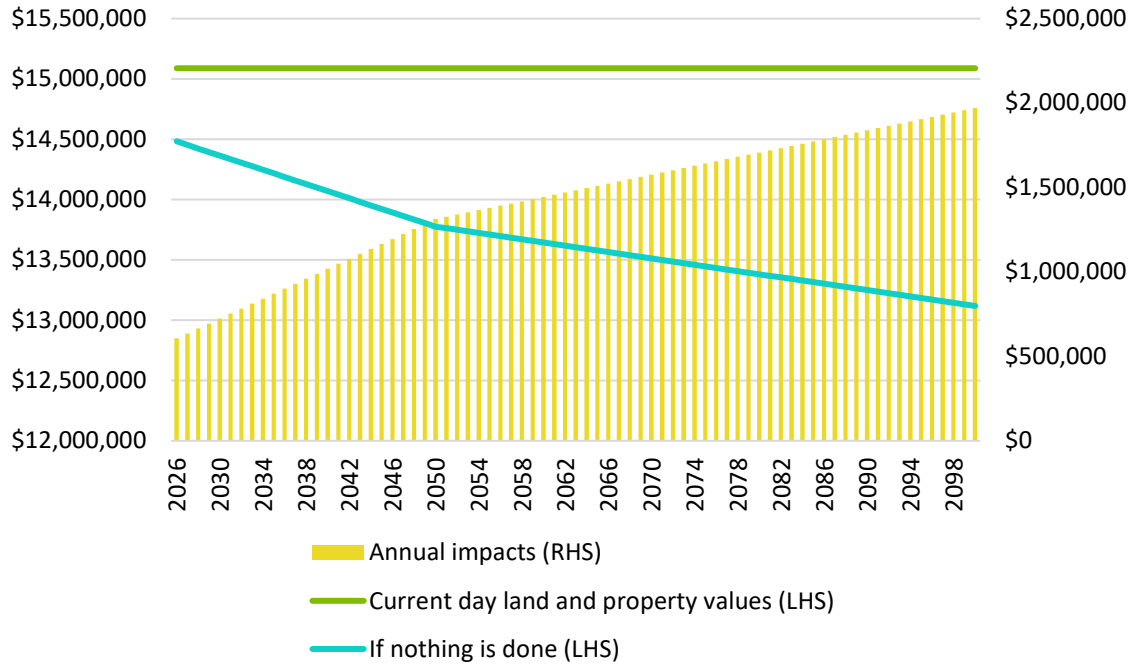
Costs	Benefits
C1: Pathway costs – Capital cost – Maintenance cost – Asset relocation cost – Contingency cost	B1: Avoided damage – The avoided damage to land and property resulting from the intervention B2: Beach access – The impact of the options on the capacity for community members and visitors to access and enjoy Steels Beach B3: Visitation spending – The impact of the options on visitation and expenditure by tourists to Scamander B4: Ecosystem impacts – The impact of the interventions on ecosystems and habitats present in the area

Source: SGS Economics and Planning 2025

Dune Street

Dune Street is the most highly exposed part of the Scamander River mouth. Hazards are complex and overlapping, though primarily reflect erosion compounded by coastal inundation and flooding. Figure ES2 outlines the impacts of damage to land and property at Dune Street from coastal hazards if nothing is done and coastal hazards proceed along the trajectories implied by the low, medium and high erosion and coastal inundation hazard bands applying to the area.

Figure ES2: damage impacts from coastal hazards at Dune Street – base case



Source: SGS Economics and Planning 2025

Three adaptation pathways in response to coastal hazards at Dune Street are analysed. These options are:

- Option 1: Living shoreline foreshore erosion protection. In the short to medium term, a living shoreline or soft protection could be implemented to address the immediate erosion processes along a 60m length of foreshore fronting Dune Street. These works would not address the inundation risk. Under this pathway, no further residential and sensitive urban development would be allowed. In the long term (as sea levels rise), inundation problems would become more severe and the foreshore erosion protection would reach the end of its effective life. This pathway provides property owners with time to reach the economic life of their assets and protect their individual properties for the foreseeable future.
- Option 2: Hybrid seawall and wave runup bund. In the short to medium term, this option proposes a rock revetment hybrid seawall in front of Dune Street and small wave runup bund in the lee of the wall. It would offer erosion protection for the medium term and protect against some inundation, but likely not extreme events. Compared to pathway 1, this option buys more time, but eventually (as sea levels rise), properties would be increasingly exposed to inundation and erosion. As with option 1, further development in the area would be discouraged.
- Option 3: Rock revetment and levee. A higher seawall and levee, expected to be raised above the current road level by approximately 1.5m. This option comes with substantial capital works and costs, and would offer longer term protection. It provides protection against erosion up to around 2075.

Table ES3 contains the results of the cost-benefit analysis results.

Table ES3: cost-benefit analysis results (7% discount rate) ($2025) ($,000) – 2025-2100

	Option 1	Option 2	Option 3
Costs			
Total cost	**$396**	**$1,807**	**$13,669**
Benefits			
Avoided damages	$2,191	$7,546	$13,459
Beach access	$0	$0	-$1,420
Visitation spending	$4,668	$9,337	-$13,052
Natural habitat	-$4	-$24	-$47
Total benefits	**$6,854,**	**$16,858**	**-$1,061**
NPV	**$6,458**	**$15,050**	**-$14,730**
BCR	**17**	**9**	**0.48**

Source: SGS Economics and Planning 2025

The cost-benefit analysis shows that options 1 and 2 strongly increase net welfare, creating 17 and 9 dollars of benefit per dollar of cost respectively. This is compared to option 3, which strongly protects a relatively small set of properties at a relatively high cost. The impact on tourism spending in particularly important, option 3 would materially influence the character of the foreshore, and as a result the strength of Scamander's attraction to tourists.

The results do not support aggressive, extensive, hard protection of the foreshore, even though this would protect some properties. The costs to the community[1] of this course of action are simply too high, and it would negatively impact other important aspects that sustain Scamander; particularly its pristine natural character and beachside recreation opportunities, which sustain the visitor economy.

The high BCR of options 1 and 2 endorse a softer, more gradual approach that would provide a range of benefits to the community:

- Low capital and maintenance costs, meaning the opportunity cost of these options is low.
- Slowing down coastal hazards in the area, buying time for the community, Council and other stakeholders to undertake best practice adaptation planning.
- Enabling property owners to use their assets to the end of their economic life, while planning avoids new development in the area.

[1] Based on the principle of 'no subsidy to occupy hazardous locations' these costs would be assumed to be borne by the property owners. This cost is likely too high relative to the value of the properties.

- Avoiding maladaptation by locking in costly maintenance expenditure and potentially inefficient or inappropriate land uses.
- Improving biodiversity and natural values in the area through native plantings and other forms of soft protection, which will increase utility for visitors and members of the community.
- Preserving important, though undervalued aspects of the foreshore such as recreation, visual amenity and natural values, which are otherwise lost.
- Preserving the contribution of the Dune Street foreshore to Scamander's visitor economy, which is of significant economic importance.

These considerations broadly align with feedback received from the community as part of this project.

Pelican Sands

Pelican Sands displays generally lower benefit drivers compared to Dune Street, with less residential development, Council and TasWater property, beach access and habitat impacted by coastal hazards. However, the intensity of hazards is also reduced as Pelican Sands is less exposed to open ocean, and foreshore development and use is not so intensive. The influence of the visitor economy on the CBA results is highly relevant to Pelican Sands, as it is a major accommodation asset. To the extent that hard protection of the Dune Street foreshore reduces the attractiveness of the area to visitors, these costs will be borne to a significant extent by those operating at Pelican Sands.

The costs of hard protection may be higher or lower at Pelican Sands depending on the length of foreshore that requires protection and the overall size and strength required to adequately protect against hazards. Overall, it is likely that the same conclusion can be drawn as for Dune Street; cheaper or 'no regrets' interventions are preferred now to buy time for more extensive adaptation planning, with eventual retreat as hazards overwhelm the adaptive capacities of current users.

Bridge Esplanade

Bridge Esplanade displays lower benefit drivers than Dune Street. Hazards are less intense due to sheltering from open ocean forces, while there is less affected land and property in the area, meaning avoided damage is lower. Natural, recreation and tourist visitation values are also lower compared to both Dune Street and Pelican Sands. The foreshore at Bridge Esplanade is shorter than these other sites, meaning the relative cost of options 1 and 2 would also be lower. Overall, the core finding remains relevant; extensive, hard protection is encouraged, while softer protection options retain flexibility, manage some inundation risk and may improve the amenity of the area. Retreat is less likely to be required in this location, meaning the financial and emotional impact of relocation, which could be substantial in other sites, is limited.

Next steps for adaptation planning in Scamander

Several 'no regrets' actions to be taken in response to coastal hazards at the Scamander River mouth. These are measures that could be implemented immediately and that, if implemented, are unlikely to create abortive work, have significant negative impacts on other processes, or cause issues for a future adaptive pathway(s).

- Barway opening policy. The condition of the barway (open/closed) at Scamander has a significant influence on hazards. The opening operation would benefit from a documented barway opening

policy. It is also recommended that Council install water level gauging to assist inform the policy and plan.

- **Restoration of reserve foreshore protection.** Restoration of the rock protection, likely including an appropriate backfill/filter layer and geotextile, as well as habitat creation through saltmarsh (or other species) planting.
- **Pelican Sands foreshore protection.** The measure should incorporate as much as possible a living shoreline, to provide positive ecological outcomes and limit the use of hard infrastructure
- **Dune Street hind dune foreshore protection.** A living shoreline or soft protection could be implemented. The buffer between the road and foreshore could be planted out. The measure would likely need to include a hybrid rock/vegetation protection.

Planning and policy considerations include:

- Do not allow intensification of residential and sensitive urban development in areas exposed to (compounding) coastal hazards, especially Dune Street, Pelican Sands and low-lying lots along Bridge Esplanade.
- Apply the proposed updated positioning and extent of the Coastal Erosion Hazard Code hazard bands at Dune Street, reflective of changed position of river mouth and landward progression of shoreline.
- Seek support and guidance from Tasmanian Planning Commission on best practice planning for coastal adaptation and managed retreat, especially in locations of multiple and potentially compounding hazards:
  - Explore Scamander River Mouth as a potential pilot for these mechanisms, recognising relatively contained scale and intensity of coastal hazards in the area.

Other recommendations include:

- Further engagement with Dune Street residents on cost-benefit analysis findings and proposed adaptation actions in the area.
- Engagement with Tasmania Parks and Wildlife Service (TPWS), which owns and has responsibility for public land in the Dune Street area and across the river mouth.
- Advocate to Tasmanian Government and/or Tasmanian Planning Commission for guidance and support to implement coastal adaptation actions, particularly managed retreat, through the planning scheme.
- Advocate for updated mapping of coastal hazards, specifically coincidental and compounding hazards.
- Engage with Department of State Growth to explore potential impact of current bridge design on hazards in Scamander River mouth.
- Continue to protect biodiversity in the river mouth.
- Explore opportunities for additional funding, such as the Future Drought Fund, to complete recommended areas of future work; for example improved hazard mapping and bridge investigations.

2. Introduction and background

2.1 Scope and aim of study

SGS Economics and Planning and Moffatt & Nichol were commissioned to develop a coastal hazards and pathways adaptation plan for the Scamander river mouth. This project responds to community concerns about the extent of hazards and impacts on their lives, livelihoods and the natural environment. The project seeks to complete the following aims:

- Better understand the coastal and estuary risks and impacts of these risks on the community, especially in light of the impacts of climate change.
- Better understand and communicate coastal processes to the community, including potential responses.
- Map and quantify the costs and benefits to the community of different options for managing risk in the Scamander river mouth.
- Provide advice on short and longer-term management solutions.

SGS led the project and performed economic and spatial analysis. Moffatt & Nichol provided expert scientific and engineering input on coastal processes, hazards and adaptation options.

The project utilises the latest available current data on assets, economic characteristics, coastal processes and natural hazards. Sources are noted throughout. No new hazard modelling was undertaken for this study. The limitations of current hazard data and their implications for the study are outlined in Chapter 3.

2.2 Process for completing this study

The study was completed between May 2025 and February 2026. It included the following steps:

- Data review – May-June 2025
  - Existing data on coastal processes, hazards, assets and values in the study area was accessed and mapped
  - The scientific evidence base of existing hazard data was reviewed to determine suitability for this study, and alterations made where necessary
- Site visit and first community engagement – June 2025
  - The project team visited Scamander to assess current conditions and gather additional primary material
  - Two community engagement sessions were hosted in Scamander to explain coastal processes and hazards, including the impact of climate change, identify values at risk and introduce concepts of adaptation pathway planning.
  - Materials were shared online with an option for community members to respond.

- Cost of risk assessment and adaptation planning – July-September 2025
  - Additional engagement with Tasmanian SES, TasWater and Break O' Day Council was held to further explore values at risk
  - Monetisation methodologies were researched and applied to values at risk in the rivermouth
  - 'No regrets' intervention options were identified and draft adaptation pathways developed for key sites
  - Online community workshop was held on values at risk in September 2025. Materials were shared online and a survey provided for those unable to attend.
- Site visit and second community engagement – October 2025
  - The project team returned to Scamander to present and collect feedback on draft adaptation pathways during two community consultation sessions
  - Materials were shared on the Council webpage and an online survey allowed community members to provide information and feedback.
- Adaptation pathways refinement and cost-benefit analysis – November-December 2025
  - Further community feedback was collected on draft adaptation pathways via online survey
  - Adaptation pathways were refined given feedback
  - Cost-benefit analysis of adaptation pathways at Dune Street explored community welfare implications of adaptation pathways given impact on values at risk
- Reporting drafting – January 2026
  - The coastal hazards and pathways adaptation plan was drafted in January 2025

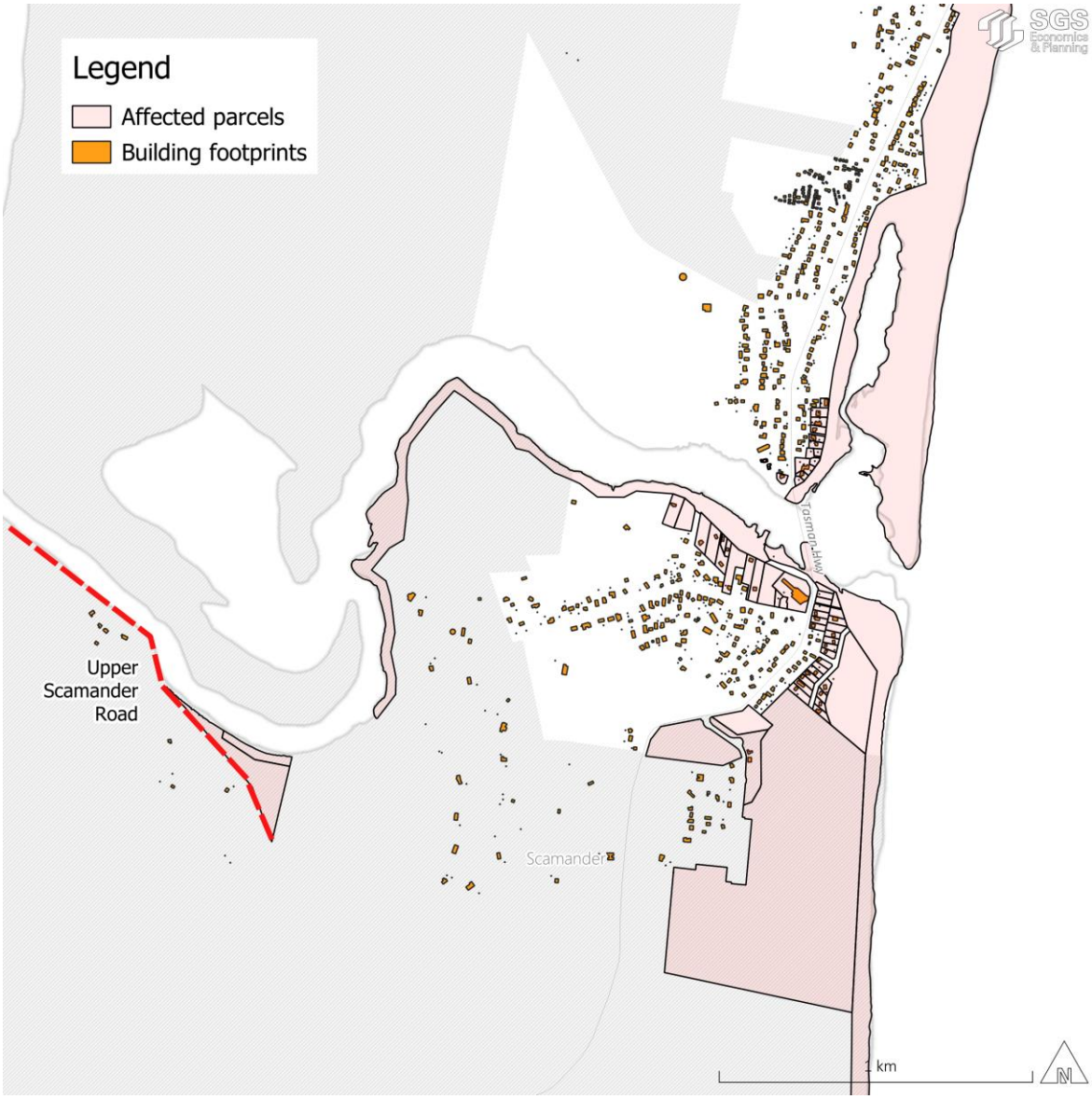
The contributions from stakeholders and community members and organisations have been invaluable for this study. Contributions included anecdotal historic evidence, reports, photos and information about community initiatives and environmental management initiatives.

2.3 Introducing Scamander

Scamander is the second largest town in Break O' Day LGA, situated on the northeast coast of Tasmania. The Scamander River runs through the middle of the town and is bridged by the Tasman Highway. The river originates to the north-east and exits to the sea via a wide, sandy rivermouth forming an 'intermittently closed and open lake and lagoon' (ICOLL). Hazards including coastal inundation, riverine inundation and coastal erosion arise in the vicinity of the rivermouth, which is relatively developed with residential, recreational and employment-generating land uses.

Figure 1 outlines the study area; broadly, the affected land parcels highlighted in red. Chapters 2 and 3 elucidate the hazards and values at risk in this study area, to which the adaptation plan seeks to respond.

Figure 1: study area



Source: SGS Economics and Planning 2025; Break O' Day Council 2025

2.4 Introducing adaptation pathways

Adaptation pathways are chains of actions taken in response to risk over time. They acknowledge that areas will look and function differently if certain changes are made. Adaptation pathways all seek to manage risk, but do so in different ways, meaning the community, economic outcomes will vary from pathway to pathway. A set of principles define successful adaptation planning.

- Developing risks must be actively managed. Doing nothing is not an option. This speaks to the reality of coastal hazards in Scamander, which pose significant threats to property and livelihoods.

These developing risks should be actively managed; it is not acceptable to ignore them once they are known.

- **Honest and transparent communication with the community.** Coastal adaptation relies on the collective action of individuals and businesses in the affected area. It is imperative that the community share a complete assessment of the risks that coastal hazards present and the trade-offs inherent to the choice of adaptation options. This will enable all actors to make appropriate informed decisions.
- **Government is not responsible for the protection of private property against natural hazards.** The protection of the community from hazards does not extend to protecting private assets. There may be cases where governments can act on behalf of property owners to enable collective responses, or where shared benefits are a basis for sharing costs and risks.
- **There should be no subsidy to occupy hazardous locations.** With climate change, it will be unsustainable to subsidise people who choose to occupy or use locations that are becoming increasingly hazardous, in line with projected and known future risks. It may be that current property owners were not fully aware of the potential risks at the time they invested in the area. In these cases some short term works may be provided to enable property owners, residents and operators to consider their future plans. However, for those who knowingly buy themselves into a risky location, managing the risk is considered a private cost.

Key terminology for adaptation planning includes:

- **Flexibility.** Inherent in the concept of adaptation pathways is flexibility. Options should be assessed and actions taken with a view to maintaining the flexibility of the community to respond to a dynamic external environment. Care should be taken to avoid locking in excessive negative impacts that cannot be undone if the balance of risk changes.
- **Thresholds**. The community's and individual level of tolerance for risk will have thresholds for maintaining it and triggers for action. People benefit from their coastal location and the use of coastal assets, such as views, beach access and recreational opportunities. To continue to enjoy those benefits people in hazardous areas may bear the cost and inconvenience of increasing risks and impacts from climate related events. But only to a point, or threshold. Adaptive works such as wave resistant barriers or raising floor levels of dwellings can increase thresholds and maintain tolerable risk.
- **Triggers**. Triggers are measurable milestones or markets for action on a threshold. For example, a large storm causing widespread damage might catalyse a decision to abandon an asset before the end of its effective life, as the costs of repairs would outweigh the benefits of maximally utilising the asset.
- **Trade-offs.** Trade-offs will inevitably arise where the choice of one action to preserve or increase certain values will have a negative effect on other values. The choice to protect physical property by building a large seawall, for instance, will reduce natural values as habitats are destroyed and amenity value as pristine environments are transformed and recreational access and opportunities are lost. Trade-offs will become more prominent the further a community moves along a particular adaptation pathway.

3. River mouth and coastal processes

The Scamander River mouth and associated coastal processes are documented and analysed in detail in the *Scamander River Coastal Hazards Risk Mitigation & Pathways Planning Outlook Report* prepared by Moffatt & Nichol.[2] The findings of this report were further summarised for the community by Break O' Day Council staff.[3] This chapter summarises key findings from this work that are especially relevant for the adaptation planning and cost-benefit analysis in later chapters.

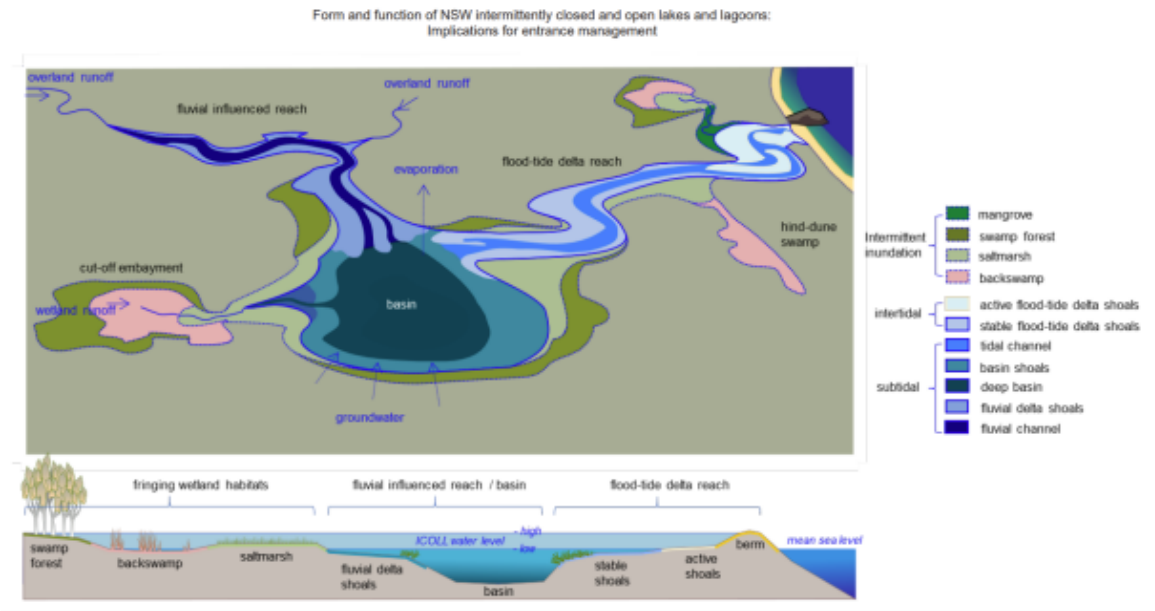
Scamander River mouth as an ICOLL

As noted in the preceding chapter, Scamander River mouth can be understood as an intermittently closed and open lake or lagoon (ICOLL). This refers to lakes that naturally alternate being open and closed to the ocean, with closure defined by the existence of a dynamic sand beach barrier that separates the ICOLL from the ocean. Risks at the Scamander River mouth reflect a complex balance of processes. Most prominent amongst these are **tides**, which influence water levels seaward of the berm, driving coastal inundation (especially during storm events) and the capacity of the ICOLL to overtop into the ocean, **sediment**, which moves up and down the coast and is deposited at the river mouth, forming the berm, and **river levels,** which determine inundation risk landward of the berm and are influenced by rain further up the catchment.

ICOLLs are geomorphologically complex, and key features, in particular the existence, height and width of the berm, and therefore water levels and speeds on either side, change often. Scamander River mouth is no different. Historically, the river mouth has migrated north and south along the sandy shore, with ICOLL closure and opening reflecting the balance of processes at any particular time. As development has intensified in the river mouth, mechanical opening of the barway via excavator has been used to alleviate risk, particularly of inundation where high river levels coincide with barway closure.

[2] https://www.bodc.tas.gov.au/wp-content/uploads/2025/10/Outlook-report-Scamander-Coastal-Hazards-Flood-Risks-final.pdf
[3] See https://www.bodc.tas.gov.au/council/current-projects-and-activities/

Figure 2: terminology and idealised ICOLL configuration



Source: Moffatt & Nichol 2025

Hazards around Scamander River mouth

Three major hazards affect the users and owners of land around Scamander River mouth.[4]

- **Coastal erosion.** Coastal erosion is the removal of coastal land by water (waves, river currents and tidal inundation), wind and general weather conditions. Long term erosion leads to coastal recession, which is the long-term movement of land due to sea level rise and typically occurs on both soft sandy and tertiary sediment coasts. Coastal erosion has many causes including tides, currents, sediment budgets, storm intensity and frequency, wave energy, fetch, sea level rise, land erodibility, and human intervention.
- **Coastal inundation.** Coastal inundation is the natural process of flooding of land by the sea and can be either temporary or permanent. Temporary inundation is flooding due to storm surge, extreme storm events, floods or tides. Permanent inundation is the permanent loss of land to the sea. A storm surge is the temporary piling-up of water at the coast due to onshore wind setup and/or low barometric pressure. A storm surge combined with high tide can be particularly hazardous, and even more so in the presence of wind-generated waves and associated wave setup. At Scamander coastal storms (surge and waves) combining with high tides can overtop the barway and adjacent beach, with waves running up over low lying areas such as Dune Street, the foreshore reserve on the south side of the river and the Pelican Sands foreshore.
- **River flooding.** River flooding is caused by the runoff of heavy rainfall in the upper catchment and resulting increases in river discharge, sufficient to exceed the river channel capacity and inundate floodplain areas. River flooding can also have dramatic impact on channel scour and the movement

[4] Moffatt & Nichol 2025, pp. 32-33

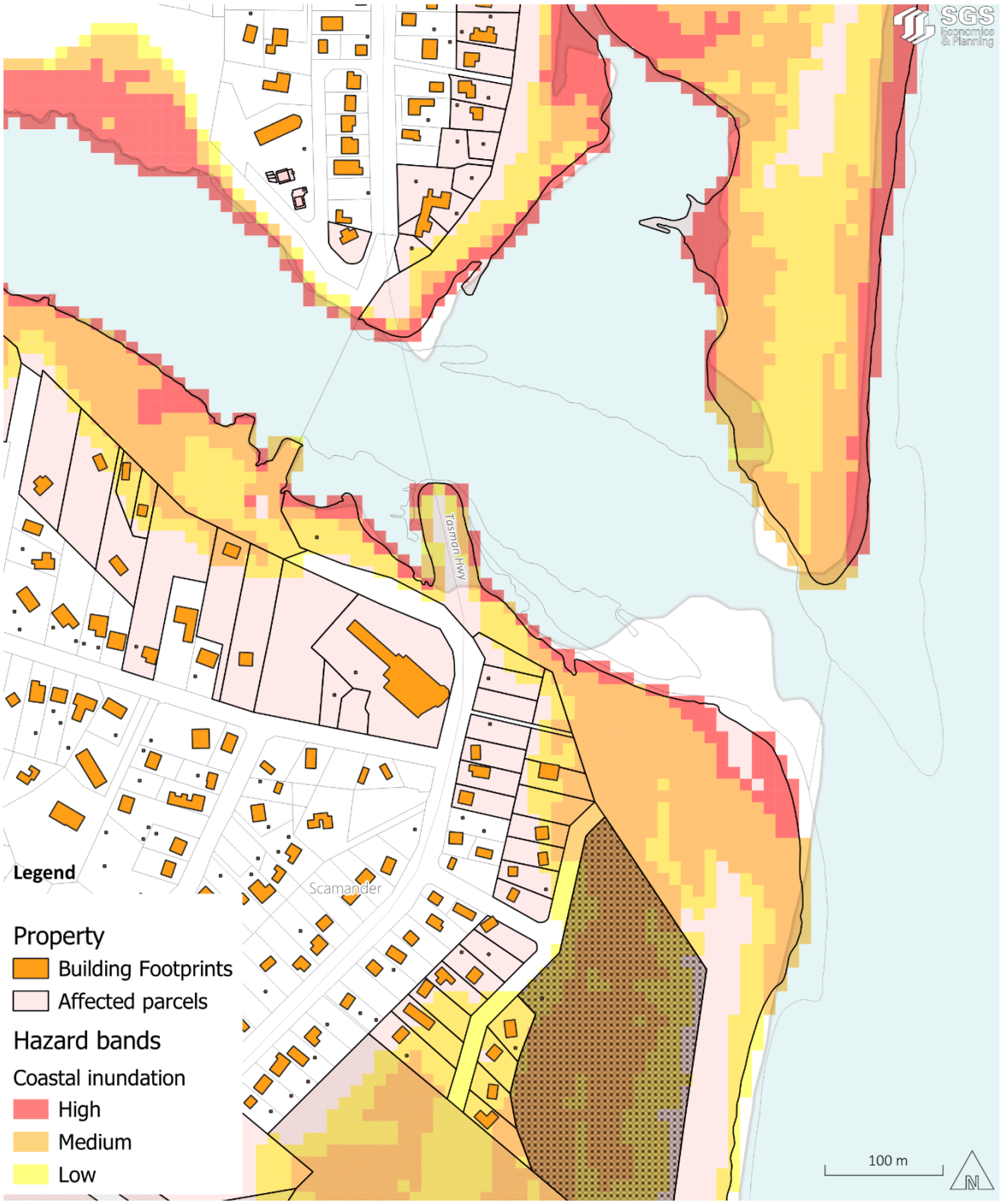
of the entrance position on the beach. At Scamander, peak water levels achieved by river flooding have the potential to be significantly influenced by the barway condition (open/closed) and / or ocean condition. River flooding has impacted roads and property, with elevated river water levels overtopping the Scamander River Road and low lying areas, for example Bridge Esplanade.

Estuary and river foreshore erosion is also an issue, but less so around the Scamander River mouth. To the extent that river erosion is a significant hazard at Pelican Sands, this primarily reflects the impact of wave runup during storm events.

A review of available data, in particular hazard bands pertaining to the level of the above hazards in the Scamander River mouth, concluded that the existing bands are a broadly accurate portrayal of risk levels, with two important qualifications. Coastal inundation risk is considered to be underestimated for wave-exposed foreshores as it does not consider wave set up and wave run up, nor any interaction with river flooding, including barway condition (figure 3). Coastal erosion is considered to be underestimated around Dune Street in particular. This is due to the shoreline positioning north of Dune Street during assessment, and failure to consider channel movements as contributing to erosion, such as in 2022 when the channel came very close to Dune Street. In light of this advice, for the purposes of cost-benefit analysis at Dune Street SGS has repositioned existing inner coastal erosion bands to align with the current shoreline (Figure 4).

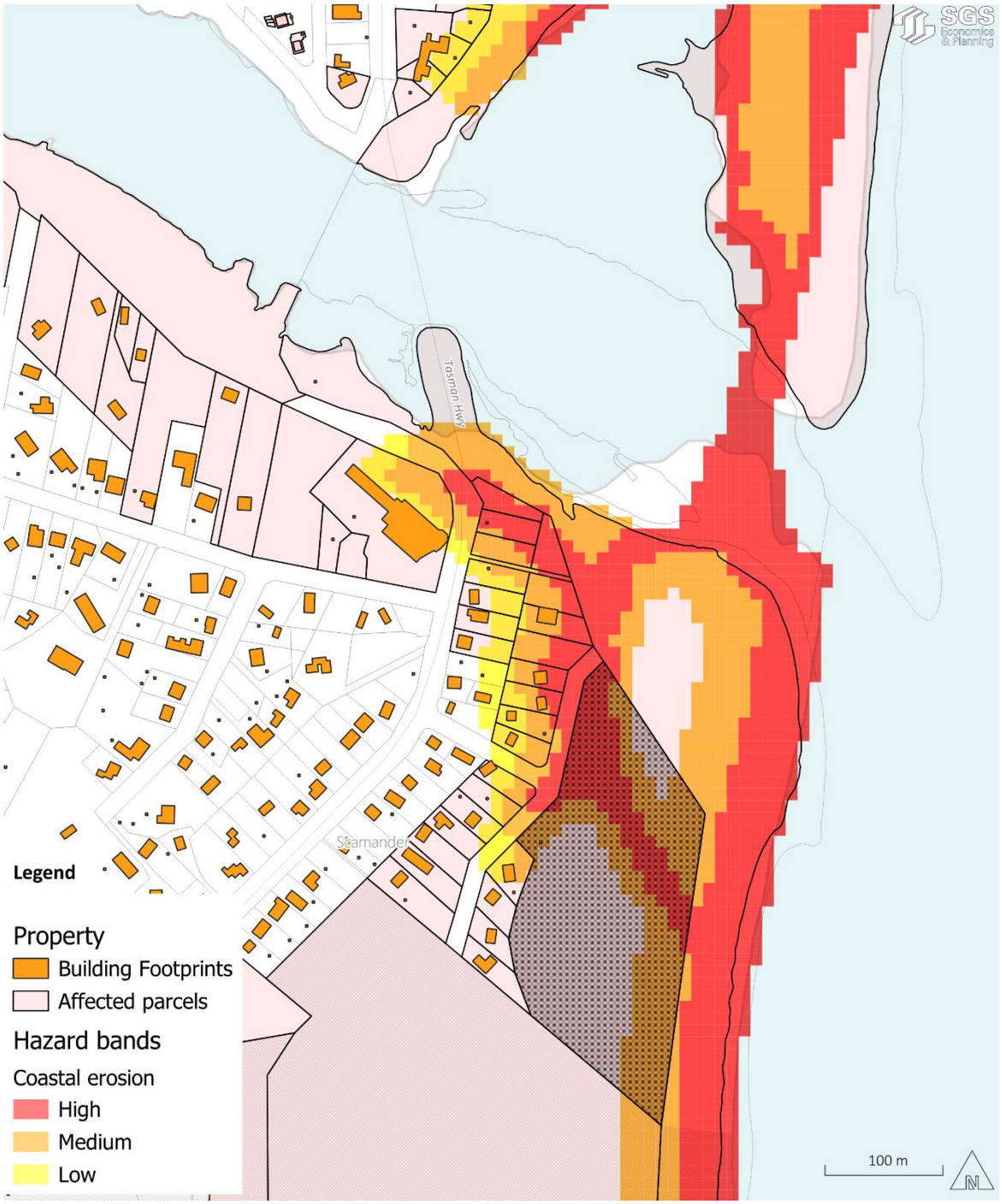
Some locations are exposed to each of the above hazards. During extreme events, these hazards can occur simultaneously and interact with each other. The consequences of compounding or multi-hazard events are generally not well understood including at the Scamander River mouth, but the combined consequences are likely to be more severe than the consequences of individual hazards. This project mapped the compounded hazards (Figure 5).

Figure 3: coastal inundation hazard bands



Source: SGS Economics and Planning 2025

Figure 4: repositioned erosion hazard bands at Dune Street



Source: SGS Economics and Planning 2025

The impact of climate change

Climate change is expected to have implications for the coastal and river processes at Scamander. Of particular note are the predicted increased intensity of rainfall, sea level rise and increased intensity of coastal storms. Increased intensity of rainfall exacerbates riverine inundation, with greater volumes of water moving down the catchment seeking exit to the sea via the Scamander River mouth. Sea level rise and increased intensity of coastal storm both intensify coastal erosion and coastal inundation, increasing the risk of damage to public and private property. Broader impacts include altered ecological conditions, and therefore character of the area for flora and fauna, changes in land use patterns as preferences and requirements for different use types change, and increased pressure on stormwater and drainage systems.

Climate change is an uncertain process. This is why adaptation planning makes use of dynamic adaptation pathways, which can flexibly respond to climate risks as they change. The impacts of climate change on coastal hazards could be less or greater than current expectations.

This study integrates climate change to the extent that it is reflected in underlying hazard studies. Specifically:[5]

- Application of increased rainfall creating higher peak water level at bridge.
- 10m horizontal erosion and retreat per 0.2m of sea level rise.

[5] Moffatt & Nichol 2025, pp. 34-35

4. Values at risk

Scamander, and the Scamander River Mouth in particular, contains numerous values that are placed at risk from coastal processes and coastal hazards. Table 1 outlines the values in the study area that are considered in subsequent analysis and adaptation pathways planning. These are explored in detail in the subsequent chapter, which analyses assets, exposure to hazards and adaptation pathways for a subset of key locations around the river mouth. Table 2 outlines the monetisation methodologies and datasets that we have used to calculate the dollar value of each asset type.

At a high level, however, values can be impacted by coastal hazards in a variety of ways. These include:

- **Property:** damage to physical land and property, cost of clean up after hazard events and overall reduced property values.
- **Community**: the community can experience damage to facilities such as recreational areas, gathering spaces and Council assets, as well as poor mental health, especially anxiety and depression, due to concern and uncertainty about the future impacts of hazards.
- **Ecological:** bird habitats can be affected, especially threatened species such as terns that nest in fragile beaches, dunes and sandbars. Wetlands and the habitats they support can also be affected by interruptions to the balance of salt and fresh water.
- **Tourism and recreation:** Scamander River mouth is a high-use sight that attracts significant visitation due to its recreational opportunities and natural character. These uses, and thereby visitation, can be interrupted by changes to the character of the foreshore, reduced beach access and increased perception of risk to users

Table 1: values at risk in Scamander River mouth

Category	Value	Count	$ value (2025) ($,000)	Key examples
Property	Private dwellings	39	$21,677	– Dune Street dwellings
	Commercial	2	$1,312	– River Mouth Café
	Accommodation	15	$19,280	– Pelican Sands
	Council assets	7	$3,080	– Scamander Recreation Reserve
	Community	1	$470	– Scamander SLSC
Roads	Roads	5km	$2,574	– Dune St – Hodgman St
Natural environment	Existing beach	n/a	$1,169	– Steels Beach adjacent to river mouth

Category	Value	Count	$ value (2025) ($,000)	Key examples
	Estuaries	n/a	$1,134	– Hind dune marsh
	Wetlands	n/a	$21,233	– Hind dune marsh – Upper Scamander River
	Saltmarsh	n/a	$195	– Scamander River
	Dunes	n/a	$1,719	– Access pathways to Steels Beach
	Bird habitat	n/a	$12	– Threatened bird nesting on Steels Beach and barway
	Playspace/recreational area	1	$17	– Scamander Recreation Reserve
Water infrastructure	Water mains	2km	$2,640	– Reticulation mains beneath Dune St, Scamander Ave
	Upper Scamander Reservoir	1	$1,300	n/a
	Upper Scamander BPT (break pressure tank)	1	$1,060	n/a
	Sewer mains	2km	$600	– Sewage mains beneath Scamander Recreation Reserve
	SPS (sewerage pumping station)	3	$608	– Pelican Sands SPS – Dune St SPS
Visitor economy	Estimated visitor spend	50,000	$12,951	– Tourist visitation to Steels Beach and local caravan parks
Total			$93,023	

Source: SGS Economics and Planning 2025

Table 2: monetisation methodologies for values at risk

Value	Methodology	Source
Private dwellings	Adjusted capital value	Break O' Day Council rates database
Commercial	Adjusted capital value	Break O' Day Council rates database

Value	Methodology	Source
Accommodation	Adjusted capital value	Break O' Day Council rates database
Council assets	Adjusted capital value	Break O' Day Council rates database
Community	Adjusted capital value	Break O' Day Council rates database
Roads	Replacement cost	*Rawlinsons Australian Construction Handbook 2025*
Existing beach	Willingness to pay (WTP) for visit to an existing beach * Scamander households * average annual beach visits	Anning, D. (2012), *Estimation of the economic importance of beaches in Sydney, Australia, and implications for management*, PhD Thesis UNSW
Estuaries	WTP for coastal protection of estuaries per ha per household * estuary area * Scamander households	Pascoe, S. et al. (2017) *What's my beach worth? Economic values of NSW coastal assets*
Wetlands Saltmarsh	Ecosystem services value of wetlands per ha per annum * area of wetland	Creighton, C. (2013) *Revitalising Australia's Estuaries, Fisheries*, Research and Development Corporation
Dunes	WTP for coastal protection of dunes per ha per household * dune area * Scamander households	Pascoe, S. et al. (2017) *What's my beach worth? Economic values of NSW coastal assets*
Bird habitat	WTP for Australian threatened bird conservation * Scamander households	Zander, K. K., Ainsworth, G. B., Meyerhoff, J. and Garnett, S. T. (2014) *Threatened Bird Valuation in Australia*
Playspace/recreational area	WTP for standard playspace per household * Scamander households	Community and Patient Preference Research (2022) *Willingness to pay for green infrastructure and public spaces in NSW*, Final Report prepared for the Department of Planning and Environment
Water mains	Replacement cost	TasWater consultation

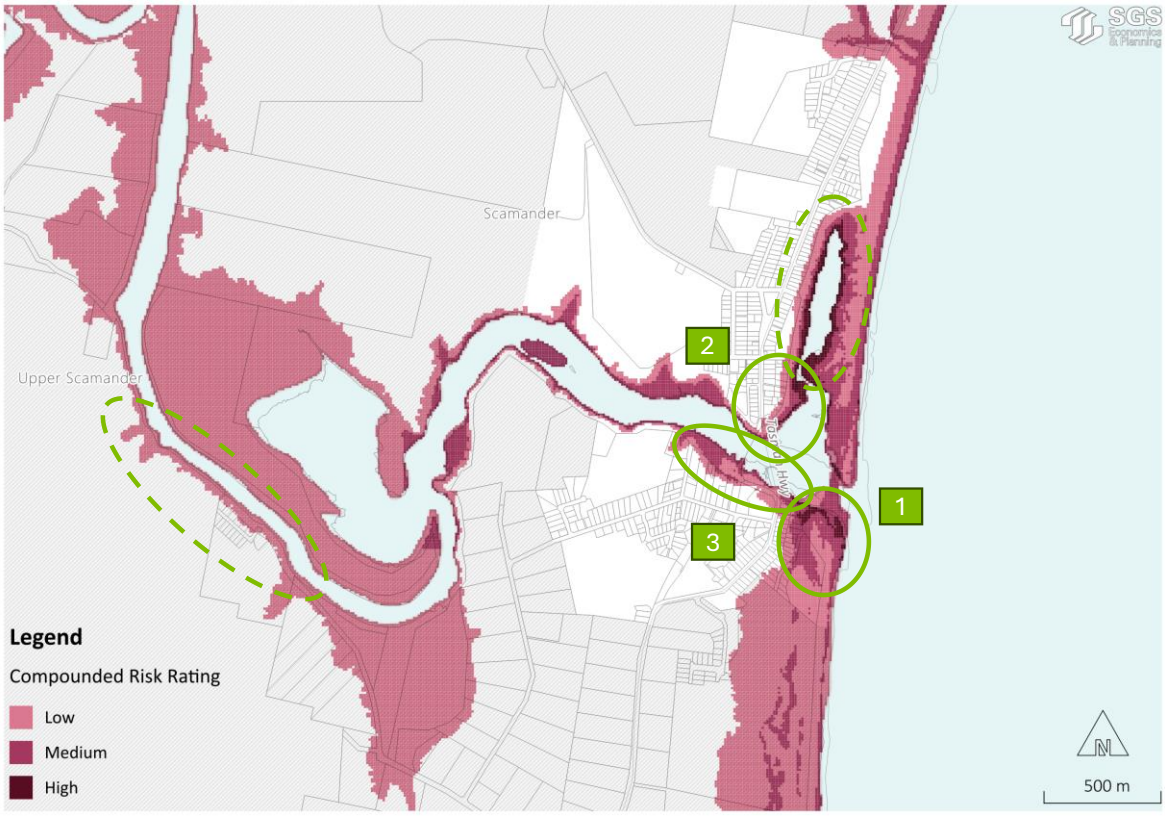
Value	Methodology	Source
Upper Scamander Reservoir	Replacement cost	TasWater consultation
Upper Scamander BPT (break pressure tank)	Replacement cost	TasWater consultation
Sewer mains	Replacement cost	TasWater consultation
SPS (sewerage pumping station)	Replacement cost	TasWater consultation
Estimated visitor spend	Scamander accommodation capacity * estimated annual visitation * average spend per night in Tasmania	Tourism Tasmania (2025) *Visitor data snapshot: Year ending March 2025*

Source: various

5. Hazard management and hotspots

The balance of coastal hazards and values at risk differs between points on the Scamander River mouth. This chapter considers three key locations in the study area with different hazards, values and risks, outlining potential adaptation pathways for each. The locations are detailed in Figure 5 below. Note the use of compounded risk ratings in the figures in this section. These are computed by SGS from spatial hazard data to show areas where coastal erosion, coastal inundation and riverine flooding (hydrology) coincide. The full methodology for computing this rating is given at Appendix A.

Figure 5: hazard management hotspots in Scamander River mouth



Source: SGS Economics and Planning 2025

Cost-benefit analysis of adaptation options at Dune Street between 2025 and 2100 was completed, recognizing that Dune Street is especially exposed to coastal hazards. Cost-benefit analysis is an approach to evaluating the merits of different interventions that seeks to quantify their respective impact on the community, whether these be economic, social or environmental. It does this by identifying the impact of different options in terms of their deviation from the 'base case' of no action, where costs and benefits otherwise proceed along their existing paths. The costs and benefits included in this analysis are outlined in Table 3.

Adaptation pathways consist of a range of interventions and actions that will be implemented simultaneously and consequently over time as risk levels evolve.

In terms of costs and benefits, adaptation typically involves costs in terms of building protection works, vegetation management and changes to planning and building requirements. The benefits encompass a range of avoided damages, amenity, use and ecological changes and these vary by the type of intervention.

Table 3: costs and benefits of adaptation to coastal hazards in Scamander River mouth

Costs	Benefits
C1: Pathway costs – Capital cost – Maintenance cost – Asset relocation cost – Contingency cost	B1: Avoided damage – The avoided damage to land and property resulting from the intervention B2: Beach access – The impact of the options on the capacity for community members and visitors to access and enjoy Steels Beach B3: Visitation spending – The impact of the options on visitation and expenditure by tourists to Scamander B4: Ecosystem impacts – The impact of the interventions on ecosystems and habitats present in the area

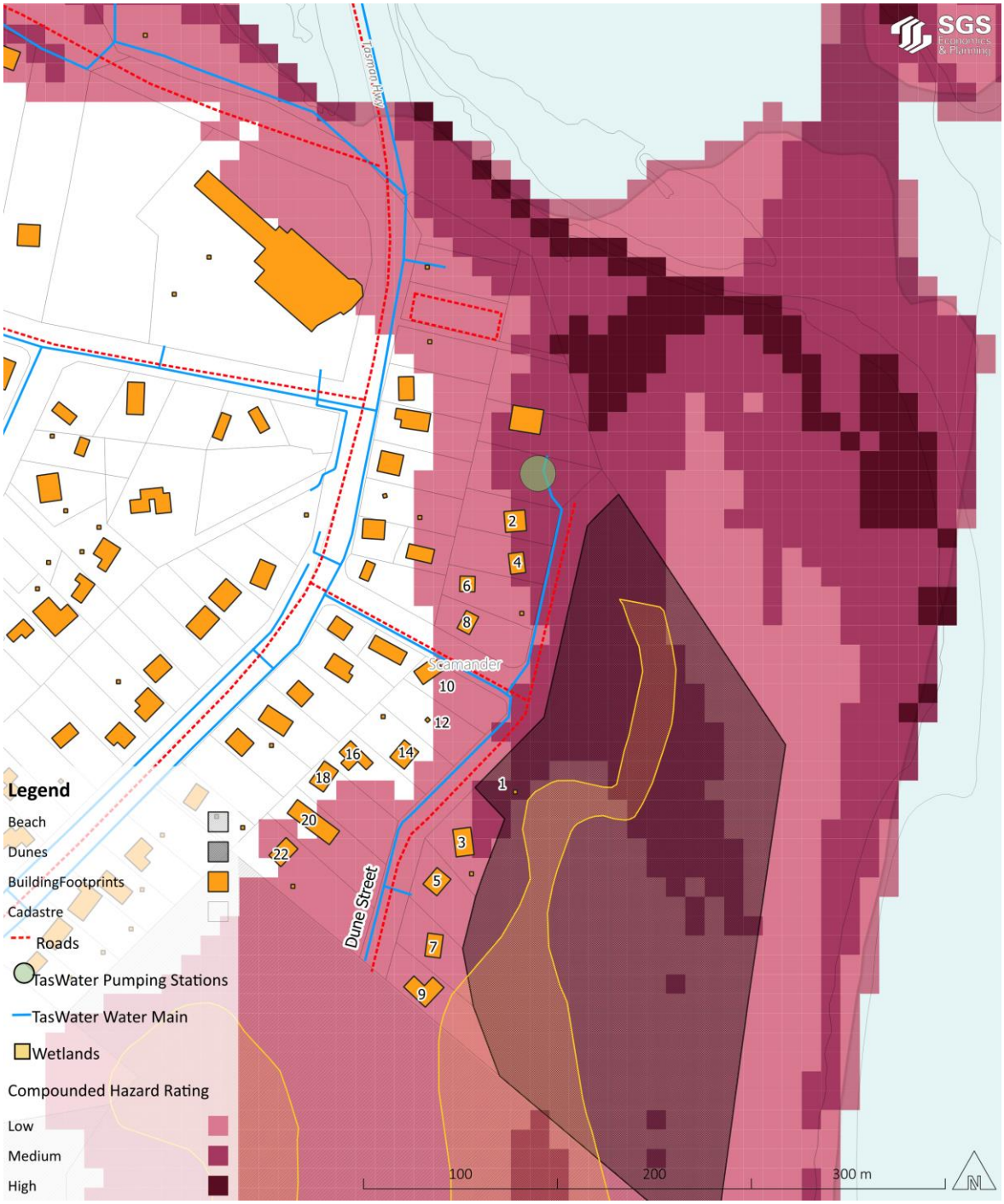
Source: SGS Economics and Planning 2025

Cost-benefit analysis was not performed for the other hotspots around Scamander river mouth. However, the relevance of the cost-benefit analysis findings for these other sites is considered for each location given the balance of coastal hazards and key cost and benefit drivers.

5.1 Dune Street

Hazards

Figure 6: assets and hazards in Dune Street



Source: SGS Economics and Planning 2025

Dune Street is the most highly exposed part of the Scamander River mouth. Hazards are complex and overlapping, though primarily reflect erosion compounded by coastal inundation and flooding. Parts of the foreshore, road and low-lying properties – especially Scamander SLSC – can be inundated during storm events, such as in March 2021, where coincidence of river flooding and a coastal storm caused extensive erosion landward and inundation of properties.

Erosion is generally reflected in a foreshore that moves consistently landward over time. The southern edge of the river mouth has migrated southward and landward in recent years, with the formation of a hind dune marsh south of the river mouth cutting access to Steels Beach and further eroding land abutting the road. A very large event, consistent with 1% AEP, is not currently known to have occurred, but would present severe risks to property and people on Dune St.

Assets

Assets at risk at Dune Street include:

- 16 private properties on Dune St. $8 million total value.
- Community infrastructure including Scamander SLSC, beach and foreshore park.
- Infrastructure including Dune St roadway and pathways, TasWater mains and pumping station. Pumping station particularly at risk from inundation.
- Extensive dunes and beach, with some wetlands. All are threatened by erosion and/or inundation and could become inaccessible.
- Tourist and recreational visitation to Steels Beach, which is accessed via Dune Street

How will the area change if nothing is done?

If nothing is done, erosion and inundation will increase at Dune Street, with properties experiencing poor access during and after events. Without foreshore hardening, the shoreline will continue to move landward undermining the road, walkways and some properties. Over time, preparation for and clean-up after events may become an almost constant activity. The Scamander skate park and recreation area may also suffer from erosion and inundation in the medium to long term, limiting access to these valuable community assets. A particularly large event could undercut the foundations of these assets, necessitating extensive repairs.

Council may repair assets such as the recreation area, skate park, foreshore verge and road repeatedly until it becomes too costly. The road may be permanently destroyed following a particularly large event, leaving properties inaccessible. Some assets may be relocated, such as the SLSC or play equipment. Property owners may no longer fix and maintain their properties as the hazards increase, and some properties may be vacated before the end of their economic life. As a result Dune Street will feel ‘emptier’.

Doing nothing in Dune Street is not an option

The base case where nothing is done to address coastal hazards at Dune Street was quantified as part of the cost-benefit analysis. This sees coastal hazards proceed on the trajectories implied by the low, medium and high erosion and coastal inundation hazard bands applying to the area (Table 4).

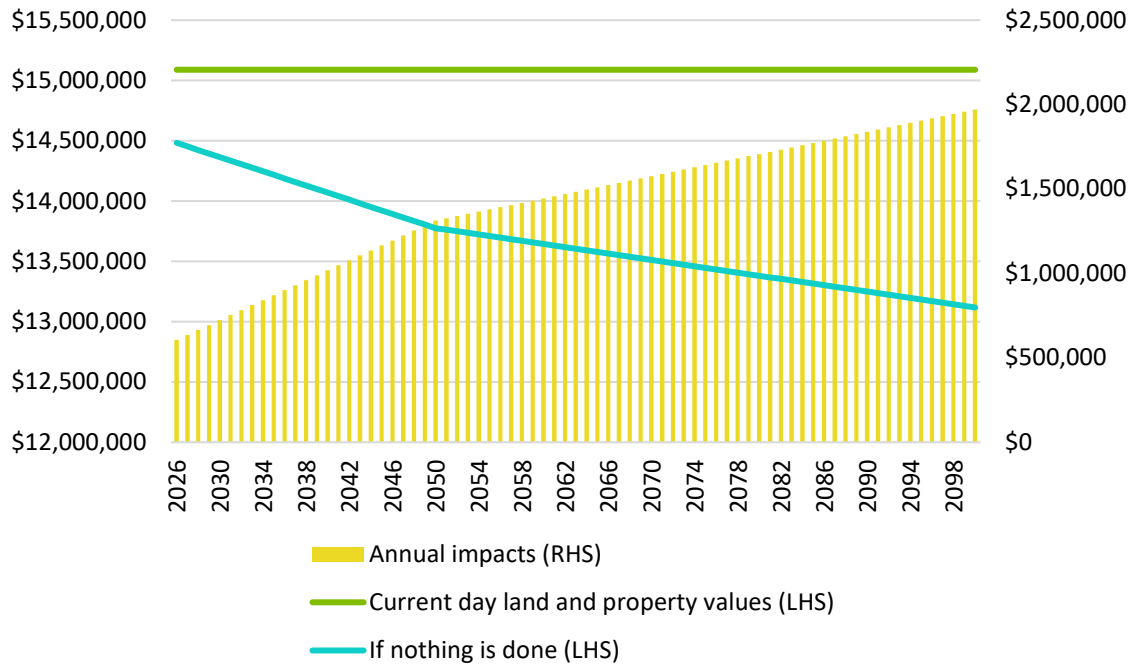
Table 4: hazard bands for Dune Street

Hazard	Low	Medium	High
Erosion	Potential shoreline to 2100	Potential shoreline to 2050	Current-day storm bite hazard reducing foundation stability
Coastal inundation	Vulnerable to a 1% AEP storm event in 2100	Vulnerable to a 1% AEP storm event in 2050	Vulnerable to sea level rise by 2050 from mean high tide

Moffatt & Nichol 2025

Land and property exposed to erosion was assumed to reduce in value by 25 per cent, consistent with the approach to past work on coastal adaptation in Tasmania. Land and property was assumed to be unaffected by 'low' inundation, and there were no properties exposed to 'high' inundation. For properties impacted by 'medium' inundation, it was assumed they would currently experience damage to contents every 5 years (consistent with 20% AEP event), and by 2050 experience damage to structures and land equivalent to 1% AEP. By 2100, these properties are expected to have experienced inundation impacts for 50 years, cumulatively increasing the level of damage sustained.

Figure 7: damage impacts from coastal hazards at Dune Street – base case



Source: SGS Economics and Planning 2025

The application of these impacts to current land and property values at Dune Street gives the profile of cumulative damage if nothing is done to address coastal hazards. Also included in the analysis, though not reflected in Figure 7, is damage to road and water infrastructure in the area, which is assumed to follow the same profile as damage to land and property.

Potential adaptation pathways in response to hazards

Moffatt and Nichol developed three adaptation pathways for Dune Street in response to coastal hazards in the area. These are outlined in Table 5 below. Note that the included costs differ between options depending on which assets are protected. For options 1 and 2 the sewage pumping station at Dune Street is relocated in 2035. This is not necessary in option 3; however this option includes the costs of maintaining affected properties, which would otherwise be progressively abandoned as hazards re-occur under options 1 and 2.

Table 5: adaptation pathways at Dune Street

Option	Details	Erosion impact	Inundation impact	Cost
Option 1: Living shoreline foreshore erosion protection	A living shoreline or soft protection could be implemented to address the immediate erosion processes along a 60m length of foreshore fronting Dune Street The buffer between the road and foreshore could be planted out. The measure would likely need to include a hybrid rock/vegetation protection, but could also include geo-bags or rock bags. In addition, it is proposed that dune stabilization be undertaken to the north, fronting the SLSC. These works would not address the inundation risk. Under this pathway, no further residential and sensitive urban development would be allowed. In the long term (as sea levels rise), inundation problems would become more severe and the foreshore erosion protection would reach the end of its effective life. This pathway provides property owners with time to reach the economic life of their assets and protect their individual properties for the foreseeable future.	Mitigated until 2035, then trajectory reasserted.	No impact on inundation hazard.	– Treatment cost: $180,000 – Contingency: $36,000 – Maintenance cost: $2,700 p.a. until 2035 – SPS relocation: $300,000
Option 2: Hybrid seawall and	The option proposed includes a rock revetment hybrid seawall to address coastal erosion. At a minimum this would run in front of Dune St where erosion is currently occurring and wrap around the foreshore to link with existing rock revetment of Foreshore Reserve.	Mitigated until 2050, then trajectory reasserted.	Mitigated until 2050, then trajectory reasserted.	– Treatment cost: $1,250,000 – Contingency: $250,000

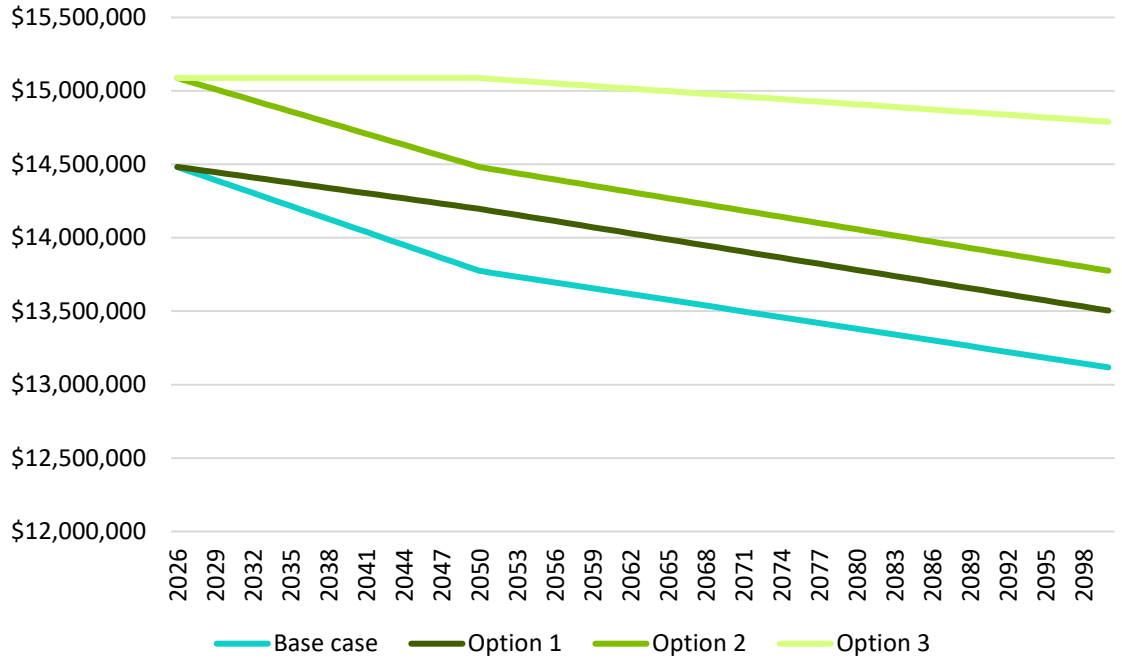
Option	Details	Erosion impact	Inundation impact	Cost
wave runup bund	A small wave runup bund be constructed in the lee of the rock wall (in the road reserve), or on the west of the road fronting properties. Such a bund could be earth filled to approximately 500mm high and grassed, or alternatively a robust timber fence. This pathways would offer erosion protection for the medium term and protect against some inundation, but likely not extreme events. Compared to pathway 1, this option buys more time, but eventually (as sea levels rise), properties would be increasingly exposed to inundation and erosion. As with option 1, further development in the area would be discouraged.			– Maintenance cost: $18,750 p.a. until 2050 – SPS relocation: $300,000
Option 3: Rock revetment and levee	Rock revetment hybrid seawall, similar in nature to Option 2, although higher and likely less vegetation. A levee is proposed to provide the river flood and coastal inundation protection needed, expected to be raised above the current road level at Dune Street by approximately 1.5m. To allow for river flooding and coastal inundation, the levee would need to link in with the higher ground at the bridge abutment (north) and higher ground south west of Dune Street (Hobden Street). Stormwater drainage and pumping would be required to mitigate damming effect of the levee. This option comes with substantial capital works and costs, and would offer longer term protection. It provides protection against erosion up to around 2075.	Mitigated until 2075, then trajectory reasserted.	Inundation is wholly mitigated to 2100.	– Treatment cost: $8,250,000 – Contingency: $1,650,000 – Maintenance cost: $123,750 p.a. – Maintenance cost of protected land and property: $232,132 p.a.

Source: Moffatt & Nichol 2025

Cost-benefit analysis results

The impact of the respective options on damage to land and property is given in Table 5 and Figure 8. Table 6 gives the impact of the options on other benefit categories relevant to the area: beach access, visitation spending and natural habitats. The approach to quantifying each of these benefits was given during the assessment of values at risk, in Table 1 and Table 2.

Figure 8: land and property values at Dune Street under different treatment options



Source: SGS Economics and Planning 2025

Table 6: impact of adaptation options on different benefit drivers

	2026	2050	2100	Reasoning
Impact on beach access				
Base case	100%	75%	50%	Beach access is gradually eroded over time
Option 1	100%	75%	50%	Beach access is gradually eroded over time
Option 2	100%	75%	50%	Beach access is gradually eroded over time
Option 3	100%	25%	25%	Beach can't be accessed with hard foreshore
Impact on visitation spending				
Base case	100%	90%	80%	Visitation falls gradually as Scamander becomes more difficult and dangerous to visit
Option 1	100%	95%	85%	Visitation falls more slowly as shoreline is protected and retains natural character
Option 2	100%	100%	90%	Visitation falls more slowly as shoreline is protected for longer and retains most natural character
Option 3	100%	75%	75%	Visitation falls significantly with no beach access and hard foreshore
Impact on natural habitat				
Base case	100%	110%	125%	Habitat grows as beach moves landward
Option 1	100%	105%	115%	Habitat grows as beach moves landward, but more slowly
Option 2	100%	85%	75%	Habitat falls slowly as beach recedes
Option 3	100%	60%	40%	Habitat falls quickly as beach recedes against hard shoreline

Source: SGS Economics and Planning 2025; Moffatt & Nichol 2025

For each benefit category, the change under each option is expressed as a percentage deviation from the current day in line with advice on the likely implications for key benefit drivers; particularly the state of the beach and foreshore area. This is a necessarily high-level approach, which due to data and resourcing limitations aims to indicate the likely trajectory of change under different options, rather than achieve a precise quantification

Table 7 contains the results of the analysis, including summary measures net present value (NPV) and benefit-cost ratio (BCR). Options with a positive NPV can be interpreted as increasing net welfare, while BCR shows the dollar of benefit resulting from each dollar of cost. As a result, BCRs above one generate at least one dollar of benefit per dollar of cost, improving welfare overall.

Consistent with the principles of cost-benefit analysis, results are displayed in terms of their difference from the base case. Where benefit categories have a positive sign they are greater under the project options than the base case; where they have a negative sign, such as for natural habitat, they are lower than the base case.

Table 7: cost-benefit analysis results (7% discount rate) ($2025) ($,000) – 2025-2100

	Option 1	Option 2	Option 3
Costs			
Total cost	$396	$1,807	$13,669
Benefits			
Avoided damages	$2,191	$7,546	$13,459
Beach access	$0	$0	-$1,420
Visitation spending	$4,668	$9,337	-$13,052
Natural habitat	-$4	-$24	-$47
Total benefits	$6,854,	$16,858	-$1,061
NPV	$6,458	$15,050	-$14,730
BCR	**17**	**9**	**0.48**

Source: SGS Economics and Planning 2025

According to the results of the cost-benefit analysis, options 1 and 2 strongly increase net welfare, creating 17 and 9 dollars of benefit per dollar of cost respectively. This reflect their efficiency – the investment of relatively small amounts for appreciable levels of benefit – compared to option 3, which strongly protects a relatively small set of properties at a relatively high cost. The impact on tourism spending in particularly important. Option 3, in drastically transforming the foreshore from a relatively natural, untouched environment to a hard, concrete barrier with no beach access, in addition to the likely accelerate erosion of the beach seaward of the wall, would significant impact Scamander's attractiveness to tourists. This would reduce visitation and spending, as visitors would likely elect to visit other locations nearby offering beach recreation and high natural values.

Given the sensitivity of the results to the tourism benefits and overall costs, sensitivity tests were carried out that varied these elements. While affecting the total size of the NPV and BCR, these sensitivity tests preserve the ordering and overall results of the analysis; that options 1 and 2 increase net welfare, while option 3 does not.

Table 8: sensitivity test results – halved tourism benefits (7% discount rate) ($2025) ($,000) – 2025-2100

	Option 1	Option 2	Option 3
Costs			
Total cost	**$396**	**$1,807**	**$13,669**
Benefits			
Avoided damages	$2,191	$7,546	$13,459
Beach access	$0	$0	-$1,420
Visitation spending	$2,334	$4,668	-$6,526
Natural habitat	-$4	-$24	-$47
Total benefits	**$4,520**	**$12,190**	**$5,464**
NPV	**$4,123**	**$10,382**	**-$8,204**
BCR	**11**	**7**	**0.62**

Source: SGS Economics and Planning 2025

Table 9: sensitivity test results – doubled costs (7% discount rate) ($2025) ($,000) – 2025-2100

	Option 1	Option 2	Option 3
Costs			
Total cost	**$793**	**$3,615**	**$27,339**
Benefits			
Avoided damages	$2,191	$7,546	$13,459
Beach access	$0	$0	-$1,420
Visitation spending	$4,668	$9,337	-$13,052
Natural habitat	-$4	-$24	-$47
Total benefits	**$6,854**	**$16,858**	**-$1,061**
NPV	**$6,061**	**$13,243**	**-$28,400**
BCR	**9**	**5**	**0.32**

Source: SGS Economics and Planning 2025

Table 10: sensitivity test results – halved tourism benefits and doubled costs (7% discount rate) ($2025) ($,000) – 2025-2100

	Option 1	Option 2	Option 3
Costs			
Total cost	**$793**	**$3,615**	**$27,339**
Benefits			
Avoided damages	$2,191	$7,546	$13,459
Beach access	$0	$0	-$1,420
Visitation spending	$2,334	$4,668	-$6,526
Natural habitat	-$4	-$24	-$47
Total benefits	**$4,520**	**$12,190**	**$5,464**
NPV	**$3,726**	**$8,574**	**-$21,874**
BCR	**6**	**3**	**0.38**

Source: SGS Economics and Planning 2025

Discussion and implications for adaptation planning

The results of the cost-benefit analysis have important implications for adaptation planning at Dune Street, and across Scamander as a whole. Most prominently, the results do not support aggressive, extensive, hard protection of the foreshore, even though this would protect some properties. The costs to the community of this course of action are simply too high, and it would negatively impact other important aspects that sustain Scamander; particularly its pristine natural character and beachside recreation opportunities, which sustain the visitor economy. Moreover, extensive hard protection is at odds with several key principles in adaptation planning, especially flexibility, given that it would lock the town into a single, increasingly costly form of action, and that there be no subsidy to occupy hazardous locations.

The high BCR of options 1 and 2 endorse a softer, more gradual approach that would provide a range of benefits to the community:

- Low capital and maintenance costs, meaning the opportunity cost of these options is low.
- Slowing down coastal hazards in the area, buying time for the community, Council and other stakeholders to undertake best practice adaptation planning, including early retreat for the owners of assets that are nearing the end of their effective lives.

- Enabling property owners to use their assets to the end of their economic life, while planning avoids new development in the area.
- Avoiding maladaptation by locking in costly maintenance expenditure and potentially inefficient or inappropriate land uses.
- Improving biodiversity and natural values in the area through native plantings and other forms of soft protection, which will increase utility for visitors and members of the community.
- Preserving important, though undervalued aspects of the foreshore such as recreation, visual amenity and natural values, which are otherwise lost.
- Preserving the contribution of the Dune Street foreshore to Scamander's visitor economy, which is of significant economic importance.

These considerations broadly align with feedback received from the community as part of this project. While noting the significant distress that coastal hazards can pose for occupants of exposed properties on Dune St, community members raised a number of issues relating to the prospect of hard protection in the area. These included the potential impact on recreation and tourism that depends on the foreshore and impact on fragile natural habitats, especially for migratory birds nesting on the beach and barway. Community members also broadly endorsed the need for transition away from residential uses, and ultimately retreat, at Dune St, noting that existing dwellings were already poorly positioned and exposed to increasing levels of risk due to climate change. This is consistent with options 1 and 2, which slow the progression of coastal hazards over the medium-term, allowing time for better planning and implementation of retreat. This is especially relevant given the dearth of domestic or overseas examples of retreat due to climate and coastal hazards and a generally lack of policy support, such as through the planning scheme.

Community members raised several other potential adaptation options at Dune Street (Table 11). While these could were not addressed directly in the CBA, some conclusions can be drawn regarding their suitability and relevance to the CBA findings.

Table 11: other adaptation options at Dune Street

Option	Potential issues	Relevance of CBA
Rebuild training wall extending from southern riverbank	Unclear that this would be an effective response to coastal erosion or inundation given complexity and balance of coastal processes. Previous wall was poorly engineered and ultimately failed.	The training wall would be classified as a 'hard' intervention most similar to option 3, and would present the same balance of cost and benefit to the community, though with less assurance of genuine property protection benefits or disbenefits to other parts of the river mouth, such as Pelican Sands..
Rivulet between Scamander estuary and Henderson Lagoon	There is no defined watercourse between these two locations and it is unclear how it would be	Given the lack of any existing watercourse, one would need to be constructed, likely at significantly higher expense than

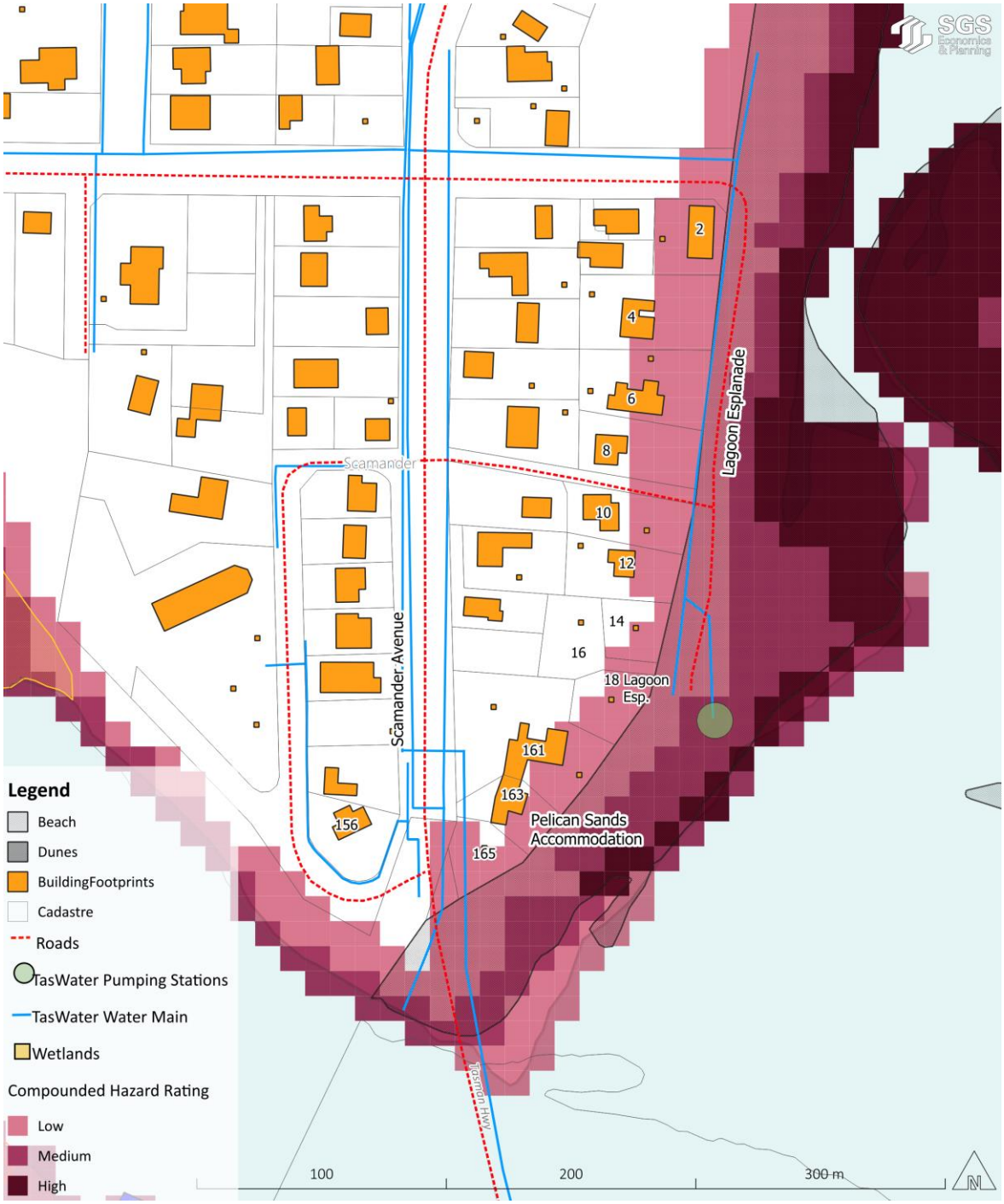
Option	Potential issues	Relevance of CBA
	effective at addressing coastal hazards in the area.	current option 3. While such a waterway may assist in mitigating the risk of riverine inundation when the barway is closed, the most material risk at Dune St is coastal erosion, which would be unaddressed.
Supported early retreat	This is consistent with options 1 and 2, which do not preclude any earlier retreat from those willing or able to leave the area. Consultation revealed some users who are already to retreat due to availability of alternate premises and assets reaching the end of effective lives. However, there is limited precedent for financial support for retreat from locations exposed to coastal hazards, though this may change as more communities make the decision to retreat. Some incentive to retreat should already exist in the form of lower market prices for land and property exposed to hazards.	Early retreat is consistent with options 1 and 2, though there has been no consideration of the financial impact of potential support payments to those who make the decision to retreat. All else being equal, this would reduce the overall welfare gains from these options.

Source: SGS Economics and Planning 2025

5.2 Pelican Sands

Hazards

Figure 9: assets and hazards at Pelican Sands



Source: SGS Economics and Planning 2025

Pelican Sands has a similar balance of hazards to Dune Street, with all three major hazards present. Inundation and erosion are significant issues. Risk of riverine inundation can increase when the barway is closed and floodwaters cannot drain out to see, while coastal inundation and erosion can increase when the barway is open and seawater enters the rivermouth. Wave run up and storm bite are additional concerns during storms and will get worse in the future. There is limited existing protection on the Pelican Sands foreshore, with thin vegetation and mown grass down to the water's edge offering little resistance to coastal hazards.

Assets

Assets at risk at Pelican Sands include:

- 9 private dwellings with a value of approximately $6 million.
- Major tourist assets core to the visitor economy, such as Pelican Sands accommodation. Valued approximately $1.5 million of land and property and significantly more in tourism expenditure.
- Recreational facilities including open space and picnic tables.
- TasWater pumping station at risk of inundation.
- Almost 1km of road, Lagoon Esplanade, with a replacement cost of $600,000
- Environment assets including foreshore vegetation (though of low current quality) and estuarine habitat.

How will the area change if nothing is done?

If nothing is done to address coastal hazards at Pelican Sands, their impacts will become more intense over time; especially erosion and inundation. This will particularly impact the tourist accommodation on-site, potentially making it more expensive due to adaptation, relocation and clean-up costs or less attractive due to more frequent and intense coastal hazards. As a result, visitation and tourist spending may become more volatile; eventually it may become unviable due to increase costs and decreased visitation. The foreshore park at Pelican Sands will be more regularly inundated, and areas of land and may wash away, particularly during major storms, floods and king tides. This will make is more difficult for the community to use the area for recreation, resulting in lower visitation outside of tourist season.

Council and landowners in the area may maintain or upgrade roads, buildings and open space in the area for a while, particularly to strengthen its resilience to coastal hazards. Eventually, however, the costs from hazards may exceed the benefits of continual investment in the face of escalating events. In this case, public investment will slow and private investment will either need to increase or cease. Accommodation buildings may need to be protected, decommissioned or relocated, materially changing the character of the area. If more intensive land uses such as tourist accommodation and housing subside in the area, and revegetation occurs as part of adaptation planning, the area may become a more popular and attractive recreation area for locals at times when conditions allow. This could provide benefit to the community.

Potential adaptation pathways in response to hazards

In the short term a number of no regrets options can help manage erosion and inundation risk. Coastal hardening can proceed from where the foreshore joins the road abutment, as this is a strong, existing structure owned by the Tasmanian Government that will be maintained. This will protect against erosion. Revegetation of existing lawns with more resilient, native vegetation is also advised, as this will protect foreshore and increase ecological values by improving habitat. Small bunds could also be considered to protect against inundation as extensive foreshore will help manage drainage issues. These interventions will protect current uses in the short term, particularly recreation and tourism. Further development and subdivision in the hazard area are discouraged, to limit the number of people exposed to hazards and the costs thereof.

In the long term however, retreat of intensive land uses is advised. This is not as urgent as Dune Street; however, inundation and erosion risk cannot be managed forever without extensive, expensive, aesthetically displeasing infrastructural interventions. Eventually, a large event or succession of smaller, compounding events may produce intolerable clean-up, reconstruction and remediation costs.

Current tourist accommodation is most impacted by hazards and may become unviable more quickly. Private dwellings will be able to remain for longer. All structures will eventually be threatened by inundation and erosion as the shoreline retreats landward and the severity and frequency of events increases. Short-term uses will be disallowed as a means to support gradual retreat.

Relevance of cost-benefit analysis results

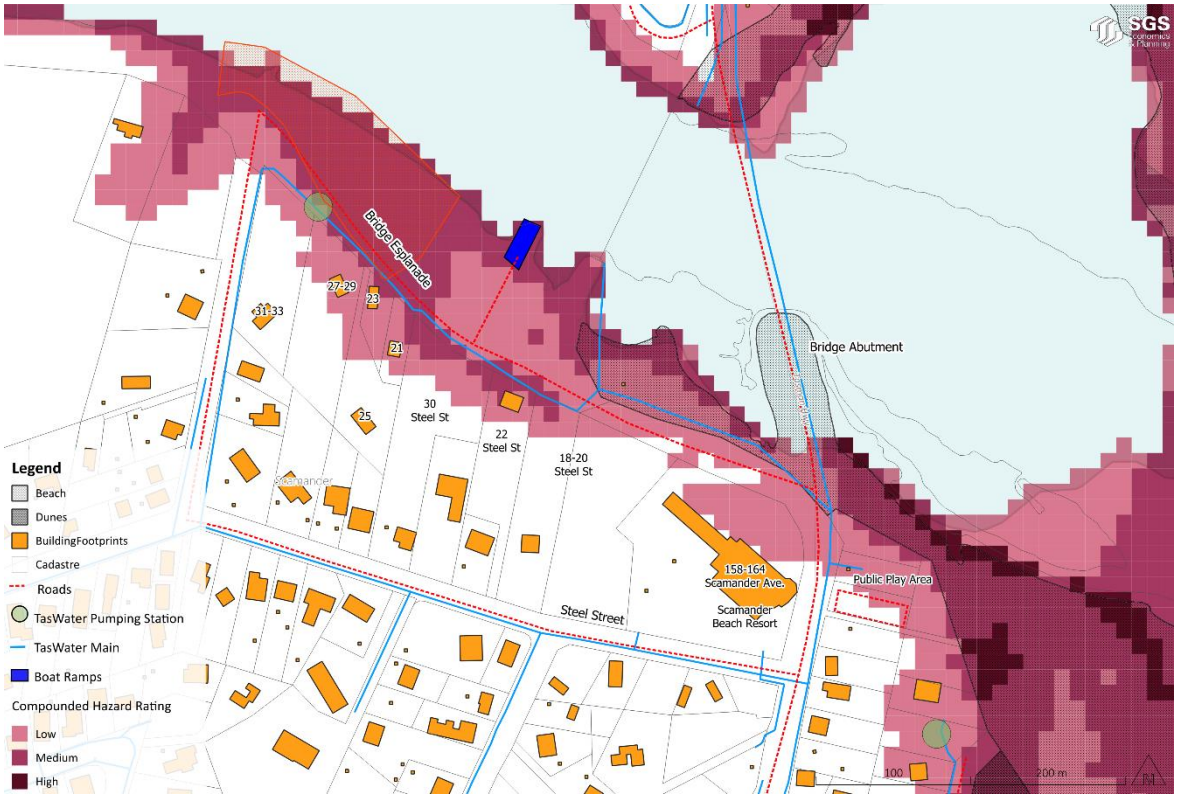
Pelican Sands displays generally lower benefit drivers compared to Dune Street, with less residential development, Council and TasWater property, beach access and habitat impacted by coastal hazards. However, the intensity of hazards is also reduced as Pelican Sands is less exposed to open ocean, and foreshore development and use is not so intensive. The influence of the visitor economy on the CBA results is highly relevant to Pelican Sands, as it is a major accommodation asset. To the extent that hard protection of the Dune Street foreshore reduces the attractiveness of the area to visitors, these costs will be borne to a significant extent by those operating at Pelican Sands.

The costs of hard protection may be higher or lower at Pelican Sands depending on the length of foreshore that requires protection and the overall size and strength required to adequately protect against hazards. Overall, it is likely that the same conclusion can be drawn as for Dune Street; cheaper or ‘no regrets’ interventions are preferred now to buy time for more extensive adaptation planning, with eventual retreat as hazards overwhelm the adaptive capacities of current users.

5.3 Bridge Esplanade

Hazards

Figure 10: assets and hazards at Bridge Esplanade



Source: SGS Economics and Planning 2025

Coastal and riverine flooding are the major issues at Bridge Esplanade, particularly north of the road, currently occupied by a low-lying reserve and planted verge. Destructive forces are lower in this location compared to those exposed to coastal erosion, storm bite and wave runup, with additional protection afforded by the large bridge abutment. Inundation primarily affects non-residential land; there may be inundation of properties south of the road, but only a few are especially low-lying. Some property owners have undertaken to improve flood-proofing of their dwellings, such as by raising floors.

Assets

Assets at risk at Bridge Esplanade include:

- 8 private dwellings with a valued approximately $4 million.
- Recreation area between road and river, including some picnic tables, is at most risk on inundation.
- Council assets including roadway, drainage and boat ramp that is well utilised for boating and fishing.

- TasWater pumping station at risk of inundation.
- Bridge abutment is exposed to erosion and inundation, but is strong and well-protected as part fo state road network.

How will the area change if nothing is done?

Inundation will become more regular over time, especially north of the road. Assets on the shoreline, such as the foreshore park, picnic equipment and boat ramp, will become harder to access during and after inundation events. Over time, low-lying drainage infrastructure underneath the road could become overwhelmed or ineffective, compounding inundation and necessitating more frequent repairs, and potentially raising, which would also require raising of the road. These would be extensive, expensive undertakings, impacting the amenity of the area and necessitating extensive outlays from Council and potential contributions from property owners.

Properties south of the road will be exposed to inundation more frequently, and for longer periods. This will necessitate private works to ensure properties are resilient to prolonged inundation – such as refurbishing lower levels with water-resistant materials – and individual adaptation planning and actions. Property values may decrease as the area becomes less attractive and more expensive in light of escalating hazards.

Potential adaptation pathways in response to hazards

In the **short term**, to reduce the impacts of inundation, 'no regrets' option would be implemented. This involves revegetation with native, more resilient vegetation, and some foreshore hardening. Further development and subdivision in the hazard area are discouraged, to limit the number of people exposed to hazards and the costs thereof. Where appropriately balanced against the needs of Council and the broader community, the planning scheme should support self-funded adaptation works within property boundaries.

Over time, inundation will increase and properties can adapt through raising and flood-proofing to manage at-times prolonged exposure to floodwaters. This cost will be borne by property owners. TasWater assets can also adapt to accommodate inundation or relocated in line with long-term strategic planning. Inundation will be most intense on the park north of road, limiting accessibility during floods and necessitating clean-up afterwards.

The bridge abutment is part of essential infrastructure, which needs further maintenance and protection to withstand erosion. However, there is expected to be significant appetite to repair and maintain the abutment by the State Government, to ensure the ongoing functioning of the asset. Additional investigation of the potential impacts of the bridge on coastal hazards, such as the position of the river mouth, is advised.

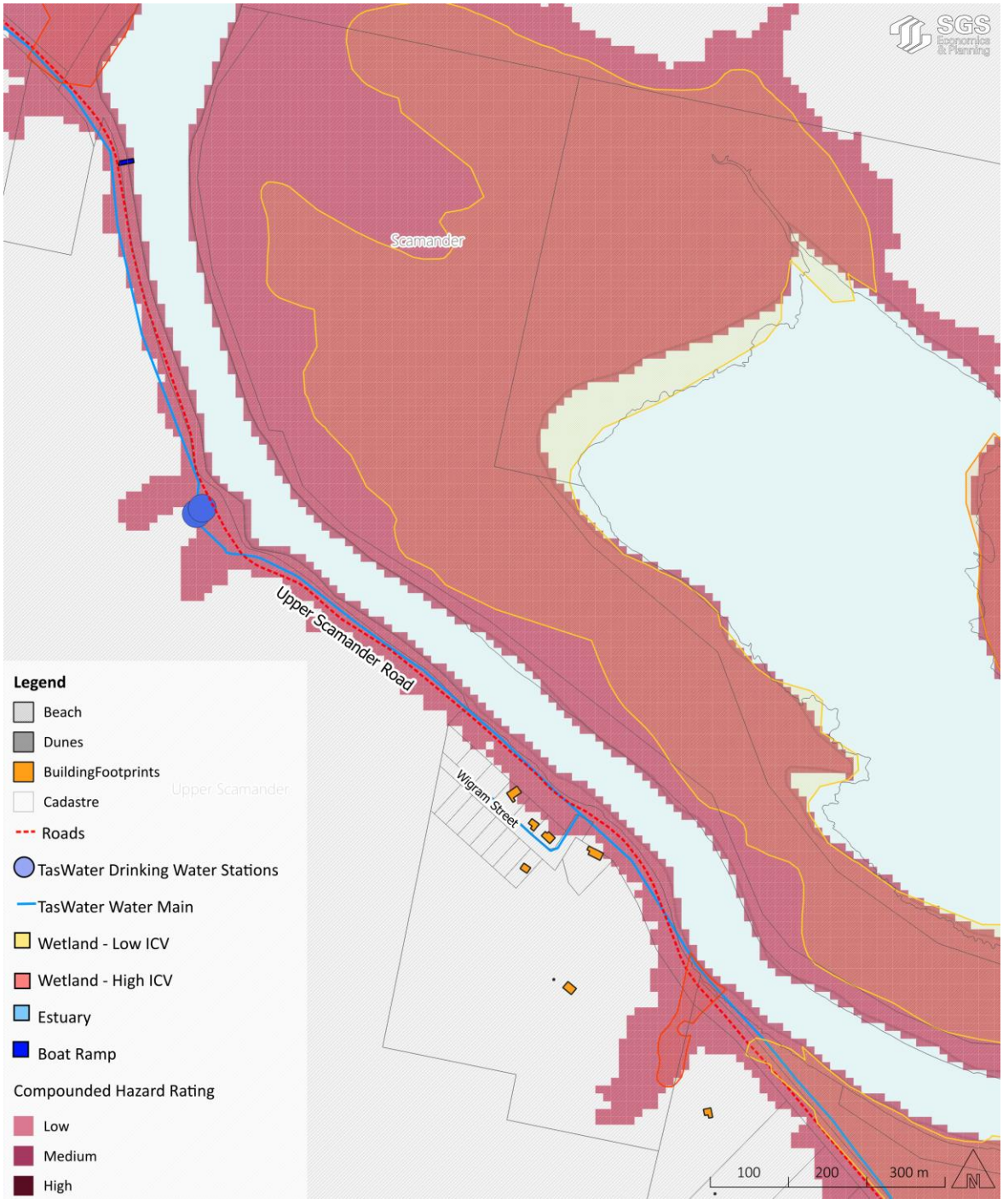
Aggressive protection measures on the riverbank area not advised due to the cost and adverse visual and functional effects. An effective seawall, engineered to withstand hazards to 2100, would approach two metres in height and integrate with bridge abutment, causing drainage issues on the road, recreation reserve and potentially properties during high rainfall. This would require additional change to the road and existing drainage infrastructure, and potentially pumping infrastructure, which would further increase costs.

Relevance of cost-benefit analysis results

Bridge Esplanade displays lower benefit drivers than Dune Street. Hazards are less intense due to sheltering from open ocean forces, while there is less affected land and property in the area, meaning avoided damage is lower. Natural, recreation and tourist visitation values are also lower compared to both Dune Street and Pelican Sands. The foreshore at Bridge Esplanade is shorter than these other sites, meaning the relative cost of options 1 and 2 would also be lower. Overall, the core finding remains relevant; extensive, hard protection is discouraged, while softer protection options retain flexibility, manage some inundation risk and may improve the amenity of the area. Retreat is less likely to be required in this location, meaning the financial and emotional impact of relocation, which could be substantial in other sites, is limited.

5.4 Other sites – Upper Scamander Road and hind dune marsh

Figure 11: assets and hazards at Upper Scamander Road



Source: SGS Economics and Planning 2025

Hazards at this location mainly relate to inundation of Upper Scamander Road where it runs very close to Scamander River. The river experiences rapid flows, especially during periods of high rainfall. Erosion is also an issue where this could compromise the riverbank on which the road sits.

Values at risk include:

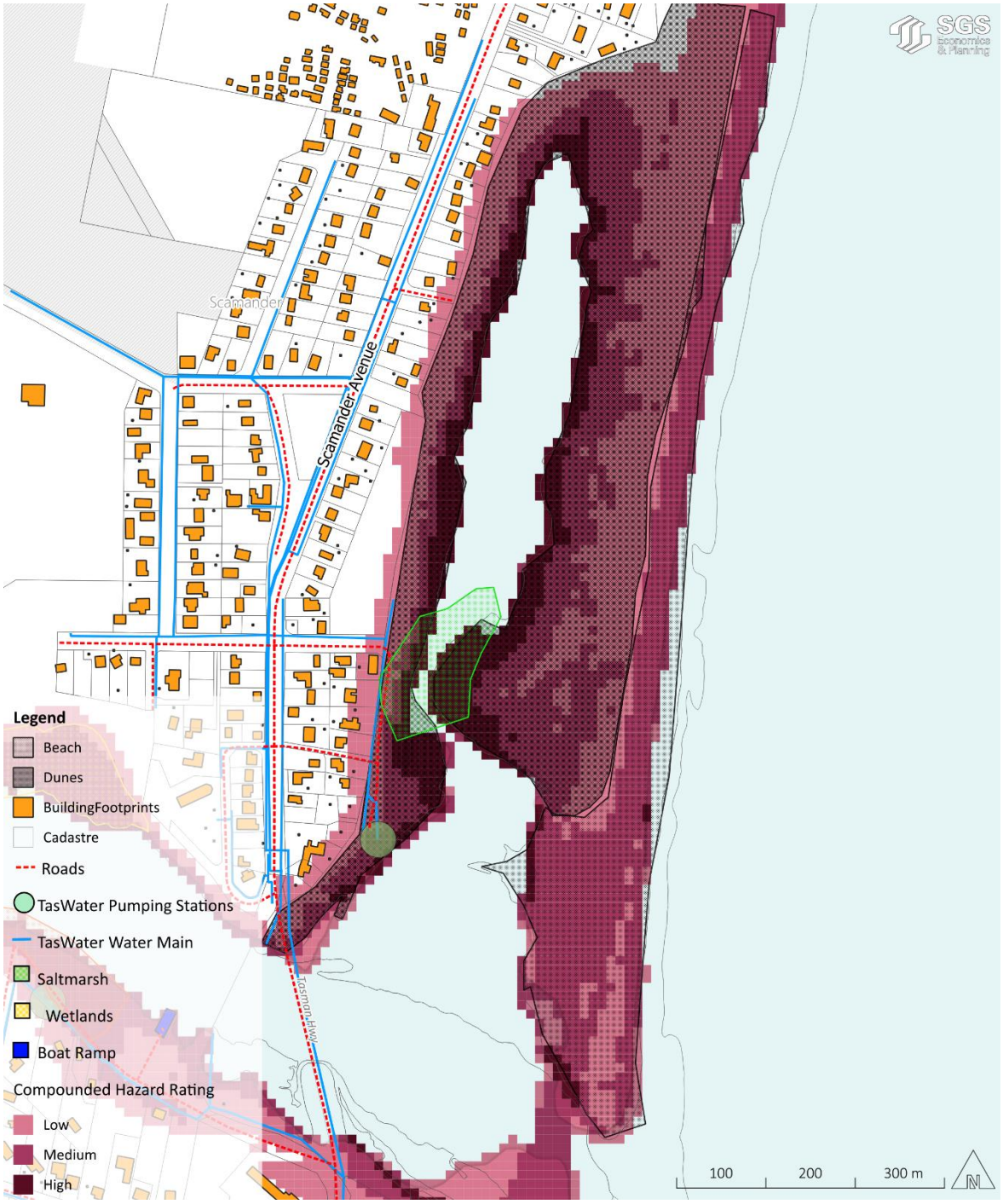
- Large stretch of Upper Scamander Road, which is exposed to both erosion and inundation. Value $1.5 million.
- TasWater reservoir and break pressure tank exposed to erosion and inundation, which affects functioning. Replacement cost $2.3 million.
- Both high and low conservation value wetlands in area.

If nothing is done, more severe and frequent rainfall in the catchment will increase inundation and erosion hazards. The road will be inundated increasingly frequently, causing travel delays as this is the major route to the west of town. Locals and companies dependent on the road may need to accept lower reliability and take adaptive measures; for instance stockpiling supplies when inundation is expected and taking precautions for emergencies that occur while the road is impassable. Over the long term erosion will threaten the structure of the road, and may necessitate reconstruction or defensive measures to be taken to ensure it remains in service.

Erosion should be managed and inundation planned for. In the short term erosion should be actively managed, including by sealing the road surface, hardening the riverbank and strengthening the road foundations to ensure its structural integrity. TasWater assets in the area are at risk and should be moved elsewhere, especially if sensitive to inundation.

Over time inundation will become more frequent and severe, and will need to be planned for in order to ensure the disruptive impacts are minimised. Inundation is likely to be too expensive to actively manage, either by constructing a large seawall, raising or wholly rerouting the road. Instead, actions should focus on adaptations that will allow the road and its users to coexist with more frequent inundation. Sealing will make the road more resilient to use during wet weather and flooding, limiting damage and minimising clean-up and repair costs following the initial outlay. Enhanced early warning of inundation will allow those impacted by inaccessibility to prepare and minimise negative consequences; for instance by making alternate travel arrangements or stockpiling essential goods such as food and medicine.

Figure 12: assets and values near hind dune marsh



Source: SGS Economics and Planning 2025

There is a lower hazard level here than elsewhere in town. Some erosion and inundation but properties largely protected by thick vegetation and beach. Mapped hazard bands are misleading due to modelling methodology not accounting for thick vegetation.

No dwellings are at immediate risk. Some potential impact is possible on Lagoon Esplanade. Major assets in the area are environmental, relating to dunes, salt marsh and the beach itself.

Current hazards are minimal compared to elsewhere in town. Inundation will increase in severity and frequency, which may impact properties over the very long term. Existing habitats – dune, estuary and foreshore vegetation and associated species, such as sea birds – will move landwards over time, potentially increasing the quality and extent of ecological values. Improved ecological quality may generate new opportunities, such as eco-tourism or scientific research; however these should be managed alongside the risks presented by intensified development and use of the area. More regular inundation may negatively impact some species that are sensitive to salt water, or have broader ecological impacts if water quality is persistently reduced. In the very long term habitats may come into contact with dwellings, but it is unclear if this will have significant impacts. Lagoon Esplanade will be exposed to coastal hazards, with clean-up after large events becoming more frequent and expensive.

In the short term clean-up and repair costs on Lagoon Esplanade should be managed, but will benefit from adaptation actions taken further south at Pelican Sands, which will further limit destructive forces in the area. Minimal adaptation action is generally recommended or required for this site given the balance of coastal hazards.

Over time habitats should be encouraged to move landwards, with ecological impacts – for instance on species sensitive to salt water – identified and monitored as they evolve. Actions and opportunities related to increases in the extent and quality of habitat in the area should be identified and actively pursued where this will not present other risks, such as to tourists accessing the site or fragile natural habitats.

If risks emerge or intensify – for instance ecological values are significantly reduced or properties begin to experience more regular, severe impacts from weather events – this pathway should be revised and adapted to account for these risks.

6. Next steps for adaptation planning in Scamander

6.1 Recommendations

'No regrets' actions

Based on their review of current practices, current and future hazards and community perspectives, Moffatt & Nichol have recommended several 'no regrets' actions to be taken in response to coastal hazards at the Scamander River mouth. These are measures that could be implemented immediately and that, if implemented, are unlikely to create abortive work, have significant negative impacts on other processes, or cause issues for a future adaptive pathway(s). No regret measures are also considered to be of a relatively lower cost and could be implemented in a staged manner in line with Council's priorities and available funding.

- Barway opening policy. The condition of the barway (open/closed) at Scamander has a significant influence on hazards. The barway is mechanically opened prior to (sometimes during) elevated river levels and can form a significant hazard mitigation function. The operation would benefit from a documented barway opening policy, including emergency management procedures and pre-defined (and agreed upon) triggers for barway opening. It is also recommended that Council install water level gauging to assist inform the policy and plan. Such water level gauging could be installed on a fixed structure, such as boat ramp pontoon pile or on the bridge.
- Restoration of reserve foreshore protection. The reserve foreshore is currently protected with rock revetment, constructed between 1992 and 1994. The rock is collapsing and the foreshore is also eroding in the lee. Further, the rock appears to have been placed without adequate filter layer or geotextile fabric. The Reserve is a valuable asset to Scamander. It is proposed that a no regret measure could include restoration of the rock protection, likely including an appropriate backfill/filter layer and geotextile, as well as habitat creation through saltmarsh (or other species) planting. Planting should not limit public access to the foreshore completely.
- Pelican Sands foreshore. The Pelican Sands foreshore was protected in past years. Previously this foreshore was experiencing erosion. The protection has collapsed and all but disappeared. This foreshore is not within a highly active area, but is expected to recede. Protecting this foreshore, albeit halting shoreline recession, would not have significant negative impact on usage or future adaptation actions. It is proposed that a no regret option could include protection of this foreshore. The measure should incorporate as much as possible a living shoreline, to provide positive ecological outcomes and limit the use of hard infrastructure. This measure would address erosion only and not significantly reduce wave runup. However, top of bank planting of vegetation may attenuate runup, as well as providing habitat improvements or creation of new habitats Woody features could be incorporated into the structure to reduce the need for rock.
- Dune Street hind dune foreshore protection. The foreshore fronting Dune Street is actively eroding. The current foreshore is only meters away from the road. A living shoreline or soft protection could be implemented. The buffer between the road and foreshore could be planted out. The measure

would likely need to include a hybrid rock/vegetation protection. This option would seek to address erosion only, however thick vegetation planting may attenuate some wave runup. Whilst this foreshore is within the window of historical and future dynamic channel alignment, the previous foreshore comprised dunes and sandy foreshore. Restoring this habitat whilst protecting the foreshore is not considered to significantly impact other processes.

  - These measures align with option 1 analysed in the cost-benefit analysis of adaptation options at Dune Street.

Further detail on no regrets options, including photographs of example treatments, was provided by Moffatt & Nichol in a written report to Council and further explored during the site visit in October 2025.

Adaptation pathways – findings from cost-benefit analysis

The results of the cost-benefit analysis at Dune Street and their implications for adaptation planning at that and other sites are discussed in detail in the preceding section. While high level, the findings do not support aggressive, hard protection against coastal hazards, as this would violate key principles of effective adaptation planning and is highly unlikely to return a positive net welfare impact on the community. Soft protection in line with no regrets options is the most appropriate immediate treatment, supported via additional adaptation planning leveraging planning changes and a range of additional site and non-site specific actions outlined below.

Planning considerations and implications for strategic planning

The project team engaged with Council's planning team on potential actions to support more effective adaptation planning. This included a review and input into the Scamander-Beaumaris Structure Plan (SBSP), which was drafted concurrently with this project. Several recommendations can be made for planning to support effective mitigation and adaptation to coastal hazards around the Scamander River mouth, including:

- Do not allow intensification of residential development in areas exposed to coastal hazards, especially Dune Street, Pelican Sands and low-lying lots along Bridge Esplanade. While draft SBSP appropriately identifies opportunities for diversity of housing types across Scamander, higher-density types such as strata titling should not be supported in these areas.
- Apply the proposed updated positioning and extent of the Coastal Erosion Hazard Code hazard bands at Dune Street, reflective of changed position of river mouth and landward progression of shoreline. Current bands in LIST are outdated and do not inhibit development in high-risk locations. Suggested potential positioning provided in Figure 4.
- Seek support and guidance from Tasmanian Planning Commission on best practice planning for coastal adaptation and managed retreat, especially in locations of multiple and potentially compounding hazards:
  - Explore Scamander River Mouth as a potential pilot for these mechanisms, recognising relatively contained scale and intensity of coastal hazards in the area. This aligns with Regional Strategic Direction 1 of the Northern Tasmania Regional Land Use Strategy review, currently underway, which identifies the need to support *site-specific responses to legacy development*

that may include adaptation measures or retreat, where risks from natural hazards and climate impacts cannot be otherwise managed.[6]

Other recommendations

- Further engagement with Dune Street residents on cost-benefit analysis findings and proposed adaptation actions in the area. Noting that this is the area of most intense risk from natural hazards, and that engagement with these specific residents was limited throughout the project.
- Engagement with Tasmania Parks and Wildlife Service (TPWS), which owns and has responsibility for most of the public foreshore land and the beaches at the river mouth, including the foreshore strip immediately east of Dune St itself. TPWS will need to be involved in and approve any mitigation options located on their land, and may be positioned to offer development, implementation and maintenance assistance.
- Advocate to Tasmanian Government and Tasmanian Planning Commission for guidance and support to implement coastal adaptation actions, particularly managed retreat, through the planning scheme.
- Advocate for updated mapping of coastal hazards, especially erosion and impact of coincident or compounding hazards, and codification of updated hazard bands in planning scheme.
- Engage with Department of State Growth to explore potential impact of current bridge design on hazards in Scamander River mouth, recognising high levels of community concern and scientific basis for plausible impact.
- Continue to protect biodiversity in the river mouth, including through adaptation actions such as living shorelines, recognising importance of biodiversity to the community and tourist visitation to Scamander.
- Explore opportunities for additional funding, such as the Future Drought Fund, to complete recommended areas of future work; for example improved hazard mapping and bridge investigations.

[6] Northern Tasmania Development Corporation and the Northern Tasmania Regional Planning Group (2025) *Northern Tasmania Regional Land Use Strategy: Draft Regional Strategic Directions*, p. 11

6.2 Summary of dynamic adaptive pathways across Scamander River mouth

Table 12: example dynamic adaptive pathway for Scamander River mouth

<table>
<tr><th></th><th>Dune Street</th><th>Pelican Sands</th><th>Bridge Esplanade</th><th>Location-agnostic</th></tr>
<tr><td rowspan="2">Immediate</td><td colspan="3">No regrets actions – modest hardening with revegetation</td><td>No regrets actions – barway opening policy</td></tr>
<tr><td>Explore application of revised erosion hazard bands at Dune St through planning scheme</td><td></td><td></td><td>Indicate strategic direction in response to coastal hazards – ultimately managed retreat in some locations –instance in Scamander-Beaumaris Structure Plan</td></tr>
<tr><td rowspan="2">Short term</td><td colspan="3">Monitor no regrets options</td><td>Explore improved mapping of coastal hazards</td></tr>
<tr><td colspan="3">Investigate detailed adaptation pathways for assets reaching end of effective life – e.g. Scamander SLSC, TasWater pumping stations</td><td>Explore policy and options for managed retreat, including disincentivising intensified use of exposed areas</td></tr>
<tr><td rowspan="2">Triggers</td><td colspan="3">Failure of no regrets options – reassertion of coastal hazards</td><td rowspan="2"></td></tr>
<tr><td colspan="3">Large event causing extensive damage</td></tr>
<tr><td>Medium term</td><td colspan="3">Consider extending ‘no regrets’ mitigation revegetation, some hardening and low inundation and wave protection</td><td>Monitor increase of coastal and flood hazard risks and develop managed retreat policy</td></tr>
</table>

	Dune Street	Pelican Sands	Bridge Esplanade	Location-agnostic
	Reduced maintenance of Council assets in area such as roadway and foreshore walkway			Strengthen planning provisions against development in at-risk areas
	Explore relocation of affected assets such as recreation equipment			
			Implement individual property-level adaptation measures	
Triggers	**Successive large events causing extensive damage**			
	Individual property owners reaching maximum tolerance for risk and damage			
	Turnover of land and property with retreat imperative capitalised into prices			
Long term	Note: any pathway actions following the above triggers are highly speculative, consistent with the significant uncertainties of planning for long-term adaptation as risk tolerances, community capabilities, policy frameworks and coastal hazards continue to unfold. Based on the analysis and recommendations in this study, the most prudent long-term strategy is likely to include: – Managed retreat of residential uses and services from site – Potential relocation assistance for remaining residents – Ceased maintenance of Council assets in area – Managed retreat becomes policy However, other futures remain relevant, including a stable residential population with appropriate tolerance for risk and damage or changes to protection measures.			

Source: SGS Economics and Planning 2026

Appendix A: Compounded risk rating methodology

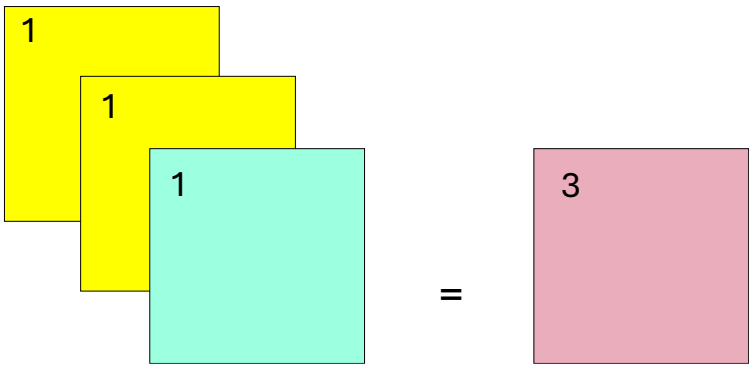
The analysis utilises data from Coastal Erosion Hazard Bands, Coastal Inundation Hazard Bands, and the 1% Average Exceedance Probability (AEP) Hydraulic Hazard. To assess the combined effect of these three hazards on a specific location, hazard bands have been assigned weights of 1, 2, or 3, indicating their severity. For erosion and inundation hazards, a weight of 1 corresponds to low hazard, 2 to medium hazard, and 3 to high hazard. In the case of the hydraulic hazard, categories H2 to H4 were combined and assigned a weight of 1, H5 received a weight of 2, and H6 was given a weight of 3.

Spatial data was then organised into a 10x10 meter grid that covers the study area. The combined weights were calculated for each grid cell.

Coastal Erosion Hazard Bands	Weight
Low	1
Medium	2
High	3

Coastal Inundation Hazard Bands	
Low	1
Medium	2
High	3

Hydrology Hazard 1pc AEP	
H1 - Unsafe for small vehicles.	1
H2 - Unsafe for vehicles and people.	1
H3 - Unsafe for vehicles and people. All building types considered vulnerable to failure	1
H4 - Unsafe for vehicles and people.	2
H5 - Unsafe for vehicles, children and the elderly.	3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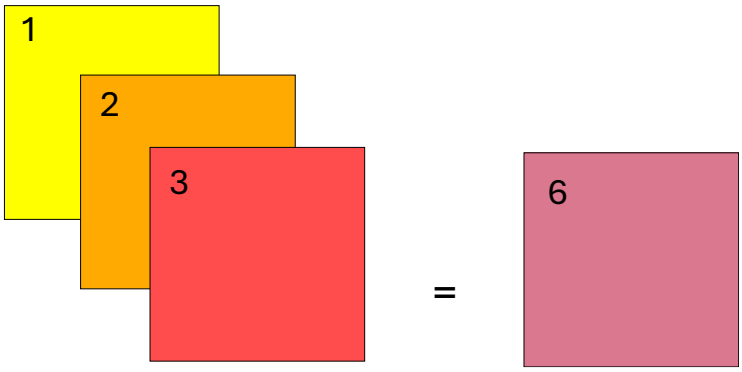
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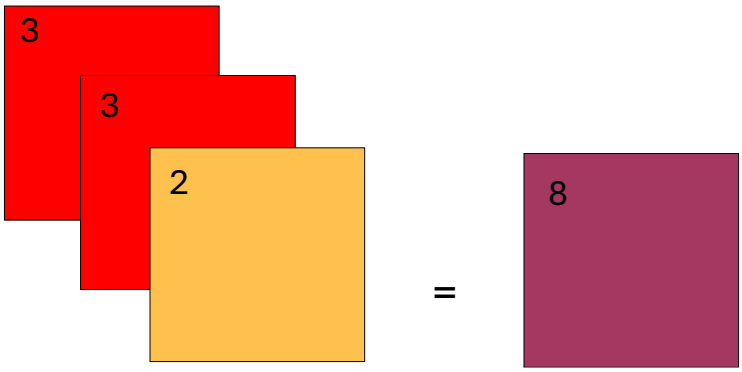
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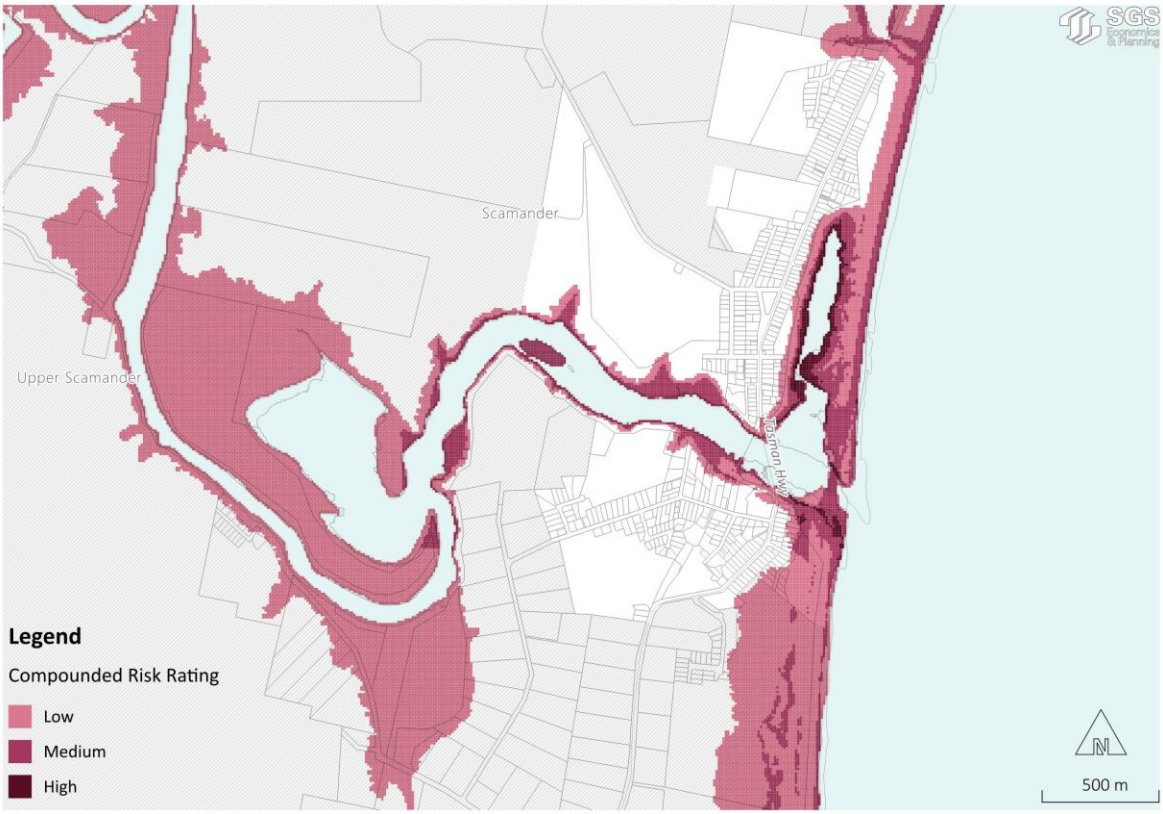
Erosion	Inundation	No Hazard	H1	H2	H3	H4	H5
No Hazard	No Hazard	0	1	1	1	2	3
No Hazard	Low	1	2	2	2	5	6
No Hazard	Medium	2	3	3	3	4	5
No Hazard	High	3	4	4	4	5	6
Low	No Hazard	1	2	2	2	3	4
Low	Low	2	3	3	3	4	5
Low	Medium	3	4	4	4	5	6
Low	High	4	5	5	5	6	7
Medium	Low	3	4	4	4	5	6
Medium	Medium	4	5	5	5	6	7
Medium	High	5	6	6	6	7	8
High	Low	4	5	5	5	6	7
High	Medium	5	6	6	6	7	8
High	High	6	7	7	7	8	9



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