



EAST GIPPSLAND PLANNING SCHEME AMENDMENT C172EGIP – PAYNESVILLE

PLANNING PANEL SUBMISSION

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Executive Summary: Coastal Hazard Risk & Environmental Issues in Amendment C172egip

Introduction

Amendment C172egip proposes to implement the Paynesville Growth Area Structure Plan (2016, updated 2023) into the East Gippsland Planning Scheme. This involves rezoning land from Farming Zone to General Residential, applying a Development Plan Overlay, and other planning controls. Given the sensitive coastal setting adjacent to Lake King and the Gippsland Lakes Ramsar wetlands, the Amendment raises several critical issues. Key concerns include:

- **Coastal Hazard Risk & Sea Level Rise:** Reliance on a static **2.8 m AHD** contour as the development exclusion line, is based on outdated modelling, which may inadequately protect against long-term inundation and erosion risks.
- **Biodiversity Protection:** Potential long term impacts on internationally significant Ramsar wetlands, coastal ecosystems, and protected species due to insufficient ecological assessments and narrow coastal buffers.

- **Legal and Policy Compliance:** Questions about alignment with the Planning and Environment Act 1987 (e.g. orderly planning, addressing environmental effects and risk), Ministerial Direction No.13 (coastal hazards), the Marine and Coastal Policy 2020, and biodiversity protection requirements.
- **Structure Planning & Adaptive Management:** Gaps in the structure planning process, including outdated or missing studies, lack of probabilistic and compound hazard assessment, deferral of critical investigations to post-rezoning stages, absence of adaptive planning measures, and long-term risks of privatising low-lying foreshore land, potentially undermining coastal ecosystems, public access and infrastructure resilience.

This executive summary provides a formal overview of these issues, supported by evidence and current best-practice guidance, to assist the Planning Panel in reviewing Amendment C172egip.

Coastal Hazard Risk: Inadequacy of the 2.8 m AHD Benchmark

The Amendment's primary coastal hazard mitigation is to prohibit development below 2.8 m AHD, effectively using this contour as a fixed coastal hazard line. This threshold originates from adding 0.8 m of projected sea level rise by 2100 to an estimated 1% AEP flood level (~2.0 m) from earlier studies. However, the data underpinning this approach – notably the *Gippsland Lakes Local Coastal Hazard Assessment 2014* (LCHA) – is outdated and was never intended for fine-grained land use planning. Critically, the LCHA 2014 only modelled Sea Level Rise scenarios to 2040 and did not extend to the 2100 horizon required by policy, forcing reliance on qualitative assumptions. The LCHA's authors cautioned that further work would be needed before applying its outputs to planning. In short, basing long-term development limits on limited modelling and simplified mapping of dynamic coastal processes – provides a poor foundation for risk management.

Advances in Hazard Projections

Since 2014, climate science and coastal modelling have advanced considerably. Recent studies by CSIRO in 2022 and McInnes (2024) indicate the likelihood of *more frequent extreme inundation events and faster-than-anticipated sea level rise* for the Gippsland coast. Best-practice hazard assessments, such as the Port Phillip Bay Coastal Hazard Assessment (PPBCHA 2022), employ probabilistic models and high-resolution hydrodynamic simulations to capture a range of scenarios and uncertainties. Updated Victorian guidelines (e.g. *Victoria's Resilient Coast 2022*) now recommend *risk-based approaches* that consider probabilistic outcomes and higher-end sea-level rise scenarios beyond the minimum 0.8 m by 2100. The CSIRO's new probabilistic inundation mapping for East Gippsland, for example, integrates projections from the IPCC Sixth Assessment (AR6) and includes allowances for wave setup. In contrast, the Amendment's 2.8 m AHD benchmark is a deterministic, single-scenario approach. It assumes a uniform rise in still water level and fails to account for compound events (simultaneous high riverine flows and storm surge), storm-tide dynamics, wave run-up, and coastal erosion feedbacks. No safety margin (freeboard) was added to the 0.8 m sea level rise, and no probability analysis was applied, meaning the 2.8 m line effectively represents only a mid-range scenario and could be overtopped under more extreme but plausible events.

Policy Requirements

Relying on a simplistic contour fails to satisfy Victorian coastal planning policy. Clause 13.01-

1S (Climate Change Impacts) and Ministerial Direction 13 mandate planning for sea level rise of at least 0.8 m by 2100 and considering the combined effects of tides, storm surges, coastal processes, and local topography. They also emphasize using the best available science and data for long-term risk assessments. The State's Planning Practice Note 53 reinforces this, directing that planning decisions avoid or minimize future hazard exposure by using up-to-date benchmarks and not just historical data. Notably, since 2021, Victorian policy has removed the earlier 2040 horizon; planning now focuses on the 2100 timeframe for greenfield and growth area development due to the long life of assets. The Amendment's use of a pre-2100 model (ending 2040) as the basis for zoning decisions falls short of this obligation. It conflicts with the precautionary approach embedded in the Marine and Coastal Policy 2020, which stipulates that coastal hazard risk must be assessed using current data and in an integrated manner (e.g. considering erosion and inundation together).

Lack of Adaptive Planning

Beyond the numeric benchmark, a fundamental concern is the lack of an adaptive management strategy. The Amendment fixes the urban boundary at ~2.8 m AHD without proposing any future adjustment mechanism or monitoring in light of evolving climate data. There is no staged adaptation plan or defined trigger (e.g. if sea levels track above projections or storm events increase) that would allow policy to adjust over time. This rigidity is at odds with modern coastal planning principles that encourage flexible adaptation pathways. The Marine and Coastal Act 2018 principles, for instance, promote dynamic planning that can respond to new information and avoid path dependency that leads to "maladaptation." Here, locking in development to a static line may preclude later adaptation options and nature-based solutions. For example, if the hazard line is underestimated, future coastal defences or retreat options could be severely constrained by private development or road infrastructure immediately landward.

Infrastructure and Public Land Vulnerability

By not adopting a more conservative buffer, the Amendment exposes public assets and foreshore open space to hazard risks. Critical infrastructure such as the foreshore roads, walking trails and parks near Lake King could face unmitigated inundation or erosion damage under higher sea-level futures. The 2.8 m AHD line runs very close to the projected future shoreline in places, leaving a narrow strip of public land. Projections for 2100 indicate that much of the land below 2.8 m AHD (the current foreshore reserve) will be frequently and eventually permanently inundated, essentially meaning the public foreshore will be submerged or erode away. This phenomenon, known as coastal squeeze, could result in the loss of public foreshore access and recreation space as the coast recedes into what will by then likely be approaching private property. No allowance for inland migration of the shoreline or wetlands has been made beyond the fixed line. Thus, over time, the community could lose both valuable ecosystem buffers and foreshore amenity. The public safety aspect is also noteworthy – future residents in areas just above 2.8 m could find their properties and access roads increasingly isolated by floods, and Council may face pressure for engineering solutions (e.g. seawalls or levees) that are costly and environmentally damaging. In summary, the deterministic 2.8 m AHD benchmark is an inadequate and risky basis for long-term land use planning in this coastal context, given its dependence on outdated data, its omission of critical risk factors, and its inflexibility to adapt to worsening hazard scenarios. It's also worth noting that the evidence did not include any hazard mapping whatsoever, which is unusual omission for a hydrology and flooding report.

Biodiversity and Coastal Ecosystems Protection

The subject land and its surrounds possess high environmental values linked to the Gippsland Lakes, a Ramsar-listed wetland system of international significance. The coastal fringe includes habitats such as Estuarine Swamp Scrub and Coastal Saltmarsh (Ecological Vegetation Classes) that are classified as Endangered in Victoria. Field surveys by Bird Life East Gippsland (albeit limited) have recorded at least eight migratory bird species protected under the EPBC Act using the site's wetlands and foreshore, including the Red-necked Stint, Sharp-tailed Sandpiper, and Latham's Snipe. Notably, Latham's Snipe – which is listed as Vulnerable federally – has a nationally significant population in the immediate vicinity, with the adjacent subdivision declared a controlled action by the Commonwealth and currently awaiting review at VCAT. To the east the land directly adjoins the Ramsar wetlands at Point Fullarton and likely serves as supporting habitat and a buffer for these wetlands. Such habitats are dynamic and will shift with the shoreline over coming decades; hence, maintaining generous buffers is critical to allow wetland migration inland as sea levels rise.

Inadequate Environmental Assessment:

Despite these known values, the structure planning process did not include a comprehensive flora and fauna assessment upfront. A detailed ecological study was only completed in 2024 – after the structure plan “refresh” in 2023 – meaning the plan was formulated with limited ecological data. Important features (e.g. seasonal wetlands, wildlife corridors, rare flora/fauna occurrences) were not mapped or considered in the initial land use layout. This belated approach contravenes the avoidance principle in both state and Commonwealth environmental policy. Clause 12.01-1S (Protection of Biodiversity) in the Planning Scheme urges that planning avoid habitat removal, especially of rare or threatened species, and strategically plan for biodiversity retention. Similarly, the Guidelines for Removal of Native Vegetation (under Clause 12.01-2S) require planners to avoid, then minimize, and only as a last resort, offset native vegetation loss, with areas of high biodiversity value identified early at the strategic stage. In this case, no such upfront avoidance mapping was done – for example, a 0.8 ha patch of endangered Swamp Scrub vegetation were destroyed potentially without a permit, and endangered Plains Grassy Woodland with recorded sightings of Latham's snipe is slated for drainage infrastructure without an alternative site assessment, highlighting serious compliance gaps.

Impacts on Ramsar Wetlands and Fauna:

The lack of robust ecological planning raises the risk of indirect and cumulative impacts on the adjacent Ramsar wetland. Increased stormwater runoff, pollution, and human disturbance from new urban development could degrade water quality and habitat in the lake's margins if not carefully managed. The proposal's stormwater strategy is not clearly integrated with protecting downstream ecological values. Moreover, by drawing the urban growth boundary at the 2.8 m contour with minimal additional setback, the Amendment leaves little room for wetlands to retreat inland, virtually guaranteeing a net loss of wetland area and biodiversity as inundation progresses. This is contrary to Clause 12.02-1S (Marine and Coastal Environment), which calls for enhancing coastal ecosystems and allowing natural coastal processes to continue. Good practice would provide a generous buffer zone above the current high-water mark to facilitate “migration” of habitats – but the current plan's coastal reserve is barely wider than the hazard extent itself. The failure to plan for coastal habitat migration could put Council at odds with its obligations under the Environmental Protection and Biodiversity Conservation

(EPBC) Act 1999, which protects listed migratory species and Ramsar sites. Before rezoning, a referral under the EPBC Act would normally be prudent to determine if the action (urban development) is likely to significantly impact those values. Deferring such considerations until after rezoning not only risks non-compliance with federal law, but also creates uncertainty for developers and the community.

Biodiversity Planning and Compliance:

The planning authority must also consider Victoria's native vegetation clearing regulations. If development of the Paynesville growth area will remove native vegetation (as it likely will, given the presence of wetlands, remnant scrub and trees), the "three-step" approach (avoid, minimize, offset) should guide the structure plan. It appears the Amendment has not demonstrated how avoidance was maximized – key vegetation stands were not earmarked for protection, nor were alternative design solutions (like realigning drainage or roads) explored to save high-value habitat. Under Clause 12.01-2S, if clearing is unavoidable, any permitted clearing would require an approved Habitat hectare assessment and offset strategy before rezoning or permits. Offsets must be secured to achieve no net loss, usually of the same vegetation type, potentially at significant cost and often off-site. The Native Vegetation Guidelines (Department of Environment, 2017) explicitly state that strategic planning should identify areas for retention and ensure offsets can be arranged ahead of time. By not doing this, the Amendment's approach of "*rezoning now, assessing later*" risks cumulative impacts not being fully considered at the strategic stage, contrary to policy and runs the risk of planning dead-ends, where development plans cannot meet offset requirements or trigger the need for costly changes. In summary, biodiversity concerns underscore the need for a much more cautious approach: one that fully assesses environmental constraints prior to rezoning and secures adequate protective measures (like expanded reserves or stronger overlays) in the planning scheme now, rather than hoping to retroactively fix environmental conflicts at permit stage.

Legal and Policy Compliance

Planning and Environment Act 1987: Under Section 12(2)(b) of the Act, a planning authority must consider environmental effects of a scheme amendment, and under 12(2)(c) the social and economic effects. The issues outlined – from increased flood risk to loss of public open space and environmental degradation – are directly relevant to these statutory tests. For example, failing to adequately plan for sea level rise could impose future costs on the community (an economic effect) and reduce public safety and amenity (social effects). The Act's objectives of planning in Victoria (Section 4) include "securing a pleasant, efficient and safe working, living and recreational environment" and "conserving and enhancing those buildings, areas or other places which are of... scientific interest, or of natural beauty or importance to the community". By potentially exposing future residents to known climate risks and by not safeguarding the natural coastal assets, the Amendment may be inconsistent with these objectives. The Panel will need to examine whether the strategic justification is sufficient and whether a Net Community Benefit is achieved, given the trade-offs involved.

Ministerial Direction No. 13 – Managing Coastal Hazards and Climate

Change: This Direction is directly relevant to Amendment C172egip, as it applies to planning scheme amendments in coastal areas. MD13 compels planning authorities to consider and apply the policies of Clause 13.01-2S (discussed above) and ensure that planning for coastal

development includes sea level rise of 0.8 m by 2100 and 100-year flood events, *plus* allowances for storm surge and other coastal processes. The Direction effectively prohibits amendments that would facilitate development in areas at risk of coastal hazards unless those risks are mitigated or acceptable. In reviewing C172egip, the Panel will examine whether the justification for the chosen 2.8 m AHD line meets MD13's test of using best available science and planning for worst-case scenarios. Given that the Amendment relies on a 2014 hazard assessment that only modelled sea level rise to 2040, there is a credible argument that MD13's requirements have not been fully met. Furthermore, MD13 expects a strategic approach to coastal adaptation – not just drawing lines on a map, but demonstrating how risks will be managed. No evidence of an adaptive management framework (e.g. planned retreat options or design responses for infrastructure) has been presented, which could be seen as a compliance gap.

Marine and Coastal Act 2018 & Policy 2020: While not a statutory planning document in the same way, the Marine and Coastal Act and its Policy provide important context and guiding principles that planning authorities are expected to heed (and indeed Clause 12.02-1S embeds many of these principles). Relevant principles include: Integrated Management (coordinate land and marine planning – in this case, ensure the structure plan meshes with foreshore management plans), Ecosystem-Based Management (protect natural coastal systems and their ability to adapt), and the Precautionary Principle (where there are threats of serious environmental damage or risk to life/property, lack of full certainty should not postpone preventative measures). The Marine & Coastal Policy 2020, Policy 6.11 specifically states that planning and managing coastal hazard risk must use the best available information and adopt a risk-based approach. Implementing C172egip as currently drafted – with known data limitations and no probabilistic risk evaluation – appears inconsistent with this directive. Additionally, the Marine & Coastal Strategy 2022 (a non-statutory but relevant policy document) calls for early identification of coastal vulnerabilities in planning processes. By deferring detailed coastal hazard mapping and ecological assessment to the development plan stage (post-rezoning), the Amendment reverses the preferred sequence. This “plan later” approach undermines the intent of having strategic planning be proactive and evidence-driven. It also raises procedural fairness issues – the community and agencies have not had opportunity during the amendment exhibition to scrutinize crucial studies (since some were not done yet or shared - even with Council planners), which is contrary to the transparent, informed decision-making principles in the Act.

Structure Planning and Adaptive Management Issues

Deferred Studies and Uncertainty: A well-prepared structure plan for a growth area should be underpinned by comprehensive technical studies (drainage, traffic, environmental, hazard, etc.) to ensure the chosen land use configuration is sound. In the case of Paynesville, many supporting studies were incomplete or outdated at the time of plan formulation. For instance, the drainage/flood modeling used was based on the 2016 structure plan layout, which was again used in the 2023 model. The coastal hazard analysis was rudimentary and did not meet best practice. The draft Coastal Hazard Vulnerability Assessment was not exhibited and is of questionable value, given data anomalies and flawed erosion mapping. Key environmental and cultural heritage assessments were either not done or done very late (a cultural heritage desktop assessment occurred in 2024, and flora/fauna surveys similarly in 2024). This sequencing means the Amendment was advanced on a piecemeal evidence base, increasing the risk of surprises later (e.g. discovering a threatened species or unstable soil and

unanticipated erosion risk that necessitates a major redesign). It also means the community has had difficulty understanding and commenting on the full impacts during the amendment stage, since many details are left to a future Development Plan. This practice can be described as “rezone now, gather the detailed evidence later”, potentially leading to ad-hoc revisions or secondary consents to fix issues that should have been resolved upfront.

Lack of Integrated Coastal Planning:

The Amendment in its current form appears to handle coastal matters in isolation rather than holistically. The decision to align the PCRZ boundary with the 2.8 m contour was made late in the process, reportedly in response to submissions. While setting a development setback is prudent, doing so solely by elevation, without integrating ecological or geomorphological data, is problematic. The new urban boundary disregards natural features – for example, it cuts through what was once contiguous habitat, without consideration for creating a logical ecological reserve boundary. A truly integrated coastal plan would consider coastal processes and biodiversity together: for instance, using a foreshore reserve that follows natural vegetation lines or topographic breaks, not just an elevation contour. There is also no indication that the plan aligns with any Foreshore Management Plan or Coastal and Marine Management Plan for the adjacent public land. Ideally, the structure plan and foreshore management would be coordinated to ensure, say, that future residents have continued foreshore track access, that coastal protective vegetation is maintained, and that any necessary adaptation infrastructure (like boardwalks) can be accommodated. The lack of a coordinated approach raises concern that the development could proceed without adequate measures to protect or enhance the coastal public realm, leading to a piecemeal, reactive management of issues as they arise – a hallmark of poor coastal planning.

Public Foreshore and Amenity: As mentioned, the narrow buffer provided by the 2.8 m AHD line could eventually result in the effective privatisation of the foreshore. Once the public land seaward of that line succumbs to the lake (by around 2100 or earlier under high-end scenarios), the new “coastline” will potentially abut private lots. Public access along the shore could be lost or require expensive interventions to maintain. This outcome contravenes longstanding coastal policy in Victoria which holds that development should be set back sufficiently to retain public access and protect coastal Crown land. It may also conflict with Clause 12.02-2S (Coastal Crown Land) which generally discourages alienation of coastal Crown land and seeks to maintain public coastal corridors. The Panel should consider whether a wider coastal reserve or different zoning (e.g. enlarged Public Conservation and Resource Zone) would be more appropriate to ensure a resilient, publicly accessible foreshore in perpetuity. Furthermore, the visual impact on the coastal landscape is a concern – the site is subject to a Significant Landscape Overlay (SLO2 for Gippsland Lakes) recognizing the scenic quality of the ridgelines and lakeshore. Removing that SLO and introducing urban development will alter views from the lake and opposite shore. Usually, a visual impact assessment or design guidelines would be warranted to manage this, but none has been provided. Thus, the amendment shows signs of incomplete integration of landscape planning.

Infrastructure Resilience and Costs: The structure plan needs to ensure that infrastructure (roads, drainage, water, sewer, etc.) is both feasible to deliver and resilient to future conditions. Placing infrastructure in low-lying areas can be both physically risky and financially burdensome over the long term. For example, a foreshore road or lakeside path at just above current high tide may frequently flood as sea levels rise, requiring raising or

armouring. Stormwater drainage infrastructure will need to account for backwater effects when lake levels are high. If not, urban flooding could worsen or water may not drain during extreme events. The Amendment documentation does not transparently detail how infrastructure has been climate-proofed. It defers many such details to the Development Plan stage, but by then the principle of development in that location is set. The economic viability of the growth area could be undermined by unaccounted-for adaptation costs – for instance, the need for pumping stations, levees, or road retrofitting that were not considered in the initial cost-benefit analysis. A more conservative planning approach (e.g. avoiding the lowest parts altogether, clustering development on higher ground, requiring developers to contribute to adaptation measures) could significantly reduce these future liabilities. This aligns with prudent financial management under the Act and general principles of intergenerational equity (not leaving future generations with avoidable problems). At present, the Amendment’s documentation suggests a relatively superficial analysis of costs and benefits, with potential long-term costs of climate impacts not fully quantified. Planning Practice Note 53 states that decisions “must be made using the best available knowledge and information at the time” – waiting until after rezoning to examine critical issues like flood mitigation or ecological impacts is at odds with this guidance.

Need for Precaution and Adaptation: In summary, the structure planning and amendment process for C172egip show a pattern of addressing key issues too late and relying on future planning stages to catch problems. This is risky in a coastal context where mistakes can be irreversible (once land is subdivided and built upon, relocating development away from an encroaching shoreline is extremely difficult). A precautionary approach would entail resolving most of these uncertainties *before* allowing the rezoning. This could mean updating flood models, conducting full biodiversity surveys, engaging with coastal engineers and ecologists to design an optimal reserve system, and only then proceeding with a planning scheme change. The current approach, however, edges toward a “lock-in” of a development pattern that may be maladaptive, requiring either expensive engineering fixes or causing avoidable loss of environmental and social values in the future. To avoid such maladaptation, it is recommended that the Panel consider modifications or additional requirements (such as expanded overlay controls, mandatory adaptive infrastructure plans, or revised boundaries) to ensure resilient, sustainable development in Paynesville’s coastal setting.

Conclusion and Recommendations

Amendment C172egip raises serious concerns regarding its treatment of coastal hazard risk, environmental protection, and alignment with policy obligations. The use of a static 2.8 m AHD benchmark – drawn from early 2000s/2014 studies (e.g. Grayson et al. 2004; LCHA 2014) – in lieu of current probabilistic hazard data contravenes the spirit of present-day coastal planning practice and could expose the community to greater risk. The insufficiency of buffers and adaptive strategies not only threatens future residents and assets, but also the ecological integrity of the Gippsland Lakes system and the public’s enjoyment of the coast. Legally, the Amendment’s approach may be seen as falling short of requirements under Ministerial Direction 13, the Planning Policy Framework, and environmental laws, which collectively demand a cautious, well-informed planning approach in coastal areas.

To address these issues, the following Top 10 Planning and Policy Recommendations are offered for the Panel’s consideration:

1. **Update Hazard Modelling:** Before approval, require an updated coastal hazard assessment using latest probabilistic models (e.g. CSIRO 2024 data) to inform planning controls, ensuring sea level rise, storm surge, wave action, and erosion are fully accounted for.
2. **Extend Coastal Buffers:** Designate a wider foreshore reserve above 2.8 m AHD to allow for shoreline retreat and wetland migration beyond 2100. This may entail rezoning additional low-lying land to Public Conservation or Recreation Zone to preserve public amenity and environmental values.
3. **Staged & Adaptive Planning:** Implement an adaptive planning framework with triggers (e.g. if sea level or flood frequency exceeds certain thresholds) and periodic review of the coastal risk line. Incorporate adaptive pathways in the Development Plan Overlay requiring development to respond to evolving hazard information.
4. **Comprehensive Biodiversity Assessment:** Complete and **integrate** a full flora and fauna survey (including wetland ecology) *prior* to rezoning finalization. Use this to identify no-go areas or require offsets upfront for any native vegetation removal, in line with the avoid–minimize–offset hierarchy.
5. **Strengthen Policy Compliance:** Amend the proposal to explicitly comply with Ministerial Direction 13 and PPN53 – e.g. by planning to the 2100+ horizon, using 0.8-1.1 SLR plus 1.4 m SLR (sensitivity scenario) + allowances, and consulting the relevant floodplain manager on the new data. Include a statement in the Explanatory Report demonstrating how these requirements are met with updated evidence.
6. **Incorporate Marine & Coastal Policy Principles:** Ensure the amendment upholds the Marine and Coastal Policy 2020 principles by adopting a precautionary, ecosystem-based approach. For instance, prioritize nature-based solutions (like conserving saltmarsh as a coastal buffer) over future seawalls, and coordinate with coastal managers for integrated foreshore planning.
7. **Retain Public Access and Foreshore Management:** Include provisions (e.g. in the Schedule to the DPO or local policy) that guarantee public access along the foreshore is maintained or enhanced. Any development must be set back sufficiently and possibly conditioned to finance coastal trails to offset its impact on public land.
8. **Infrastructure Resilience Requirements:** Mandate that the Development Plan and future permits demonstrate infrastructure resilience to coastal hazards – e.g. EPA Priority Stormwater standards for high value sites, water-sensitive urban design to protect wetlands, and road designs that ensure evacuation routes remain serviceable during extreme events.
9. **Legal Compliance Checks:** Before gazettal, undertake a compliance audit of the Amendment against the Planning and Environment Act, particularly Sections 12 and 60, and relevant environmental legislation (EPBC Act, Victorian Flora and Fauna Guarantee Act). If significant impacts are likely, consider delaying approval until any required environmental referrals or offset arrangements are secured.

10. **Conservative Zoning Approach:** Adopt a more conservative zoning strategy in light of the uncertainties – for example, use a lower-density NRZ for the most sensitive parts of the site, rather than GRZ, apply wider buffers to allow flexibility for future adaptation (such as relocatable structures or open space uses). This aligned with a “risk-averse, no-regrets” planning approach recommended by climate adaptation experts.

By implementing these recommendations, the Panel and Council can better align Amendment C172egip with best practices and statutory duties – ensuring that Paynesville’s growth is sustainable, resilient, and respectful of the precious coastal environment it borders. The goal is to achieve an outcome where development is safely situated and environmentally responsible, safeguarding both the community’s long-term interests and the Gippsland Lakes’ outstanding natural heritage.

Introduction

Amendment C172egip seeks to implement the Paynesville Growth Area Structure Plan (2016) (as modified December 2023) (‘the Structure Plan’) into the East Gippsland Planning Scheme. The Structure Plan was adopted by Council in 2016 to facilitate the growth and expansion of Paynesville for the next 20+ years.

The Amendment aims to:

- Introduce new local planning policy to guide land use, subdivision, and development in the Paynesville Growth Area.
- Rezone land from Farming Zone to General Residential Zone (GRZ) to enable residential development.
- Apply a Development Plan Overlay (DPO), requiring detailed Development Plans before subdivision and development.
- Apply a Public Acquisition Overlay (PAO Schedule 3) to allow intersection upgrades at 25 Waterview Road, Eagle Point.
- Apply an Environmental Audit Overlay to address potential land contamination.

Given the significance of these changes, thorough consideration of environmental, social, and economic impacts is essential.

Ministerial Direction No. 11 (MD11)- *Strategic Assessment of Amendments* requires a planning authority to evaluate and document how a planning scheme amendment addresses specified strategic considerations. The purpose of MD11 is to ensure a comprehensive strategic evaluation of planning scheme amendments and the outcomes they produce.

Planning Practice Note 46 (PPN46) *Strategic Assessment Guidelines* provides guidance to planning authorities on how to meet the requirements of MD11. PPN46 advises planning authorities to respond to all amendment strategic considerations or explain why they are not relevant. Furthermore, the practice note explains that “the level of justification needed for each [strategic] consideration and the amendment overall should be proportional to the impact the amendment will have.”

Major amendments such as this one, which involve “major changes to the ordinance or mapping involving a large number of lots” (approx. 1400 lots) and introduce new overlays and zoning are “required to provide a detailed analysis against the guidelines” and are “to be supported by detailed strategic studies.” PPN41 also requires an amendment to consider “all relevant planning practice notes...in association with the Strategic Assessment Guidelines when preparing an amendment to ensure consistency and best practice.”

Strategic Assessment Framework

This submission applies the Strategic Assessment Guidelines outlined in Planning Practice Note 46 (PPN46) as a structured analytical framework. Using this framework, the submission undertakes a comprehensive strategic evaluation of Amendment C172egip, critically examining its alignment with the broader planning policy context, regulatory frameworks, and strategic objectives. Additionally, this assessment identifies and analyses both the intended and potential unintended consequences of the Amendment, ensuring a robust and transparent evaluation process to inform decision-making.

Strategic Assessment Guidelines for Planning Scheme Amendments -

1. Why is an amendment required?

- What does the amendment intend to do and what is the desired outcome?
- How does it intend to do it?
- Is it supported by or is it a result of any strategic studies or reports?
- Will the proposed provision result in a good planning outcome?
- Will the amendment have a net community benefit?
- Will the community benefit outweigh the cost of the new control?

2. Does the amendment implement the objectives of planning and address any environmental, social and economic effects?

- Does the amendment implement the objectives of planning in Victoria (sections 4(1) and 12(1)(a) of the Act)?
- Does the amendment adequately address any environmental effects (sections 12(2)(b) of the Act)?
- Does the amendment adequately address any social effects (sections 12(2)(c) of the Act)?
- Does the amendment adequately address any economic effects (sections 12(2)(c) of the Act)?

3. Does the amendment comply with all the relevant Minister’s Directions?

- Does the amendment comply with the requirements of the Ministerial Direction 13 (Managing coastal hazards)

4. Does the amendment support or implement the PPF?

- Does the amendment support or give effect to the PPF?
- Are there any competing PPF objectives and how are they balanced?
- Does the amendment support or give effect to any relevant adopted state policy?
- Does the new or amended local planning policy:
 - o respond to a demonstrated need?

- implement a strategic direction in the MPS?
 - relate to a specific discretion or group of discretions in the planning scheme?
 - assist the responsible authority to make a decision?
 - assist any other person to understand whether a proposal is likely to be supported?
 - Does the amendment affect any existing local planning policy or tool?
 - Is a local planning policy necessary OR being the issue adequately covered by another planning tool or decision guideline?
- 5. Does the amendment support or implement the MPS?**
- How does the amendment seek to implement or support the MPS?
 - Does the amendment seek to change the strategic directions of the MPS? If so, what is the change?
 - What effect will any change to the MPS have on the rest of the MPS?
 - Is the amendment consistent/inconsistent with strategic directions elsewhere in the MPS?
 - What is the cumulative effect of this amendment on the other directions in the MPS?
- 6. Does the amendment make proper use of the VPP?**
- Does the amendment use the most appropriate VPP tool to achieve the strategic objective of the planning scheme?
 - Does the amendment affect, conflict with or duplicate another existing provision in the planning scheme that deals with the same land, use or development?
 - If so, have the provisions been reconciled?
 - Does the control capture matters that do not specifically relate to the purpose or objectives of the control or matters that should not be dealt with under planning?
 - Does the amendment make any existing provision in the planning scheme redundant?
 - Is the amendment consistent with any relevant planning practice note?
- 7. How does the amendment address the views of any relevant agency?**
- Have the views of any relevant agency been addressed?
- 8. What impact will the new planning provisions have on the resource and administrative costs of the responsible authority?**
- Has the council considered the cost implications in implementing and administering the new planning provisions? - including:
 - other miscellaneous costs including legal or other professional advice, for example, heritage advisers?

The following East Gippsland Shire Council meeting minutes and associated tabled documents—including referenced background reports and materials—presented under Agenda Item 5.1.1 at the 15 April 2025 Council Meeting in support of Amendment C172egip, will be systematically assessed against the relevant criteria set out in Planning Practice Note 46 (PPN46): *Strategic Assessment Guidelines*:

- Officer's Report: *Item 5.1.1 – Planning Scheme Amendment C172egip: Implementation of the Paynesville Growth Area Structure Plan*
- Attachment 5.1.1.1 – *Submissions Table*

- Attachment 5.1.1.2 – *Redacted Submissions (Final)*
- Attachment 5.1.1.3 – *Summary of Changes (Final)*
- Attachment 5.1.1.4 – *Combined Planning Scheme Documents*
- Attachment 5.1.1.5 – *Planning Assessment (Final)*
- Attachment 5.1.1.6 – *Engagement Report (Final)*
- East Gippsland Shire Council Meeting (Tuesday 15 April 2025 at 6.00 pm) – Minutes; Questions of Council.

This assessment forms part of our submission and is intended to evaluate the amendment’s strategic justification, its consistency with applicable state and local policy frameworks, and the transparency and procedural integrity of the amendment process, as required under the PPN46 framework.

Strategic Assessment of C172egip

Why is amendment C172egip required?

The Explanatory Report notes the amendment is required to facilitate the implementation of the Paynesville Growth Areas Structure Plan (PGASP) and achieve various planning objectives, primarily those of Clause 11.01-1L-2 (Growth Area Towns), Clause 72.08 (Further Strategic Work) and Strategic Objective 2 of the Council Plan 2021-2025. As noted in the Explanatory Report’s strategic assessment (EGSC Council Meeting Agenda, 15/04/2025; p. 284), “the amendment seeks to implement a number of the strategies associated with [clause 11.01-1L-2], including:

- Provide a variety of housing types and styles that add to the special character of Paynesville.
- Expand the town westwards generally between Waratah Avenue and Grandview Road.
- Contain urban development within the area to the east of Grandview Road.
- Provide a distinct separation of Eagle Point and Paynesville incorporating extensive open space areas.
- Provide expansive green edges to abut entry roads to maintain the sense of country atmosphere to the arrival experience.”

In principle, we support the rationale for the orderly and sustainable expansion of the township of Paynesville, as set out in the relevant strategic frameworks. However, several key strategies from the existing *Growth Area Towns* clause have been omitted, selectively modified, or entirely abandoned in the drafting of Amendment C172egip—making the amendment’s underlying policy justification unclear and inconsistent. Notably, the first strategy cited in the Explanatory Report has been altered: a directive to enhance “the special character of Paynesville” has been removed and replaced with the more generic objective to “provide a variety of lot sizes and housing types to meet community needs.” Additionally, other place-based strategies—such as

the need to “provide linkages between residential, commercial, recreation, town centre activity areas, the foreshore, the waterfront and the hinterland”—are omitted from the amendment’s justification all together.

While these may appear to be minor textual changes or omissions, the removal of explicit, location-specific strategic directions—particularly those relating to the town’s character and connectivity—is highly significant. These changes erode the integrity and continuity of the planning framework by replacing carefully developed, place-based strategies with broad, generic growth objectives. The *C172egip Summary of Changes Table* (EGSC Agenda, 2025; p. 277) references the *East Gippsland Housing and Settlement Strategy (2023)* as justification for amending Clause 11.01-1L-2 (*Growth Area Towns*). However, this justification is inconsistent with the Housing Strategy’s stated policy direction.

The Strategy explicitly endorses **character-based planning objectives** (Objective 9) to “enhance the character and environmental values of the Shire’s towns,” and codifies a core planning principle (Principle 5) that “the unique character of towns and settlements will be maintained and enhanced across East Gippsland” (EGSC 2023; pp. 8, 14). Furthermore, the Strategy appropriately recognises that “protecting and enhancing the character of where we live helps communities to retain existing population and attract new community members.”

Far from supporting the removal of character-based provisions, the *East Gippsland Housing and Settlement Strategy (2023)* explicitly reinforces their importance. It is therefore disingenuous and strategically unsound for the amendment to cite character-related strategies from Clause 11.01-1L-2 as justification, while simultaneously removing those same provisions from the clause as part of the amendment process.

One cannot rely on a clause in its current form to justify an amendment, only to discard its core content in the final version. Such internal contradictions and policy dilution undermine the strategic integrity of the amendment and raise serious concerns about its consistency with the *Planning Policy Framework*, especially the *East Gippsland Housing and Settlement Strategy*, and the *Paynesville Growth Area Structure Plan (PGASP)*.

What are the desired outcomes of the Paynesville Growth Area Structure Plan (PGASP)?

The *Paynesville Growth Area Structure Plan* outlines thirteen desired outcomes (the Vision). Of these, we consider the following outcomes most relevant to the sustainability, liveability and coastal character or identity of the township, namely:

- Entry to Paynesville at the Grandview Road intersection will strongly reinforce a transition from rural and lake vistas and arrival in a spacious lakeside urban parkland environment
- Generous open space linkages and pedestrian/cycle corridors will provide convenient offroad access into the existing town and to connect with public foreshores. The Lake King foreshore will be managed and protected as an important environmental and public open space asset.
- Open spaces will create green corridors supporting natural drainage and provide off-road connections for cyclists and pedestrians, retaining as much native vegetation as possible and enhanced with new plantings.

- Strong native landscape themes will provide visual and environmental character for the growth area, establishing tree-lined avenues, movement corridors and an urban landscape respectful of the lakeside location.
- The cost of provision of infrastructure to service the community will be apportioned through infrastructure contributions by landowners, augmented by public investment to support ongoing maintenance and management of services and amenities.

On balance, we generally support these planning outcomes. However, we have some concerns regarding aspects of their implementation through the proposed Amendment C172egip. These concerns are discussed and analysed further in subsequent sections of this submission.

How does Amendment C172egip intend to achieve its desired outcomes?

The amendment seeks to introduce key land use planning directions of the PGASP into the East Gippsland Planning Scheme. Specifically, the amendment:

- Updates the local policy for Paynesville and the Paynesville Framework Plan at Clause 11.01-1L-02 (Growth Area Towns).
- Introduces Schedule 3 to the General Residential Zone (GRZ3) to guide development across the Paynesville Growth Area.
- Rezones land at 5 and 95 Grandview Road, 1325 Paynesville Road, and part of 1255 Paynesville Road, Paynesville from Farming Zone to GRZ3.
- Introduces Schedule 10 to the Development Plan Overlay (DPO10) to guide development in the Paynesville growth areas.
- Applies the DPO10 to the same land being rezoned.
- Applies the Environmental Audit Overlay to 95 Grandview Road and 1255 Paynesville Road, Paynesville to ensure appropriate investigation of potentially contaminated land.
- Deletes the Significant Landscape Overlay Schedule 2 (Gippsland Lakes) from part of 1255 Paynesville Road and part of 1325 Paynesville Road, Paynesville.
- Applies the Public Acquisition Overlay 3 – Road acquisition to part 25 Waterview Road, Eagle Point to facilitate intersection improvements.
- Amends the Schedule to Clause 72.03 (What does this planning scheme consist of?) to update mapping references.
- Amends the Schedule to Clause 72.08 (Background Documents) to include the Paynesville Growth Area Structure Plan as a background document.
- Amends the Schedule to Clause 74.02 (Further Strategic Work) to update references to the work to implement the Paynesville Growth Area Structure Plan.

Subsequent sections will evaluate the appropriateness and effectiveness of the various policy controls and planning provisions listed above in greater detail, as well as assess their consistency with the Planning and Policy Framework.

Is the amendment supported by any strategic studies or reports?

The original Paynesville Growth Area Structure Plan (2016) was informed principally by only five commissioned studies and technical reports. In 2023, the Structure Plan underwent a minor update, limited to revised traffic volumes, updated population projections and the omission of the road network and a small park.

Despite claims that “a review and refresh of the PGASP and technical background reports was undertaken in 2023,” the updated Structure Plan did not include the revised reports cited in its appendices. Upon request, Council officers provided the missing reports; however, no changes to the original content were evident.

We submit that the so-called ‘refreshed’ technical reports referenced in the 2023 Structure Plan update are identical to the original 2015–2016 reports and were not meaningfully updated as part of the 2023 review.

While we acknowledge the Structure Plan (2023) was refreshed with updated demographic and traffic data, the underlying technical and scoping studies remain outdated and unaltered, and were not included in the publicly accessible version of the revised Plan.

The Explanatory Report (p.5) for Amendment C172egip states:

"The Structure Plan also draws on detailed analysis of background information including the assessment of traffic management; drainage; land supply and demand; ecology and biodiversity; natural hazards; cultural heritage; and social impact."

Both the Paynesville and Eagle Point Structure Plans lack significant technical studies or land capability assessments, including a site-specific coastal hazard vulnerability assessment and biodiversity studies—critical omissions for the development of a strategic and deliverable Precinct Structure Plan.

The following reports are cited as informing the revised 2023 Structure Plan:

- *Key Issues and Responses Report*, Oct 2015
- *Consultation Report*, Oct 2015
- *Traffic Impact Assessment*, Jun 2016
- *Social Impact Assessment*, Feb 2016
- *High-Level Hydrological Analysis*, Mar 2016

Notably absent are key site-specific investigations including:

- Neighbourhood character assessment
- Aboriginal cultural values assessment
- Flora and Fauna assessments
- Bushfire assessments

- Visual landscape impact assessment
- Land capability assessments (e.g., contamination, geotechnical investigations, coastal hazard vulnerability)

It is acknowledged that a number of unpublished studies relating to a Bushfire planning (March 2019), and a revised Social Impact Assessment (July 2023) were subsequently prepared prior to the 2023 ‘refresh’ of the Structure Plan. Furthermore, expert witness statements were prepared in 2011 and 2014 to support a VCAT application for a nearby foreshore subdivision that may have been reviewed when preparing the Structure Plan. However, only some of the VCAT expert evidence reports are directly relevant to the growth area, and there is no evidence that the original studies were peer-reviewed or updated, as required under the *Precinct Structure Planning Guidelines for Regional Victoria (2021)*:

“Review existing technical studies and commission any land capability studies (e.g. heritage, land capability, etc.) or update existing studies to support early planning decisions.”

In preparation for the Planning Panel Hearing, we requested, and kindly received from Council, a number of unpublished and/or confidential background technical reports, including:

- Paynesville Growth Area Structure Plan -*Aboriginal Cultural Heritage Desktop Assessment* (May 2024)
- Paynesville Growth Area Structure Plan (July 2016) *Review of bushfire planning considerations – Draft Report* (March 2019)
- Paynesville Growth Area Structure Plan (July 2016) *Review of bushfire planning considerations – Final Report* (June 2024)
- Paynesville Growth Area Strategy – *Social Infrastructure Demand Report* (July 2023)
- Proposed Planning Scheme Amendment – Paynesville Growth Area Structure Plan- *Transport Engineering Assessment* (Nov 2024).
- Paynesville Growth Area – *Structure Plan[Drainage] Model Review -Final Report* (May 2024)
- *Preliminary Site Investigation – Paynesville Growth Area* (Apr 2024)

Despite the existence of the above reports, considerable uncertainty remains as to which background reports were relied upon, and how unpublished or unreferenced studies were incorporated into early planning decisions. This is particularly concerning in relation to ecology, biodiversity, cultural heritage, and natural hazard risks.

The following table outlines key differences in the supporting documentation underpinning the Paynesville and Eagle Point Structure Plans (see below).

Structure Planning Comparison Table Supporting documentation informing the Eagle Point and Paynesville Structure Plans

Eagle Point Structure Plan 2019	Paynesville Growth Area Structure Plan 2023	Comments
Unavailable or not included as a background report in Structure Plan	Key Issues and Responses Report, Oct 2015	
Unavailable or not included as a background report in Structure Plan	Consultation Report, Oct 2015	
Not completed , unavailable or not included as a background report in Structure Plan	Traffic Impact Assessment Report, Jun 2016 Proposed Planning Scheme Amendment – Paynesville Growth Area Structure Plan- <i>Transport Engineering Assessment (Nov 2024).</i>	Based on 2011 census demographic data Based on 2021 census demographic data but analysis of land parcels based on the 2016 Structure Plan’s road layout (see p.26)
Not completed, unavailable or not included as a background report in Structure Plan	Social Impact Assessment Report, Feb 2016 Paynesville Growth Area Strategy – <i>Social Infrastructure Demand Report (July 2023)</i>	Based on 2011 census demographic data Based on 2021 ABS Census data however the socio-spatial analysis was based on the 2016 Structure Plan.
Not completed, unavailable or not included as a background report in Structure Plan	High Level Hydrological Analysis, Mar 2016 Paynesville Growth Area – <i>Structure Plan[Drainage] Model Review -Final Report (May 2024)</i>	No consideration of coastal hazard risks Minimal consideration of coastal hazard risks (up to year 2050 only) Modelling of catchment impervious surface areas is based on the outdated 2016 Structure Plan, rendering the modelled output results unreliable,

		unrepresentative of current development expectations, and inconsistent with the updated growth scenario presented in the proposed 2025 C172 Amendment
The Public Realm & Infrastructure Plan	Not completed	Deferred to the Development Plan
Significant topographic features (ridgelines / high points) mapped	Not included	Neither plan undertook a landscape impact assessment despite the Significant Landscape Overlay- Schedule 2 (SLO2)-Gippsland Lakes applying in both areas.
Significant view lines shown on maps	Not included	Neither plan undertook a landscape impact assessment despite the SLO2
Environmental Values & Cultural Heritage Assessment (date unknown)	No environmental assessment completed Paynesville Growth Area Structure Plan - <i>Aboriginal Cultural Heritage Desktop Assessment</i> (May 2024)	Deferred to the Development Plan Limited, desktop assessment prepared AFTER the release of the updated 2023 Structure Plan
Vegetation clusters or significant trees identified and mapped	Not completed	Flora assessment deferred to the DP No Vegetation Precinct Plan deemed necessary
No habitat assessment (fauna) undertaken	No fauna assessment	Deferred to the DP
Creek/tributaries and minor drainage lines identified and mapped	Not included	Deferred to the Development Plan
Landscape and/or wildlife corridors identified / shown on maps	Not completed	Deferred to the Development Plan

High Conservation Value vegetation mapped	Not completed	Deferred to the Development Plan
Environmental overlays (e.g., Vegetation Protection Overlay) shown on maps	Not included	
Inundation overlay (LSIO) shown on maps	Not included	Deferred to the Development Plan presumably
Road / Street Cross Sections included	Not included	Deferred to the Development Plan's Public Infrastructure Plan
Neighbourhood Character and Change Areas mapped, defined and delineated	Not completed	Not considered a requirement
Strategic development site plans	Not completed	Deferred to the Development Plan
Public Transport and Path Network Plan	Not completed	
Bushfire risk pathways mapped	Not included	A draft high level <i>Bushfire Planning Considerations Report</i> was prepared in 2019 and peer reviewed final report completed in June 2024, but was still based on the 2016 Structure Plan To be considered by the Development Plan
Road networks plan	Not included	Deferred to the Development Plan's Public Infrastructure Plan
Natural Hazards mapped (bushfire and 1% AEP flood extant only) Sea level Rise, Storm/Tide Surge not mapped	Not included	Historic <i>Local Coastal Hazard Assessment (2014)</i> and other unspecified Government data used to justify the 2.8m AHD development exclusion line. However, this outdated study did not model sea level rise impacts beyond 2040, and as such provides a poor basis for coastal hazard

		policy determination. To be considered by the Development Plan No Full Flood Study undertaken
Basic Drainage Plan included	Not included	Deferred to the Development Plan's Public Infrastructure Plan
Open Space Network Plan	Not included	Deferred to the Development Plan
Land Use Budget and summary tables not included	Not included	Deferred to the Development Plan
Gateways and Streetscapes Plan	Not included	Deferred to the Development Plan
No contaminated land investigations	Not undertaken	Deferred to the Development Plan, triggered by the Environmental Audit Overlay
Detailed Precinct Area Plans – foreshore and community precincts	Not completed	Deferred to the Development Plan

Will the proposed amendment result in a good planning outcome?

The *Precinct Structure Planning Guidelines (2021)* along with *Precinct Structure Planning Guidelines for Regional Victoria (2021)* were developed to address longstanding issues in greenfield and peri-urban development across regional Victoria, including poor sequencing, under-serviced subdivisions, and ad hoc decision-making. The Guidelines aim to "lift the bar" by requiring planning authorities and proponents to adopt a more integrated, proactive, and strategically sequenced approach to development planning.¹ This includes ensuring that key land use, infrastructure, environmental, and open space considerations are resolved **before** land is rezoned—not after.

These guidelines make clear that good planning outcomes depend on **early and transparent resolution** of key planning challenges, informed by detailed technical analysis and community consultation. The PSP process is designed to deliver coordinated infrastructure planning, protect environmental and cultural values, identify risks and constraints (such as flooding, coastal hazards or bushfire), and guide the **orderly** rollout of housing and services. The output of this process includes a suite of interrelated precinct-level plans—such as the *Public Realm and Water Plan*, *Movement Network and Public Transport Plan*, *Environment and Heritage Plan*,

¹ Victorian Planning Authority (2021) *Precinct Structure Planning Guidelines: New Communities in Victoria*; p.3

and *Coastal Adaptation Plan*—which should logically be prepared in an orderly manner to inform the overall precinct layout, stormwater sizing and development staging strategy.

However, Amendment C172egip does not follow this structured, orderly approach to structure planning. Instead of resolving these foundational matters at the structure planning stage, the amendment defers the preparation of these critical PSP outputs to the Development Plan Overlay (DPO) schedule, effectively postponing their development until after the land has been rezoned. In doing so, the amendment is inconsistent with the integrated and orderly planning approach required by the *Planning and Environment Act* and intrinsic to the wider planning policy framework.

The amendment’s planning approach is defective for the following reasons:

- **Key PSP outputs are treated as post-rezoning tasks**, when in fact they are prerequisites for making sound rezoning decisions. According to the *PSP Guidelines*, these plans are not discretionary or supplementary—they are essential tools that ensure development is properly informed by environmental, cultural, infrastructure, and design constraints.² It is also fundamentally inconsistent with the *Marine & Coastal Policy 2020* and *Marine & Coastal Strategy 2022* which direct decision makers to embed **integrated**, data-driven, coastal zone planning (which is proportionate and risk based) at the local and regional level.
- **Deferring these plans compromises transparency and community confidence**. Without access to these documents during the amendment exhibition process, the community and relevant agencies cannot properly assess the suitability, risks, or impacts of the proposed growth area. This undermines the legitimacy of the amendment process and weakens accountability.
- **The sequencing is backwards**. Rather than shaping the form and staging of development, the Development Plan will be forced to react to a rezoning that has already occurred, leaving little scope for meaningful adaptation. This risk’s fragmented and maladapted urban form which lacks climate resilience, misaligned infrastructure delivery, loss of important environmental and cultural values, and higher long-term costs to councils and service authorities.
- **It sets a poor precedent**. Allowing rezoning to proceed in the absence of these PSP outputs sends a signal that integrated and orderly planning is optional, not essential. It weakens the role of strategic planning policy and opens the door to developer-led rather than policy-led decision-making in future amendments.

Given these deficiencies, we submit that Amendment C172egip does not represent a good planning outcome. It fails to comply with the clear process sequencing and evidentiary expectations set out in the *Precinct Structure Planning Guidelines for Regional Victoria*, and does not give effect to the core planning principles enshrined in the *Planning Policy Framework*,

² Victorian Planning Authority (2021) *Precinct Structure Planning Guidelines: New Communities in Victoria*; p.69

particularly those relating to integrated decision-making, orderly development, and the protection of environmental and cultural values.

We recommend that the amendment be restructured to incorporate or exhibit the full suite of PSP outputs *prior* to rezoning, in line with the intent of the *PSP Guidelines*. Only by following this approach can the amendment deliver a strategically sound, transparent, orderly and integrated planning outcome for the Paynesville Growth Area.

Will the amendment have a net community benefit?

Clause 71.02-3 of the *Planning Policy Framework* requires that planning authorities deliver integrated decision-making by balancing relevant policy objectives in favour of net community benefit and sustainable development for current and future generations. It further directs that planning outcomes be underpinned by coordinated strategic planning across agencies, particularly where proposals have regional implications. In bushfire-prone areas, the protection of human life must be prioritised above all other considerations.

In relation to Amendment C172egip, we submit that the amendment does not achieve a net community benefit, for the following reasons:

Deferred essential assessments and implementation risks

The amendment defers the preparation of key structure planning outputs – such as flora and fauna assessments to the developer-driven detailed development planning stage (Development Plan Overlay), rather than incorporating them into the exhibited amendment. These vital ‘pre-commencement’ planning reports and assessments are identified in the *PSP guidelines* as critical outputs, essential to the formulation of a sound precinct structure plan and necessary inputs to the design of the Development Plan itself.³

This sequencing contradicts the principles of integrated, orderly and informed decision-making. It creates a disconnect between the strategic justification for the amendment and the supporting technical and spatial documentation needed to assess its implications. Without these inputs, the amendment cannot be said to meaningfully integrate and balance conflicting objectives or deliver a transparent and evidence-based planning outcome. Subsequent sections of this submission will explore the failure to integrate conflicting policy directives in more detail.

Inconsistency with strategic policy

The amendment relies on the *East Gippsland Housing and Settlement Strategy (2023)* to justify changes to Clause 11.01-1L-2 (*Growth Area Towns*), but it omits or removes key policy directions contained in that same strategy—particularly those relating to neighbourhood character, environmental values and risks, and town identity. This selective referencing undermines policy coherence and diminishes confidence in the amendment’s strategic integrity.

³ Victorian Planning Authority (2021) *Precinct Structure Planning Guidelines: New Communities in Victoria*; p.69

The net effect is a weakening of established planning policy and an erosion of place-based planning principles that are fundamental to maintaining liveability and distinctiveness in regional towns such as Paynesville.

Fragmented and uncoordinated development risk

By rezoning land in the absence of essential environmental plans and infrastructure siting and sequencing strategies, the amendment increases the risk of fragmented development, service delivery delays, and long-term cost inefficiencies. It places the burden of resolving foundational land use and infrastructure questions on future decision-makers, rather than resolving them through the structure planning process as intended. This approach is inconsistent with Clause 71.02-3, which emphasises the need for coordinated and efficient use of resources.

Inadequate consideration of regional and environmental risks

The amendment does not adequately address regional environmental risks, particularly in relation to stormwater discharge impacts to the Gippsland Lakes, threatened EPBC-listed species and vegetation communities, and the absence of site-specific assessments of coastal hazard vulnerability. These risks are not isolated to the local development footprint—they have broader implications for the ecological health, water quality, and climate resilience of the Gippsland Lakes, which is a Ramsar-listed wetland and lake system of international importance. As such, they must be considered at the regional scale, in accordance with Clause 71.02-3, which explicitly states that planning and responsible authorities must “identify the potential for regional impacts in their decision-making” and “coordinate strategic planning with their neighbours and other public bodies to achieve sustainable development and the effective and efficient use of resources.” This coordination has not occurred in a meaningful or transparent way. While the amendment proceeds on the basis of a local structure plan, it fails to demonstrate how it aligns with or gives effect to the broader marine and coastal policy framework, including the *Marine and Coastal Policy 2020*, the *Marine and Coastal Strategy 2022*, the *Gippsland Lakes Ramsar Site Management Plan*, and the *East Gippsland Catchment Management Strategy*.

This policy misalignment is further evidenced in the formal referral responses from key state and regional agencies. DEECA raised concerns about the lack of strategic identification and protection of biodiversity values at the rezoning stage, emphasising that ecological values—including foreshore and estuarine habitat—must be addressed early, not deferred to the Development Plan stage. This reflects a fundamental principle of Clause 12.01-1S (Biodiversity), which requires that planning avoid impacts, not simply manage them after zoning decisions have been made.

The East Gippsland Catchment Management Authority (EGCMA) noted that the exhibited zoning maps did not reflect the Paynesville Growth Area Structure Plan (PGASP) it had previously reviewed. This discrepancy highlights a concerning disconnect between strategic environmental risk input and final planning outputs. It also suggests that agency feedback—particularly regarding drainage, flood vulnerability, and foreshore risk—has not been fully or transparently incorporated into the amendment in a timely, orderly and consistent manner.

The amendment also lacks any clear demonstration of how stormwater discharge will be managed to avoid adverse impacts on receiving waters and wetlands—namely, the Gippsland Lakes—despite clear expectations under *Environment Protection Act 2017 (Vic)* and associated *Environment Protection Regulations 2021*, and Clause 13.02-1S (Floodplain Management) that

planning protect water quality and natural systems. The omission of any publicly accessible cumulative impact assessment is particularly notable given the known stormwater and nutrient sensitivity of downstream saltmarsh communities.

In short, the amendment's current approach appears piecemeal and agency-siloed, lacking the integrated, whole-of-system planning coordination envisioned by Clause 71.02-3, along with the wider *Marine and Coastal Policy* provisions and policies incorporated into the planning scheme via [Amendment VC171](#). Without site-specific assessments, without regional-scale planning, and without strategic policy alignment, the amendment does not demonstrate that it will deliver a sustainable or responsible outcome for the Gippsland Lakes or the wider region. Its approval in this form risks undermining key state environmental objectives and normalising a piecemeal, rather than strategic, approach to planning in sensitive coastal areas.

Bushfire risk not properly prioritised

Finally, the amendment does not demonstrate how bushfire risk has been assessed or prioritised, despite the proximity of the growth area to vegetated coastal reserves and known fire-prone landscapes. Clause 71.02-3 is clear that in bushfire-prone areas, the protection of human life must be paramount. The omission of a bushfire assessment plan at the initial structure planning stage is a major deficiency, leading to unresolved conflicting policy objectives, which will be discussed in latter sections of the submission.

Concluding remarks

For the reasons outlined above, we submit that Amendment C172egip, in its current form, does not achieve a net community benefit as required by Clause 71.02-3 of the *Planning Policy Framework*. It does not demonstrate integrated planning, policy alignment, or effective risk management, and its procedural approach is inconsistent with the expectations of both the *PSP guidelines* and the broader *Planning Policy Framework*.

We respectfully recommend that the amendment be revised to incorporate the full suite of PSP outputs prior to rezoning, and that further strategic coordination and technical assessments be undertaken to ensure the amendment delivers a balanced and sustainable outcome for the community.

Will the community benefit outweigh the cost of the new controls?

Amendment C172egip's strategic planning does not appear to have been informed by a cost-benefit analysis or detailed risk assessment. Understanding the extent of vulnerability to coastal hazards such as erosion, inundation, and sea-level rise is critical given the inherent risk profile of the foreshore area. The amendment defers detailed hazard mapping of local hazards and conditions to the Development Plan stage, making scenario-based coastal planning that is informed by stochastic risk assessments at the structure planning stage impossible. In the absence of detailed hazard mapping and adaptation planning, it's unclear how planners have anticipated and modelled future risks to coastal values, and to public and community infrastructure that's proposed to be sited in the coastal zone.

Moreover, no evidence has been forthcoming which has evaluated the cost implications of potentially 'at-risk' coastal infrastructure versus the modest increase in the rates base that

additional housing supply in the sensitive coastal interface zone would provide. Therefore, while the expansion of Paynesville offers additional housing supply and economic opportunities, these potential benefits may well be undermined by the cost implications of disorderly coastal planning. By neglecting a thorough assessment of coastal hazard risks based on the best available stochastic hazard modelling, and deferring strategic planning to the Development Plan, the amendment exposes Council and the community to long-term costs and uncertainties. This is contrary to the *PSP guidelines*, which emphasise that such plans and assessments are **inputs** to rezoning—not outputs to be finalised afterwards.

Uncosted risks: coastal inundation and erosion impacts

The Paynesville Growth Area borders Lake King and is adjacent to low-lying foreshore and estuarine assets that are increasingly exposed to coastal hazards. Understanding the extent of vulnerability to coastal hazards such as erosion, inundation, and sea-level rise is paramount. Best practice coastal planning involves detailed hazard mapping and stochastic scenario modelling to help planners anticipate future risks and evaluate the cost implications of mitigating them efficiently and effectively.⁴

Without a publicly exhibited, **site-specific Coastal Hazard Vulnerability Assessment (CHVA)** that meets best practice requirements, or the courage to detailed *Coastal Adaptation Plan*, the amendment fails to assess or account for lifecycle costs of infrastructure located in, or near, erosion and inundation-prone areas. The amendment's primary planning tool to address the identified coastal hazard risks is to constrain development below 2.8 meters AHD; citing the *Gippsland Lakes Local Coastal Hazard Assessment 2014 (LCHA)* as justification for its approach to coastal hazard risk mitigation.⁵

While the regional-scale study was a valuable starting point, it is now significantly outdated, and more importantly, was never designed for local-level land use planning.⁶ It did not model 1% AEP flood events incorporating sea level rise beyond 2040, therefore falling short of 2100 planning horizon required by PPN53 and Clause 13.01-1S. Overall, the limited data available at the time forced the modellers to rely on too many qualitative assessments and assumptions, that are can be readily challenged today by current climate science. Critically, the authors themselves cautioned that the model was not designed for land use planning purposes, and recommended further work before its outputs could be applied to strategic planning.⁷

Since then, major advances in climate modelling—many incorporated into the CSIRO's 2022 Gippsland Lakes study—have highlighted the likelihood of more extreme and frequent inundation events, faster-than-anticipated sea level rise, and compounding coastal hazard risks projected to occur well before 2100. Relying solely on the 2.8 m AHD threshold as a

⁴ O'Grady, JG. et al (2024)). A probabilistic coastal inundation assessment for Australia. In: Phillips, M.R.; Al-Naemi, S., and Duarte, C.M. (eds.), *Coastlines under Global Change: Proceedings from the International Coastal Symposium (ICS) 2024 (Doha, Qatar)*. Journal of Coastal Research, Special Issue No. 113, pp. 185-189; see also Appendix A: Review of the 2014 Gippsland Lakes Local Coastal Hazard Assessment (LCHA)

⁵ NB: the Water Technology report was incorrectly identified as being completed in 2016 in the gazetted Explanatory Report to the amendment (see p.9).

⁶ Water Technology (2014) *Gippsland Lakes/90 Mile Beach Local Coastal Hazard Assessment – Report 2: Inundation Hazard*, State Government of Victoria; pp.26-7

⁷ ⁷ Water Technology (2014) *Gippsland Lakes/90 Mile Beach Local Coastal Hazard Assessment – Report 2: Inundation Hazard*; p.67

definitive planning control, without conducting site-specific flood studies, geotechnical investigations (including acid sulphate soils and soil erosion) and comprehensive coastal hazard risk assessments, is inconsistent with Clause 13.01-1S which advises planners “identify at risk areas using the best available data and climate change science.”

Additionally, the 2.8m line does not sufficiently comply with Clause 13.01-2S, which emphasizes the need for site-specific, long-term coastal planning that fully considers the combined impacts of tides, storm surges, coastal processes, and local environmental conditions (including topography and geology). Further detailed analysis of the coastal hazard risks of the northern growth area and the limitations of the LCHA are provided in Clause 13.01-1S, 13.01-2S and Appendix A respectively.

Examples of uncostered risks include:

Stormwater Assets:

Coastal flooding and saline intrusion accelerate failure of stormwater outfalls, WSUD assets, and open drains. According to the *Victorian Coastal Hazard Assessment (DELWP, 2022)* and *Asset Management Approaches for Coastal Infrastructure (National Sea Change Taskforce, 2015)*, coastal retrofit costs for stormwater infrastructure range from \$800,000 to \$1.2 million per kilometre, depending on foreshore geology and proximity to tidal areas. As sea levels rise and extreme weather events become more frequent, the costs of defending and eventually relocating stranded assets are expected to escalate exponentially.

Foreshore Roads and Car Parks:

Unprotected coastal access roads require reinforcement, realignment or retreat due to shoreline erosion and storm surge events. Based on East Gippsland coastal road upgrades (e.g. Lakes Entrance Foreshore Stabilisation Project), costs range between \$500,000 and \$1.5 million/km, depending on site conditions and erosion severity (*EGSC Infrastructure Delivery Plan, 2021*). Even if we ignore the additional costs from inflationary pressures, the costs of armoring and eventually realigning roads further inland are expected to escalate significantly as sea levels rise and extreme weather events become more frequent. Moreover, without substantial coastal setbacks or adaptation buffers, road realignment or retreat as sea levels rise might not be possible without impacting public open space or even private land.

Parks and Recreation Infrastructure:

Inundation degrades parklands, paths, playgrounds and shelters. The *Victorian Coastal Strategy (2014)* estimates remediation and replacement costs of \$100,000 to \$400,000 per hectare in low-lying recreational zones, with inflation ensuring such costs would be far higher today. These costs are typically borne by councils and are exacerbated when future retreat corridors have not been secured.

A [2023 study](#) commissioned by the Victorian Marine and Coastal Council projects that by 2100, the combined effects of sea level rise and storm surges could result in economic losses

totalling approximately \$442 billion.⁸ This includes up to \$105 billion in damages to wetlands and \$337 billion in losses related to land and property along the Victorian coast. Notably, the study highlights that nearly 40% of these potential damages could affect coastal reserves, such as public recreational areas along Victoria's 2,500 km coastline .

These findings underscore the escalating financial risks associated with coastal inundation and erosion, particularly concerning public infrastructure and recreational assets. They also emphasize the necessity for proactive adaptation planning and investment to mitigate future costs and protect community assets. Clauses 12 and 13 will explore the specific coastal hazard risks of the growth area's northern shoreline and the proposed coastal reserves and infrastructure to be sited there.

LOSS OF COASTAL BUFFER ZONES AND BIODIVERSITY:

"Coastal squeeze"—where fixed urban development abuts rising seas—leads to irreversible loss of wetland, dune and saltmarsh habitat. The *Marine and Coastal Policy (DELWP, 2020)* warns that this accelerates biodiversity loss and limits future adaptation options. Loss of buffer zones also undermines natural defences, increasing reliance on hard infrastructure. As noted by DELWP: "when coastal inundation and erosion risks are not factored into the siting of public infrastructure, costs of adaptation or asset failure are transferred to councils and future generations."⁹ Similarly, *Infrastructure Victoria* warns that "placing infrastructure in coastal hazard zones without an adaptation strategy increases fiscal exposure and reduces long-term resilience."¹⁰

Concluding remarks

Given these foreseeable and evidence-based risks, we submit that the costs—both financial and environmental—significantly outweigh the claimed benefits of the proposed control. Without a robust evidence-base, and the inclusion of core PSP outputs at the rezoning stage, the proposal fails to demonstrate integrated decision-making. It does not provide transparency around long-term asset viability, climate resilience, or infrastructure sequencing.

In our view, Amendment C172egip, in its current form, does not represent a net community benefit and risks burdening the community with uncoded liabilities, poor coastal outcomes, and preventable infrastructure failures. It should not proceed until all required technical studies—particularly those relating to coastal hazard risk and infrastructure planning—are prepared, peer-reviewed, and publicly exhibited in accordance with the *PSP guidelines* and the *Marine and Coastal Policy 2020*.

Does the amendment implement the objectives of planning in Victoria (sections 4(1) and 12(1)(a) of the Act)?

This submission puts forward the case that the amendment is not sufficiently consistent with

⁸ Kompas, T. et al (2022) *Economic Impacts from Sea Level Rise and Storm Surge in Victoria, Australia over the 21st century*- Report prepared for the Victorian Marine and Coastal Council (VMACC), with support from the Department of Energy, Environment and Climate Action (DEECA) and Life Saving Victoria, Centre for Environmental and Economic Research, University of Melbourne, Melbourne and Climate Risk Pty Ltd., Sydney

⁹ DELWP, 2022 – *Victorian Coastal Hazard Assessment*, p.18

¹⁰ *Infrastructure Victoria – Resilient Infrastructure Report*, 2021, p.34

key objectives of planning in Victoria. Responsible economic management, intergenerational equity, and sustainable planning principles are explicitly embedded within the objectives of the *Planning and Environment Act 1987* (Vic). Specifically, the Act seeks to provide for the "fair, orderly, economic and sustainable use, and development of land," balance "the present and future interests of all Victorians," and ensure the protection of natural resources and maintenance of ecological processes (s 4).

However, the amendment demonstrates inadequate consideration of significant coastal hazard risks, including erosion, inundation, and the increasing severity and frequency of storm surge events associated with projected sea-level rise. By neglecting comprehensive risk assessment, adopting overly simplistic hazard mapping, and failing to implement sufficiently protective coastal buffers, the amendment disregards best-practice coastal planning approaches. This neglect not only compromises long-term economic viability and places future generations at risk, but also jeopardizes vital ecological processes and the resilience of coastal ecosystems. Thus, the amendment's deficiencies in addressing foreseeable coastal hazards represent a profound departure from the core statutory planning principles intended to safeguard Victoria's coastal communities, infrastructure, and natural assets for present and future generations.

Does the amendment adequately address any **environmental effects** (sections 12(2)(b) of the Act)?

The amendment does not adequately address the environmental effects as required under section 12(2)(b) of the *Planning and Environment Act 1987* (Vic). Specifically, it fails to comprehensively assess and mitigate significant ecological impacts arising from increased coastal hazard risks such as erosion, inundation, and sea-level rise. The amendment overlooks critical environmental consequences, including habitat loss, disruption of ecological connectivity, and degradation of sensitive foreshore ecosystems. Furthermore, the superficial approach to hazard identification and the reliance on simplified and outdated inundation modelling rather than dynamic, process-based assessments demonstrate insufficient regard for the complex and long-term environmental impacts likely to arise. Consequently, the amendment does not satisfy statutory obligations to properly consider and address the environmental effects associated with future coastal processes and climatic uncertainties.

Does the amendment adequately address any **social effects** (sections 12(2)(c) of the Act)?

The amendment does not adequately address the social effects as required under section 12(2)(c) of the *Planning and Environment Act 1987* (Vic). Specifically, it fails to sufficiently evaluate how increased exposure to coastal hazards—such as inundation and erosion—will impact community wellbeing, particularly for vulnerable populations. Additionally, the proposed social infrastructure solutions lack practicality and resilience, inadequately accounting for the disruption and isolation of essential community services during high sea-level events.

Insufficient assessment of the social impacts of climate change

The Social Infrastructure Demand Report (July 2023) accompanying the amendment, acknowledged that it was prudent “to factor in the effects of climate change on interdependent social infrastructure, especially in those Paynesville township areas which are subject to flooding.” To illustrate the level of projected flooding the report reproduced the 2010 ‘10% AEP Flood Scenario Maximum Inundation Extent under Existing MSL and SLR Scenarios at Paynesville’ map from the Inundation report of the Gippsland Lakes Local Coastal Hazard Assessment (2014) (see Figure 5-8)



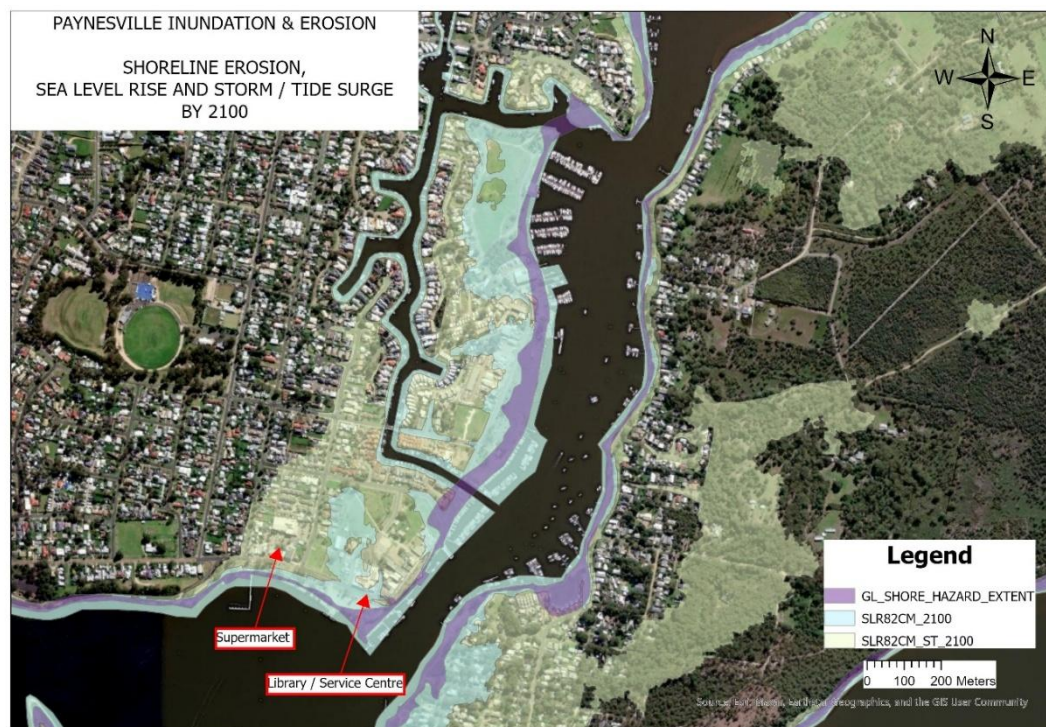
Figure 5-8 Representative 10% AEP Flood Scenario Maximum Inundation Extent under Existing MSL and SLR Scenarios at Paynesville. The red marker indicates the location of the depth and duration time series displayed in Figure 5-10.

The report also noted that “at 0.8m of SLR the major service areas [of Paynesville] are both inundated and cut off from the road network” and recommended “a strategy that enables the new residents of the PGA to remain connected to service provision by establishing a small multi use facility acting as home to satellite services for those already in existence within Paynesville.” The report goes on to suggest that “future proofing, although a seemingly positive approach provides a less flexible social infrastructure system, than one designed for adaptation in the face of change.” The report concludes its discussion on climate change adaptation by stating “the recommendations of this report are prefaced on this flexible, adaptive system, designing a framework for social infrastructure that will continue to evolve with the changes that are embedded in growth strategies.”

Critically, the report provides insufficient analysis regarding the potential impacts of sea-level rise and shoreline erosion, notably the risk of substantial and permanent inundation of extensive areas of Paynesville. Without costly protective infrastructure or carefully managed retreat strategies, these impacts could effectively redefine the town's boundaries and significantly disrupt the main activity centre. The report's cursory treatment of these complex challenges undermines effective strategic planning and fails to adequately address the community's long-term vulnerability. Moreover, the report sidesteps the devastating impacts that frequent flooding will likely have on community wellbeing, particularly for vulnerable populations such as the elderly or people with disabilities.

Simplistic responses to climate risk

The recommendation that a single small facility or "new neighbourhood centre within the PGA" could adequately substitute inundated key services—including vital retail businesses like pharmacies and supermarkets—is overly simplistic and untenable. This proposition demonstrates a superficial approach to strategic and emergency planning, especially given that high sea-level events are projected to occur approximately 10 times per year under low-emission scenarios, and up to 100 times per year under high-emission scenarios by the end of the century.¹¹ As illustrated in the map below, projected sea-level rise, shoreline erosion and



frequent high sea-level events by the turn of the century—only 75 years from now—will likely inundate Paynesville's main activity centre, affecting all commercial premises and government service facilities.

The implications for community resilience, economic stability, and essential service continuity are severe and must be urgently addressed in strategic planning decisions. Additionally, the lack of serious consideration of the broader social implications of regular flooding on community life and infrastructure is perhaps partly due to an excessively optimistic assumption that permanent inundation and frequent tidal or storm-driven flooding impacts can be effectively addressed later through an undefined "flexible, adaptive system." This approach is inconsistent with the principles set out in the broader legislative and policy framework which mandates proactive, detailed, and early-stage planning for climate adaptation and coastal resilience.

Notably, the *Victorian Marine and Coastal Policy (2020)* explicitly outlines objectives for proactive adaptation to climate hazards through rigorous, risk-based planning. Similarly,

¹¹ See Kirono, D. *et al* (2022) Vulnerability of the Gippsland Lakes Ramsar Site and its catchment to bushfire and climate change. Final Report submitted to the Department of Agriculture, Water and the Environment, DAWE. CSIRO, Australia; pp.62-63

Victoria's Climate Change Strategy (2021) emphasizes the necessity for proactive adaptation planning. Moreover, the *Victoria's Resilient Coast – Adapting for 2100+* framework and guidelines advocate for comprehensive, **early action to build resilience**, incorporating long-term scenario planning, active community engagement, ecosystem restoration, and nature-based solutions or strategic retreat options. Collectively, these frameworks underline the imperative for immediate and informed action rather than deferring critical adaptive planning and responses to an uncertain future stage.

Insufficient assessment of public open space loss

The amendment does not adequately evaluate the potential reduction and fragmentation of public open space along the foreshore arising from coastal hazards, specifically sea-level rise, inundation, and erosion. This oversight could result in substantial loss of recreational opportunities, negatively impacting community wellbeing, social cohesion, and overall quality of life.

Limited engagement and participation reducing community trust in the planning process

The amendment process demonstrated insufficient and ineffective community engagement, exacerbated by scheduling the initial consultation period during the busy Christmas holiday season. Reliance primarily on two advertisements in the local newspaper and the Shire's 'have-your-say' webpage, led to extremely limited community awareness and poor attendance (approximately 40 residents) at council-organised face-to-face events.

In contrast, a subsequent community-led letter-drop campaign resulted in over 250 residents attending an open-air public meeting (in challenging weather conditions) - the majority of whom expressed limited prior knowledge of the amendment. Despite strong community opposition expressed both online and at Council meetings, there was minimal alteration to the exhibited plans, with significant community concerns largely ignored or deferred for panel consideration. There remains widespread negative sentiment regarding the use of the Development Plan Overlay as the primary planning instrument, contributing to an overall diminished trust in the fairness and transparency of the planning process.

Does the amendment adequately address any economic effects (sections 12(2)(c) of the Act)?

Superficial cost-benefit analysis

The amendment lacks a comprehensive economic assessment clearly demonstrating the overall net benefit or cost implications to the community, evaluated across both short-term and long-term horizons. Though partially acknowledged, it does not sufficiently quantify or address economic impacts associated with climate change adaptation, such as escalating costs due to coastal inundation, sea-level rise, increased storm intensity, and ongoing erosion hazards. These hazards pose substantial economic liabilities including the potential loss or degradation of public infrastructure, increased expenditure on protective or remedial measures, and elevated insurance premiums.

Additionally, broader economic impacts on tourism, recreation, local business sustainability, and ecosystem services, which contribute significantly to the regional economy, have not been thoroughly evaluated. Consequently, the amendment's omission of a detailed cost-benefit

framework results in uncertainty and inadequate preparedness regarding future economic burdens on the community, contravening best practice guidance on climate-responsive economic planning.

Underestimated infrastructure costs

The amendment inadequately addresses and significantly underestimates potential infrastructure-related costs arising from increased development density and climate-induced coastal hazards. It fails to transparently document or quantify the financial implications associated with ongoing maintenance, adaptation, and protective measures required to safeguard essential infrastructure—such as roads, drainage systems, stormwater treatment assets, utilities, and coastal protection structures—against sea-level rise, coastal erosion, and storm surge impacts.

Moreover, essential upgrades to public and community infrastructure, including schools, healthcare facilities, community centres, parks, transport networks, and emergency and police services, necessitated by population growth, remain inadequately assessed. The absence of detailed cost estimates, funding strategies, or clear assignment of financial responsibility heightens the risk of significant future economic burdens being transferred to local government and taxpayers, undermining the long-term economic sustainability of the community and contravening robust planning and governance practices.

Unquantified climate adaptation costs

The amendment inadequately addresses the substantial economic implications arising from future climate adaptation needs, particularly concerning coastal inundation, erosion, and flooding. Specifically, it lacks detailed, transparent assessment and quantification of potential economic liabilities associated with necessary protective measures—such as seawalls, revetments, or drainage infrastructure—ongoing maintenance requirements, and periodic reconstruction necessitated by accelerating climate risks.

Crucially, the absence of proactive and comprehensive adaptation planning at the current amendment stage will inevitably amplify future costs. Reactive, emergency-driven responses and unplanned infrastructure interventions historically incur significantly greater financial burdens compared to planned, strategic adaptation measures implemented in advance.

Further economic impacts overlooked by the amendment include losses from damaged public and private infrastructure, decreased property values, higher insurance premiums, disruptions to tourism, and impaired local business viability resulting from frequent or prolonged climate-related events. Had the amendment adequately quantified these adaptation and mitigation costs, it would have clearly demonstrated the financial prudence of investing in detailed flood and erosion studies before rezoning the land.

This omission transfers disproportionate economic burdens onto future generations and taxpayers, representing a significant departure from responsible economic management, intergenerational equity, and sustainable planning principles enshrined within the *Planning and Environment Act 1987*. Specifically, the Act seeks to provide for the "fair, orderly, economic and sustainable use, and development of land," balance "the present and future interests of all Victorians," and ensure the protection of natural resources and maintenance of ecological processes (s 4). These foundational principles guide planning decisions toward achieving sustainable, equitable, and economically responsible outcomes.

Does the amendment comply with all the relevant Minister's Directions?

Does the amendment comply with the requirements of the Ministerial Direction 13 (Managing coastal hazards)

Ministerial Directive 13 puts forth the following key requirements to be met:

In preparing an amendment which would have the effect of rezoning non-urban land for urban use or development, a planning authority must include in the explanatory report how the proposed amendment:

Is consistent with the planning policies, objectives and strategies for coastal Victoria as outlined in state planning policies (including regional planning policies) in the Planning Policy Framework.

Addresses the current and future risks and impacts associated with projected sea level rise and the individual and/or combined effects of storm surges, tides, river flooding and coastal erosion.

Is based on an evaluation of the potential risks and presents an outcome that seeks to avoid or minimise exposing future development to projected coastal hazards.

Ensures that new development will be located, designed and protected from potential coastal hazards to the extent practicable and how future management arrangements will ensure ongoing risk minimisation.

As outlined in Appendix A, the Amendment's coastal hazard strategy leans almost entirely on the Gippsland Lakes Local Coastal Hazard Assessment (LCHA) 2014 by Water Technology. The heavy reliance on one major study introduces significant uncertainties and analytical risks.. Although detailed, the 2014 assessment was never intended to be a full flood study suitable for land use planning.¹² Notably, the report fails to explicitly model a critical scenario combining an 0.8 m sea-level rise with a 1% Annual Exceedance Probability (AEP) storm tide surge event occurring independently of catchment flooding. This omission represents a significant gap in hazard assessment, undermining confidence in the accuracy and comprehensiveness of the planning response.

Furthermore, the LCHA does not extend modelling of combined 1% AEP catchment flooding and sea-level rise scenarios beyond 2040. These omissions represent a substantial data gap, undermining accurate hazard identification for coastal inundation risks anticipated by 2100. In sum, to rely solely on the outdated and limited 2014 Coastal Hazard Assessment falls notably short of the rigorous modelling and risk-based planning expectations outlined in Ministerial Direction No. 13, and therefore does not fully comply with the directive's requirements.

NB: For a detailed analysis of the 2014 Local Coastal Hazard Assessment (LCHA), including the

¹² Water Technology (2014), Gippsland Lakes Local Coastal Hazard Assessment Project: Report 1 - Summary; p.xix

limitations associated with relying on it as the primary basis for coastal planning, please refer to Appendices A and C.

Does the amendment support or implement the Planning Policy Framework?

The amendment cites several specific clauses of the Planning Policy Framework (many of which are outlined below) to claim consistency with state policy. However, as demonstrated in the following sections, these claims are not supported by the exhibited materials or planning process. The analysis below critically evaluates each cited clause (along with several additional uncited clauses), and explains why the amendment, in its current form, is unlikely to deliver the policy objectives those clauses are intended to achieve.¹³

Clause 11.01-1S – Settlement

The amendment is said to facilitate “sustainable growth,” yet it fails to deliver the integrated planning outcomes required to make that growth sustainable in practice. It defers essential land capability assessments, infrastructure planning, and environmental risk analysis to the post-rezoning Development Plan stage. This directly undermines the PPF’s strategic principle of ensuring land is “suitable for the intended use” and that “environmental, landscape, and cultural values are protected” prior to rezoning. The lack of exhibited plans such as a Public Realm and Water Plan, Coastal Adaptation Plan, or Movement and Transport Framework indicates an absence of front-loaded planning that sustainable settlement planning demands.

Clause 11.01-1R – Settlement – Gippsland

While the Paynesville Growth Area is identified in the regional settlement hierarchy, the amendment undermines key environmental and infrastructure objectives of the *Gippsland Regional Growth Plan*. That Plan emphasises protecting the ecological integrity of the Gippsland Lakes, managing climate change risk, and avoiding development in hazard-prone areas. The amendment fails to exhibit site-specific coastal hazard assessments or demonstrate compliance with Ministerial Direction No. 13, which requires that rezoning in coastal areas assess future sea-level rise and erosion risks using best-available science. Thus, while nominally aligning with the spatial vision of the regional growth plan, the amendment does not implement its underlying policy safeguards, particularly in relation to coastal hazards, biodiversity protection and public amenity. These key issues are discussed in further detail in the Clauses 12, 13 and PPN53.

Clause 11.02-1S – Supply of Urban Land

While rezoning rural land may increase nominal supply, the amendment does not demonstrate that the land is viable or environmentally unconstrained. This clause cautions that “planning for urban growth should consider:

¹³ Please note Clause 11.01-1L-2 which underpinned the rationale for the Amendment in the Explanatory Report has been evaluated in Section 1 of the submission.

- Neighbourhood character and landscape considerations.
- The limits of land capability and natural hazards and environmental quality.”

However, no exhibited coastal hazard vulnerability assessment, coastal adaptation plan, full flood study or biodiversity assessment of the site has been made available. In the absence of this detail, the amendment risks creating lots and infrastructure that are not sustainable in the long term. Refer to Clause 12.05-2S for more detailed analysis of coastal and landscape character considerations and Clause 13 for natural hazard constraints and Clause 12 for environmental limitations

Clause 11.02-2S – Structure Planning

The amendment does not implement a structure plan in the manner envisaged by this clause, in that the PGASP does not sufficiently “facilitate the fair, orderly, economic and sustainable use and development of urban areas”. This shortcoming is primarily due to the amendment’s failure to consider the *Precinct Structure Planning Guidelines* (VPA, 2021)—which are specifically cited as a **policy document** in the relevant clause. Despite this, Council has explicitly stated, in response to formal Questions of Council regarding Amendment C172egip, that it did not consider the *PSP guidelines* to be applicable in East Gippsland. When asked specifically about the amendment’s lack of consistency with the *PSP guidelines*, Council stated:

“The Paynesville Growth Area Structure Plan was prepared in 2016 whilst the Victorian Precinct Structure Plan Guidelines were not released until 2021. The guidelines are optional and are more applicable to a metropolitan context as they are designed to guide the development of new suburbs of a size and scale that is not applicable in East Gippsland. Furthermore, the guidelines only strictly apply to Victorian Planning Authority (VPA) designated precincts which we do not have in East Gippsland”.¹⁴

This position directly contradicts the guidelines’ intended application across both metropolitan and regional growth areas, and undermines the policy basis for delivering integrated and strategically aligned structure planning outcomes. While it is true that the Precinct Structure Planning Guidelines (2021) post-date the original 2016 Paynesville Growth Area Structure Plan (PGASP), this does not diminish their relevance to current structure planning or their policy weight in guiding regional growth area planning today.

The 2021 update to the *PSP guidelines* was specifically intended to expand their application beyond metropolitan growth corridors to include regional and peri-urban growth areas, such as Paynesville. This is explicitly stated by the Victorian Planning Authority:

*"While the Guidelines maintain a focus on preparing PSPs in Melbourne’s new communities, PSPs will also be prepared across regional Victoria’s growing cities and towns. While a more nuanced approach to the application of the Guidelines in these areas is required, the same principles, features and targets should be considered in the regional context, particularly where larger growth areas are proposed."*¹⁵

¹⁴ EGSC Council Meeting -Minutes – Tuesday 15 April 2024; p.8

¹⁵ Victorian Planning Authority, *Precinct Structure Planning Guidelines, 2021, Part 1, p. 3*

The Guidelines include a section titled “Application to the Regions”, which states that while regional circumstances vary, the same planning principles, outputs and targets should be considered and adapted to the local context. This directly refutes the claim that the *PSP guidelines* are only for metropolitan-scale planning or that they are irrelevant to East Gippsland’s growth areas. Further, although the PGASP was first prepared in 2016, the 2023 version of the Structure Plan and this Amendment (C172egip) post-date the release of the *PSP guidelines*. Clause 11.02-2S requires planning authorities to facilitate the orderly development of urban areas and explicitly references the role of structure planning in achieving this. While the *PSP guidelines* are not mandatory, they are a policy document cited in the planning scheme and must therefore be given due regard under Section 12(2)(b) of the *Planning and Environment Act 1987*, which requires planning authorities to consider adopted government policy in preparing planning scheme amendments.

Finally, the assertion that the *PSP guidelines* apply "strictly" to VPA-led precincts is incorrect. The guidelines are written to support all planning authorities in delivering best-practice structure planning outcomes. If anything, regional planning authorities have a greater responsibility to apply consistent strategic planning frameworks, given the absence of direct VPA oversight. Ignoring such guidance risks inconsistent outcomes, fragmented and more costly infrastructure delivery, and reduced long-term community benefit. The *PSP guidelines* should not be dismissed as irrelevant or optional in this context. While not mandatory, they serve as a clear policy benchmark for assessing whether Amendment C172egip meets contemporary expectations for integrated, evidence-based, and strategically coordinated growth area planning in regional Victoria.

Moreover, the proposed amendment fails to align with the *Precinct Structure Planning Guidelines for Regional Victoria* (DELWP, 2021), which provide clear direction on the process and sequencing of greenfield development in all regional areas. The regional PSP guidance advises that structure planning precede rezoning to ensure decisions are evidence-based, integrated, and transparent:

“The structure plan must be prepared prior to rezoning land for urban development to ensure infrastructure planning, environmental constraints, and community needs are fully considered” (DELWP, 2021, p. 11)

In contrast, the proposed amendment applies a Development Plan Overlay (DPO) and rezones land to General Residential Zone *prior* to undertaking the pre-commencement studies that underpin detailed structure planning. This defers critical assessments—such as land capability, ecological values, coastal hazard risk, and drainage catchment modelling that’s closely aligned to the proposed lot, reserve and road layout—until *after* the land has been rezoned. Deferring these critical assessments to the later Development Plan stage undermines the guidelines’ objective of delivering orderly, staged, and climate resilient, cost-effective planning outcomes:

“Rezoning should not occur until sufficient investigations and planning have been undertaken to demonstrate that the land is suitable for development and can be serviced in a coordinated and cost-effective manner.”
(DELWP, 2021, p. 13)

The Guidelines also highlight the risks of ad hoc planning:

“Early rezoning in the absence of structure planning can lead to fragmented development, infrastructure shortfalls, and environmental degradation.”
(DELWP, 2021, p. 6)

Accordingly, the use of the Development Plan Overlay as a proxy for a Precinct Structure Plan (PSP) is inconsistent with both the intent and purpose of the *PSP guidelines*. It represents a backward planning sequence that risks irreversible ecological impacts and places the burden of unintended planning outcomes on council and the community, rather than on the proponent at the appropriate strategic planning stage. A case could also be made that such ‘back-to-front’ planning is at odds with objectives 4(a) and (g) of the *Planning and Environment Act* “to provide for the fair, orderly, economic and sustainable use, and development of land” and “to balance the present and future interests of all Victorians.”

Clause 11.03-2S – Growth Areas

This clause seeks to locate urban growth where it can be efficiently serviced, integrated with transport and infrastructure, and deliver “sustainability benefits” while protecting “valued environmental areas.” Importantly, this clause explicitly references the *Precinct Structure Planning Guidelines* (Victorian Planning Authority, 2021) as a relevant policy document and directs decision-makers to:

*“develop precinct structure plans **consistent** with the Precinct Structure Planning Guidelines... approved by the Minister for Planning.”*

Despite this, the amendment fails to demonstrate sufficient evidence of coordinated land use and infrastructure planning, or integration with regional biodiversity strategies, as required by the objectives and strategies of the clause. It also does not adequately respond to climate change or demonstrate how it will “increase environmental sustainability” or “deliver accessible, integrated and adaptable community infrastructure,” as further detailed in Clauses 12.02-1S, 13.01-1S and 13.01-2S.

Moreover, the amendment’s claim that the development will “retain the special character of Paynesville” is not supported by any neighbourhood character assessment or analysis of valued landscape features. Instead, the removal of the *Significant Landscape Overlay (Gippsland Lakes)* and deletion of character-based provisions from Clause 11.01-1L-2, further undermines the clause’s intent to deliver context-sensitive growth, particularly in sensitive locations such as the ridgetops and north-facing slopes overlooking the coastal interface to Lake King. In doing so, the amendment compromises the policy’s core objectives of integrated planning, environmental and landscape protection, and sustainable development.

Clause 12.01-1S – Protection of Biodiversity

This clause seeks “to protect and enhance Victoria’s biodiversity,” and directs planning authorities to strategically plan for the conservation of significant ecological areas. While the amendment claims to support this objective by proposing the future transfer and rezoning of Lake King foreshore land to the Public Conservation and Resource Zone (PCRZ), the actual size and location of the PCRZ has been pre-determined (extending from the Lake King waterline to the 2.8m contour line)—prior to any detailed biodiversity or coastal hazard vulnerability assessment. This approach is inconsistent with following strategy of clause 12.01-1S:

Use biodiversity information to identify important areas of biodiversity, including key habitat for rare or threatened species and communities, and strategically valuable biodiversity sites.

Furthermore, the deferral of critical assessment as a condition of the Development Plan Overlay (DPO) and the preparation of a Foreshore Improvement Plan, contradicts the clause's requirement for early-stage, strategic biodiversity planning:

Strategically plan for the protection and conservation of Victoria's important areas of biodiversity [emphasis added].

The amendment's penchant for effectively '**planning in reverse**' is inconsistent with the *PSP guidelines* which explicitly require that land capability and biodiversity constraints be identified and addressed *before* land use zones and infrastructure layouts are finalised. The guidelines emphasise that structure plans must be underpinned by an evidence base that includes site-specific ecological studies, and that unresolved constraints—such as coastal vulnerability or ecological significance—must inform rather than follow rezoning decisions. The *PSP guidelines* are clear; just as a good architect maps out structural limitations before sketching the layout, planners must identify ecological and land capability constraints before finalising zoning and infrastructure. Otherwise, you're forcing the design to fit around potential problems you should have resolved first.

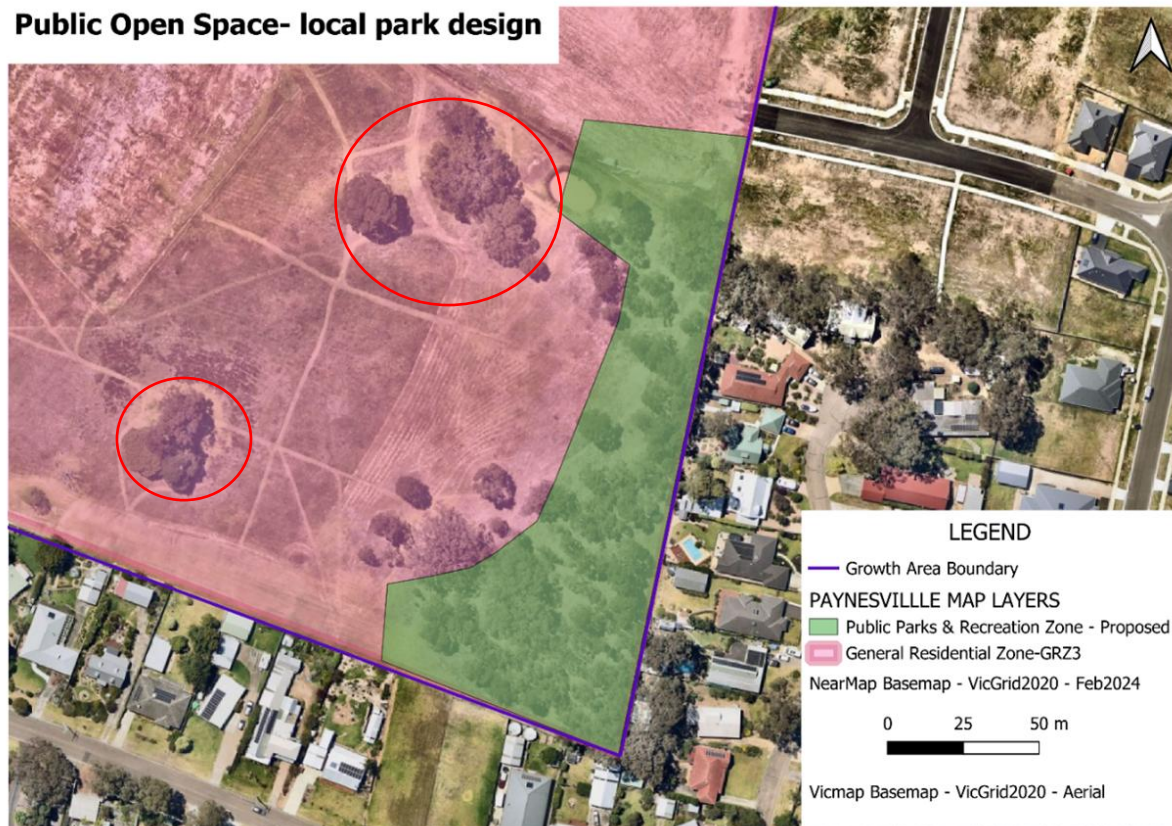
Crucially, DEECA has cautioned that biodiversity values should be **identified and protected at the rezoning stage**, not deferred. Proceeding with detailed planning without ecological assessments risks inappropriate land use outcomes and the potential loss of significant wetland, foreshore and riparian habitat—especially as the Paynesville Growth Area Structure Plan (PGASP) was not informed by any targeted flora or fauna studies or a site-specific coastal hazard impact assessment. The disorderly manner in which the PGASP considered biodiversity values is made evident in the following examples:

- Poor reserve design
- Siting of drainage assets in environmentally sensitive habitat areas
- The destruction of 0.884ha of Endangered Swamp Scrub habitat (EVC 53_61)

Poor Reserve Design

EXAMPLE 1: REMNANT BUSHLAND RESERVE

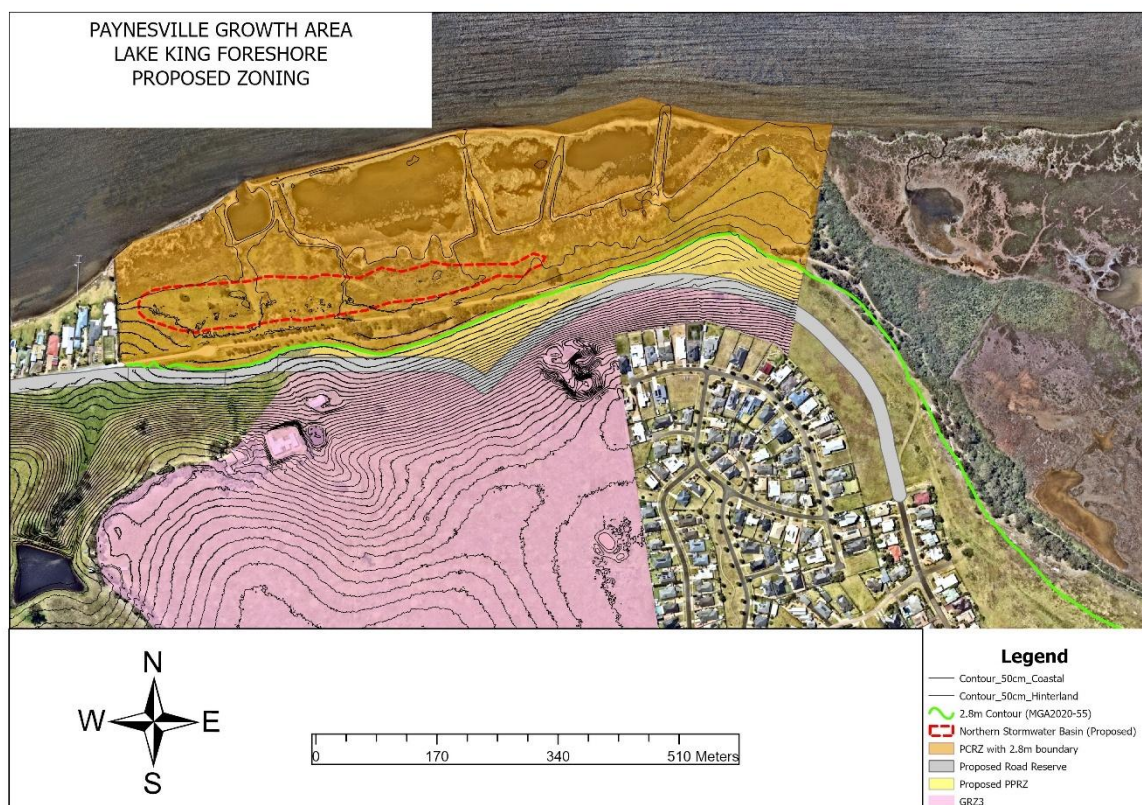
Public Open Space- local park design



The proposed 1-hectare tree reserve (shown above in green) currently excludes areas identified as Endangered Plains Grassy Woodland (EVC 55), which contain large remnant Gippsland Red-gums (*Eucalyptus tereticornis* subsp. *mediana*), as indicated by the areas circled in red. These endangered Red-gum stands provide critical habitat for native wildlife and significantly enhance the coastal and rural character of the town. The design and layout of the reserve would have benefited from the findings of a comprehensive flora and fauna survey. However, this important survey was completed only in 2024—after the 2023 ‘refresh’ of the Paynesville Growth Area Structure Plan (PGASP). Had the flora and fauna assessment been undertaken earlier as part of the initial pre-commencement studies, this biodiversity information could have directly informed the reserve's design. Conducting essential ecological assessments at an early stage of structure planning enables planners to strategically integrate protection and conservation measures for significant biodiversity values into the planning framework.

Example 2: Foreshore reserve

The delineation of the proposed Public Conservation and Resource Zone (PCRZ) highlights significant deficiencies in orderly and strategic planning. Critically, the boundaries of the foreshore reserve were not informed by comprehensive biodiversity data gathered early in the structure planning process.



Neither the original 2016 structure plan nor the 2023 refreshed plan provided substantial evidence of strategic biodiversity planning. This oversight was demonstrated clearly by the initial reserve boundary, which simply adopted the existing road easement as its southern limit. The subsequent revision of the southern boundary to follow the 2.8m AHD contour line was made very late in the process, largely driven by community submissions during the amendment's exhibition and consultation phases. Moreover, the new urban boundary now cuts through what was once contiguous habitat. It would appear no consideration was given to potential impacts this excision of land from the future reserve might have on biodiversity and long-term viability. This is emblematic of the amendment's disorderly approach to biodiversity planning, where major zoning decisions are undertaken without any impact analysis whatsoever. Significantly, this updated boundary was established primarily as a coastal hazard mitigation measure without referencing ecological criteria or detailed biodiversity data, which were never specifically requested nor obtained during the structure planning process. Instead, an administrative boundary was simply redrawn using the outdated 2014 coastal hazard assessment.

The reliance on the 2.8m AHD contour as a reserve boundary is problematic for multiple reasons. Not only does it disregard biodiversity considerations, it also provides questionable effectiveness in mitigating coastal hazards. Specifically, the new boundary fails to adequately account for dynamic coastal processes, such as shoreline retreat, sea-level rise, and the inland migration of wetlands—all processes vital for maintaining coastal biodiversity. Moreover, the proposed siting of public infrastructure within areas vulnerable to these natural processes' risks impeding natural shoreline migration and ecological adaptation as sea levels rise

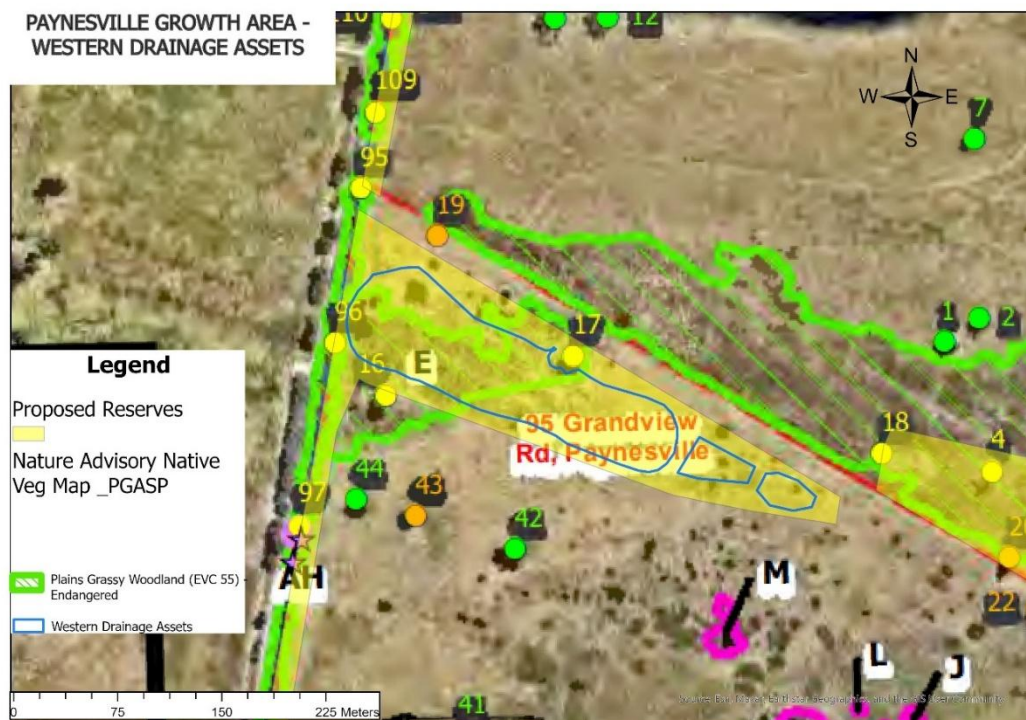
(discussed further in the next section). This approach directly conflicts with the objectives outlined in Section 4(b) of the Planning and Environment Act 1987, which requires the "protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity."

Furthermore, the 2.8m AHD contour line itself is derived from outdated hazard modelling conducted in 2014 (refer to Appendix A for details), thus failing to integrate contemporary coastal hazard data or the latest sea-level rise projections. Without explicitly considering current ecological conditions, coastal processes, or updated hazard assessments, the amendment does not provide adequate setbacks or adaptation buffers. Instead, the habitat area above 2.8 m AHD which had the greatest resilience to coastal hazard risks was removed to align the reserve with the hazard line boundary. Consequently, this oversight potentially compromises the long-term ecological resilience and functionality of the reserve.

While applying the PCRZ to the foreshore reserve is supported in principle, its strategic effectiveness remains substantially undermined by the absence of mapped ecological values and the lack of a comprehensive, site-specific coastal hazard vulnerability assessment to justify the precise location and extent of zone boundaries.

Siting of Drainage Assets in Environmentally Sensitive Habitat Areas

The placement of drainage infrastructure within environmentally sensitive habitat areas reflects a significant failure of integrated and orderly strategic planning, stemming largely from the lack of timely ecological assessments during the initial planning phase. Specifically, the proposed western drainage assets are located in areas containing Endangered Plains Grassy Woodland (EVC 55), which supports valuable biodiversity and remnant vegetation. The map below is an extract from the Nature Advisory Flora and Fauna Assessment with the proposed western stormwater infrastructure overlaid on top (blue line).



Similarly, the proposed northern stormwater infrastructure (shown as a red polygon in the map below) directly impacts habitat areas of the EPBC-listed migratory bird species, Latham's Snipe, as well as Estuarine Swamp Scrub (EVC 53) within the Ramsar-fringing foreshore zone. Introducing stormwater infrastructure into these ecologically important coastal interfaces risks significantly disrupting natural coastal processes, such as habitat migration, shoreline retreat, and wetland adaptation to sea-level rise.



Consequently, this inadequately informed stormwater infrastructure siting decision is likely to lead to long-term ecological degradation, undermining the biodiversity, resilience, and overall ecological integrity of the coastal environment. The early completion and integration of comprehensive ecological, biodiversity, and coastal hazard assessments within the initial structure planning phase could have guided more sustainable and strategically appropriate reserve design and locations for stormwater infrastructure from the outset. In sum, utilising biodiversity and hazard data to inform zoning decisions is essential to ensure the effective protection and maintenance of environmental values in an orderly, efficient, and integrated manner.

Destruction of 0.884ha of Endangered Swamp Scrub habitat (EVC 53_61)



Figure x: Near map aerial image taken Jan 8 2023. Note the Swamp Scrub (green crosshatch)



Figure x: Near map aerial image taken Feb 2024. Note the dam and Swamp Scrub (green crosshatch) have been removed.

The removal of approximately 0.884 hectares of endangered Swamp Scrub (EVC 53_61) at 5 Grandview Ave, Paynesville, occurred between January 2023 and February 2024. Photograph 1 – reproduced from the Nature Advisory Flora & Fauna Assessment Report (2024; p.25) gives a visual representation of the EVC before its removal, which is identified as “Aquatic Habitat Zone

C” in the photograph and the accompanying report. The potentially unauthorised removal of this endangered EVC suggests that Council and planning authorities did not adequately identify this ecologically significant habitat at an early planning stage, leading to subsequent inconsistencies with Clause 12.01-1S (Protection of biodiversity) and possibly Clause 12.01-2S (Native vegetation management). Specifically, a critical flora and fauna assessment was neither conducted early enough nor explicitly requested by Council during preliminary structure planning.



Photograph 1: Aquatic habitat – Habitat Zone C. shallow freshwater ephemeral wetland dominated by rushes and closely grazed herbs and grasses.

Consequently, the proponents proceeded to clear the endangered Swamp Scrub, presumably without completing the required detailed assessment to determine. Early ecological assessments are fundamental to structure planning, enabling planners to proactively identify, protect, or appropriately offset significant biodiversity values. In this instance, it remains unclear whether the proponent adhered to Clause 12.01-2S by obtaining the necessary vegetation removal permit. Such an application would typically require referral to the Department of Energy, Environment and Climate Action (DEECA) for a detailed assessment in accordance with the

Guidelines for the removal, destruction or lopping of native vegetation (DELWP, 2017). These guidelines explicitly require biodiversity offsets to be identified and secured through third-party arrangements before native vegetation is cleared.

In summary, the amendment fails to adequately implement Clause 12.01-1S by:

- deferring critical biodiversity assessments to DPO10,
- failing to integrate contemporary climate science and site-specific coastal hazard assessments early in the structure planning,
- overlooking relevant policy guidance provided by DEECA and the Precinct Structure Planning Guidelines,

Therefore, the amendment does not deliver strategically integrated and timely biodiversity protection. This approach falls short of both State policy requirements and established best practices in strategic biodiversity planning

Clause 12.02-1L – Protection of coastal areas

This policy aims to ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation. This objective is achieved by ensuring decisions that involve, or will lead to, the removal, destruction or lopping of native vegetation, apply the **three-step approach** in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (Department of Environment, Land, Water and Planning, 2017) an incorporated document under the PPF. The three-step approach is thus not a discretionary guideline, and all planning decisions must directly follow the three-step process when considering native vegetation related matters in the order outlined below:

1. Avoid the removal, destruction or lopping of native vegetation.
2. Minimise impacts from the removal, destruction or lopping of native vegetation that cannot be avoided.
3. Provide an offset to compensate for the biodiversity impact from the removal, destruction or lopping of native vegetation.

The native vegetation guidelines specify that:

*The **strategic planning process** is the **most effective planning mechanism** to protect and manage native vegetation and to achieve the objectives of the SPPF. Considering how native vegetation will be protected and managed through strategic planning:*

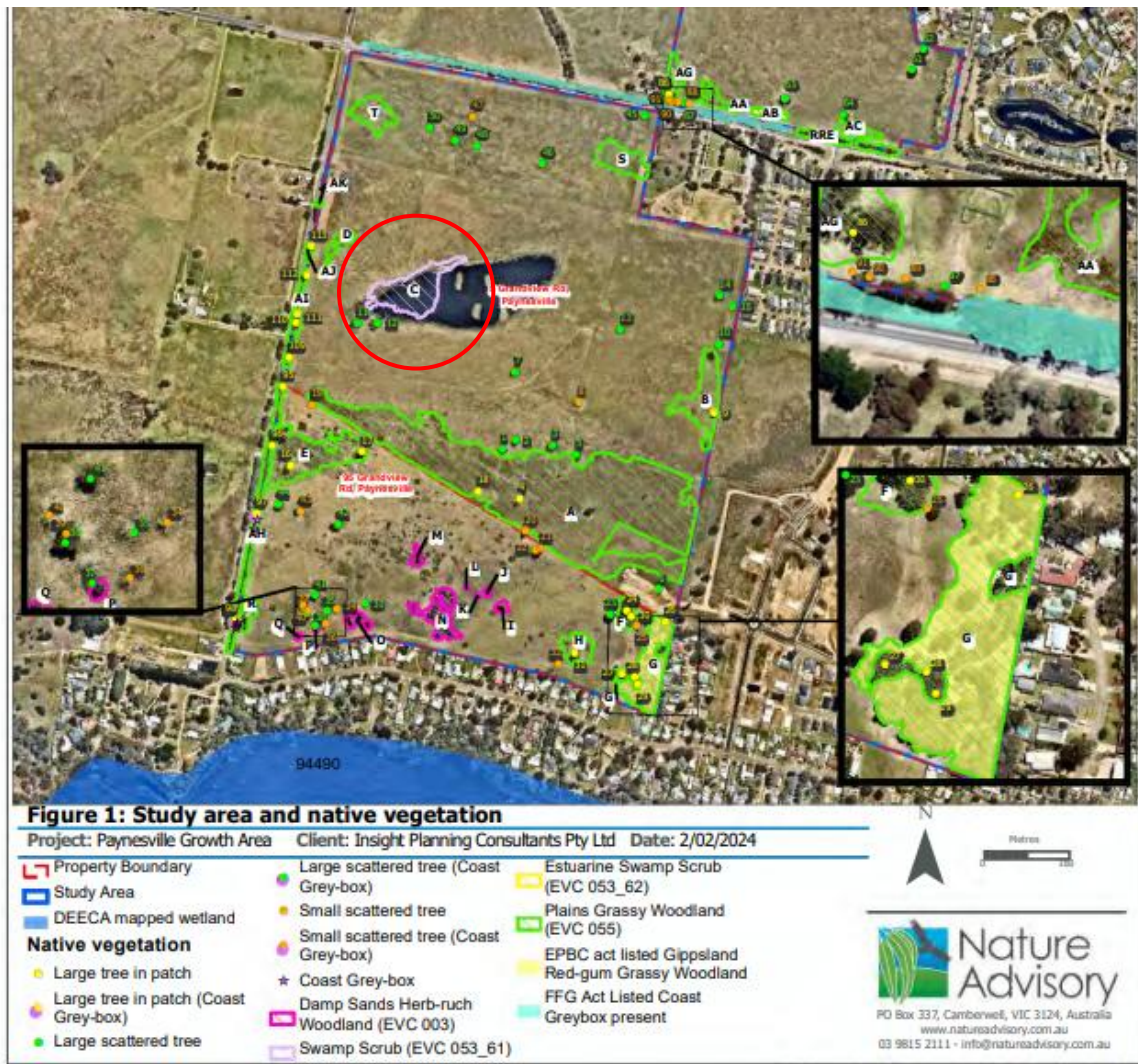
- *allows for identification of areas of higher value native vegetation at a landscape scale*
- *allows for indirect and cumulative impacts of use or development on native vegetation to be understood and addressed*
- *provides the best opportunity to avoid and minimise impacts on native vegetation by directing use and development away from higher value areas*
- *minimises unnecessary or complex regulation by establishing clear expectations for where use and development can occur, and/or by coordinating approvals and offsets.*

The methods and approaches outlined in the Guidelines should be used to inform strategic planning processes and the application of appropriate planning controls to ensure Victoria's native vegetation is well managed and protected.

The potentially unauthorised removal of Habitat Zone C (circled in red in the Nature Advisory Map shown overleaf) highlights how timely ecological assessments are fundamental to orderly and integrated structure planning. Adopting the three-step approach at the **strategic planning level** is critical to the protection of biodiversity in Victoria, particularly in heavily modified landscapes such as the growth area - where remnant native vegetation is often rare and/or endangered at the bioregional level. Even degraded endangered habitats or a single large old tree in a largely denuded landscape, has relatively high conservation value. Rare and endangered EVC's like Swamp Scrub are still valuable when in poor condition because of their very high conservation value when managed appropriately – enabling their degraded elements to be restored over time.

The effective implementation of the three-step approach necessarily begins with obtaining survey reports of the existing native vegetation and fauna in any given project area. This biodiversity information is critical to **evidence-based structure planning** that appropriately identifies and avoids or minimises direct, indirect and cumulative impacts of use and development on significant native vegetation and habitats. As stipulated by the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017), strategic planning “provides the best opportunity to avoid and minimise impacts on native vegetation by directing use and development away from higher value areas.”

In this instance, a lack of timely flora and fauna survey data ensured the three-step approach was not followed at the strategic planning level. Had Council requested or obtained a biodiversity report during the pre-commencement phase the PSP process, it is possible an alternative pathway to avoid or minimise impacts to Habitat Zone C could have been found.



Moreover, it remains unclear whether DEECA (or its predecessor agencies), prior to their February 2025 recommendation to “include a strategic assessment of biodiversity values,” had previously recommended Council follow the ‘three-step hierarchy approach’ during the preparation of the 2016 and 2023 Structure Plans. If such referral advice was indeed given, and subsequently ignored or not followed, then this would indicate a systematic failure by the responsible planning authority to strategically plan for the protection of important areas of biodiversity.

In this instance, it is also disappointing that the proponents did not disclose the existence of their Flora & Fauna Assessment report (completed in Feb 2024) until June 2025 as part of the Planning Panel Hearings process. The delay in providing Council with the biodiversity report contributed to the unfortunate disorderly planning outcome for Habitat Zone C. Nonetheless, the primary responsibility for orderly and integrated planning rests with the Responsible Authority for planning, and it is hoped this incident underscores the significance of obtaining and integrating valuable biodiversity information very early on in the PSP process.

It also remains unclear whether the proponent adhered to Clause 12.01-2S by obtaining the necessary vegetation removal permit. In the current context, such an application would typically trigger a referral to the Department of Energy, Environment and Climate Action

(DEECA) for a detailed assessment in accordance with the three-step approach. The *Guidelines (2017)* explicitly require biodiversity offsets to be identified and secured through third-party arrangements *before* native vegetation is cleared and only as a last resort - after all possible impact avoidance and minimisation pathways have been exhausted. The guidelines are unequivocal that all potential pathways to avoid or minimise impacts must first be considered and exhausted, before native vegetation can be cleared and offset.

Clause 12.02-1S – Protection of the Marine and Coastal Environment

This clause gives policy effect to the *Marine and Coastal Policy 2020* and the *Marine and Coastal Strategy 2022*, which together articulate a clear planning directive to “**protect and enhance the marine and coastal environment**” [emphasis added]. While these are non-statutory policy documents, their integration into the Planning Policy Framework gives them practical force in guiding land use and development decisions under the *Planning and Environment Act 1987*.

The inclusion of the term “enhance” signals a proactive policy intent - decision-makers are directed not only to safeguard existing environmental values but also to actively improve ecological conditions where degradation has occurred. This is particularly relevant to the Lake King foreshore and adjoining catchment, which have been substantially modified. The clause further mandates the protection and enhancement of “natural features, landscapes... and public visual corridors,” reinforcing the expectation of ecological and landscape improvements through revegetation and restoration, especially in areas adjoining coastal reserves. The amendment’s Foreshore Improvement Management Plan (FIMP) implicitly acknowledges the policy intent of this clause but falls short as an adaptation response to climate change.

The Foreshore Improvement Management Plan (FIMP)

In light of current and projected climate change impacts, the enhancement of coastal ecosystems must support **climate-resilience**. Restoration efforts need to anticipate future risk scenarios — including sea level rise, coastal erosion, and increased storm intensity — and should incorporate adaptation measures that support **long-term ecological viability**, including large setbacks from the present foreshore to enable inland habitat migration. In this context, the policy requirement to “enhance” must be understood not as a static or cosmetic objective, but as a forward-looking, resilience-based planning principle that aligns with Victoria’s integrated coastal zone management framework and the precautionary principle embedded in state planning policy. The FIMP falls short of this principle precisely because it is limited to a predetermined spatial area that will be heavily impacted by coastal inundation and erosion. A climate responsive FIMP would extend upslope past the 2.8m AHD contour to include land less vulnerable to coastal hazards, and therefore more likely to be climate-resilient beyond 2100.

The Public Conservation and Resource Zone (PCRZ), which is intended to underpin the Foreshore Improvement Management Plan (FIMP), is not proposed to be applied as part of this amendment. Instead, its implementation has been deferred to a future and as yet unspecified stage. This sequencing raises substantive concerns regarding the integrity of orderly, integrated coastal planning, particularly with respect to the timely application of environmental protections and land management controls.

Premature rezoning with insufficient evidence

Compounding this issue, the spatial extent of the future PCRZ has already been delineated *prior* to the completion of any ecological or site-specific coastal hazard assessments. As such, the proposed zoning boundaries do not appear to be informed by context-appropriate assessments regarding ecosystem values, coastal processes, or projected climate risks.

This approach undermines the core policy objective of strategically protecting and enhancing the coastal environment. It is clearly inconsistent with the principles of orderly, evidence-based, and precautionary planning as required under the *Planning Policy Framework*, including Clauses 12.02-2S and 13.01-2S. As noted by the Marine and Coastal Policy’s guiding principle of ‘Evidence-based decision-making,’ which is defined under section 11 of the *Marine and Coastal Act 2018* as:

“a guiding principle for the management of the marine and coastal environment that marine and coastal planning and management decisions should be based on best available and relevant environmental, social and economic understanding, recognising that information will often be limited”.

Lack of integrated coastal zone planning

The PGASP zoning was not informed by detailed biodiversity or site-specific coastal hazard assessments. Instead, the amendment proposes to defer both the flora and fauna assessments and the preparation of the Foreshore Improvement Plan (FIMP) to the Development Plan stage. The FIMP is intended to evaluate coastal hazard vulnerability—including sea level rise, storm surge exposure, and shoreline processes—and propose appropriate mitigation measures.¹⁶ However, proceeding with rezoning prior to undertaking these critical assessments is inconsistent with the guiding principle of integrated coastal zone planning and management, central to the two marine and coastal policy documents cited by this clause.¹⁷ The principle is defined in Part 2 s8(1)(2) of the *Marine and Coastal Act 2018*:

(1) It is a guiding principle for the management of the marine and coastal environment that planning and management should be co-ordinated and integrated, as appropriate, across—

(a) the marine and coastal environment and associated catchments; and

(b) the water cycle, including as it relates to estuaries, oceans, bays and coastal waters, groundwater and waterways, where this affects the marine and coastal environment and water quality; and

(c) industry sectors and users of the marine and coastal environment; and

(d) land tenure where this affects the marine and coastal environment.

¹⁶ EGSC Council Meeting Agenda 15 Apr 2025; p.24

¹⁷ Refer to *Marine and Coastal Policy* (Department of Environment, Land, Water and Planning, 2020) *Marine and Coastal Strategy* (Department of Environment, Land, Water and Planning, 2022)

(2) Planning and management should also take into account long-term and short-term environmental, social and economic considerations

The ‘**rezone first, consider the evidence later**’ approach adopted by the amendment in relation to the coastal zone and its catchment falls well short of this guiding principle. Identifying and mapping significant environmental values and coastal processes, including shoreline and habitat retreat as sea levels rise needs to occur early in the strategic planning process. The absence of *site-specific* environmental and topographic (LiDAR) surveys for instance, risks overlooking ecologically significant values and coastal processes that may well extend beyond the 2.8 m AHD foreshore reserve boundary in the long term. Moreover, any ecological or hazard mitigation actions identified after rezoning may be constrained by:

- land use zoning decisions already locked in,
- cross-boundary land tenure issues,
- the loss of low-cost, nature-based adaptation options,
- A stormwater management strategy not fully integrated with the water cycle of downstream habitats

The ‘**rezone first, consider the evidence later**’ approach adopted by the amendment in relation to the coastal zone and its catchment falls well short of this, and all other, guiding principles of the Marine & Coastal Act and Policy. Identifying and mapping significant environmental values and understanding coastal processes, including shoreline and habitat retreat as sea levels rise, needs to occur early in the strategic planning process. *Site-specific* environmental surveys and topographic (LiDAR) informed hydrodynamic and geomorphological modelling are the ‘gold standard’ for high resolution temporal and spatial analysis of coastal hazard risk and environmental impact at the *property level*. If such high-resolution analysis is not feasible or required for strategic planning purposes, then the next best alternative is to utilise the latest Probabilistic Coastal Inundation Assessment datasets for East Gippsland (CSIRO, 2024).¹⁸

Using best available coastal hazard assessment data

Updated international and Victorian guidance now recommend a risk-based approach considering probabilistic and higher-end sea-level rise scenarios (IPCC AR6, 2021; *Victorian Resilient Coast Extended Guideline*, 2022). The CSIRO probabilistic inundation layer for East Gippsland provides estimates of the likely range (uncertainty) of how high future design storm water levels will reach, using numerical simulations of historic extreme water levels with future mean sea level projections from the sixth IPCC assessment report (AR6). The flood estimates are presented as **indicative hazard zones** – appropriate for strategic planning and climate risk appraisal. Although based on a probabilistic static ‘bathtub’ rather than a dynamic inundation model, the dataset does incorporate a freeboard allowance for wave setup. Moreover, augmented bathtub modelling using relatively high-resolution data may provide an acceptable

¹⁸ Refer to Appendix C: Response to Expert Witness Statement of Warwick Bishop – Hydrology and Flooding (Amendment C172egip, 2025) for further detail on the CSIRO inundation mapping for the East Gippsland Local Government Area (LGA)

low-cost alternative approach to dynamic flood modelling in young lake-like estuarine systems such as the Gippsland Lakes (Kumbier, et al. 2019).

By contrast, the amendment's use of a fixed contour line to denote safe and unsafe areas to 2100 is exceptionally simplistic. It does not account for the temporal and spatial aspects of coastal inundation (e.g. flood duration, wave overtopping, multi-day flood peaks, shoreline erosion) nor the inherent uncertainties of future climate impacts across a range of emissions scenarios– critical factors for infrastructure resilience and ecological impact in estuarine environments. Additionally, no freeboard allowance was applied to the +0.8 m Sea Level Rise to account for wave setup, and fails to incorporate event probabilities and unexpected flood factors; effectively representing only a single, static 'bathtub' inundation scenario. Thus, the 2.8 m AHD benchmark adopted by the amendment, and justified by the expert report without reference to the latest available probabilistic coastal inundation modelling does not effectively account for compound hazards, coastal processes that lead to shoreline retreat, or higher-end sea-level rise scenarios. This simplistic and deterministic approach could significantly underestimate future risks by a considerable margin, and fails to align with contemporary risk assessment methodologies and best practice.

Therefore, the amendment cannot be confident that plausible, high emissions sea level rise scenarios won't compromise significant coastal values and impact coastal processes beyond the 2.8 m AHD foreshore reserve boundary over the longer term. Moreover, any ecological or hazard mitigation actions identified after rezoning may be constrained by:

- Land use zoning decisions already locked in,
- Cross-boundary land tenure issues,
- The loss of low-cost, nature-based adaptation options,
- A stormwater management strategy not fully integrated with the water cycle of downstream habitats

This sequencing flaw undermines the amendment's credibility and increases the likelihood of maladaptive planning outcomes and avoidable environmental degradation in future years. Furthermore, rezoning land prior to detailed environmental assessments risks direct, cumulative and synergistic effects on sensitive ecosystems and habitats, contrary to the strategies of clause 12.02-1S:

Minimise direct, cumulative and synergistic effects on ecosystems and habitats.

Maintain the natural drainage patterns, water quality and biodiversity in and adjacent to coastal estuaries, wetlands and waterways.

The lack of consideration of flora and fauna surveys and detailed biodiversity assessments **at the rezoning stage** is of particular concern, given the saltmarsh wetland and coastal grasslands are known to support at least eight EPBC-listed migratory species,¹⁹ including:

- Red-necked stints
- Sharp-tailed sandpipers
- Red-capped plovers

¹⁹ Birddata database records; BirdLife East Gippsland, pers. com. (May 2025)

- Common greenshanks
- Pacific golden plovers
- Grey plovers
- Pied stilts
- Latham’s snipe (also listed as Vulnerable under the EPBC Act).

In sum, the sites’ coastal zone supports:

- at least eight protected migratory species (including a migratory species listed as Vulnerable under *the Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act),
- contains 8.334 Ha of Endangered Estuarine Swamp Scrub (EVC 53_62) and may also contain Vulnerable Temperate Coastal Saltmarsh EVC (53_62) *EPBC Act*-listed with further survey effort.²⁰
- the land the adjoins the internationally significant Ramsar-listed wetlands of Point Fullarton, and
- 17 EPBC-listed Latham’s Snipe were recorded in just 2 targeted surveys in Nov 2023 inside the project area.²¹
- a nationally significant population of Latham’s snipe occurs on the adjoining private land.²²

In this context, a detailed environmental assessment is essential to determine whether a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is required. In accordance with the principles of orderly, efficient, and integrated planning, such matters should be resolved **prior to rezoning**, not deferred. Addressing this significant site constraint at the strategic planning stage minimises the risk of reactive or ad hoc amendments to zoning and overlay controls, or substantial and costly revisions to the Development Plan—which, under the current process, is unrealistically expected to be finalised and adopted by Council as early as 2026.²³ Early resolution would also provide greater certainty to landowners, developers, and the community, and ensure compliance with national environmental obligations from early on in the process.

Inadequate Buffer for Dynamic Coastal Systems

The amendment also fails to incorporate sufficient setbacks to accommodate coastal recession, shoreline retreat, and wetland migration—coastal processes that are implicitly recognised in Clauses 12.02-1S:

Protect and enhance the overall extent and condition of native habitats and species diversity distributions across public and private land in the marine and coastal environment.

²⁰ Nature Advisory *Flora & Fauna Assessment* (2024); pp.22,29

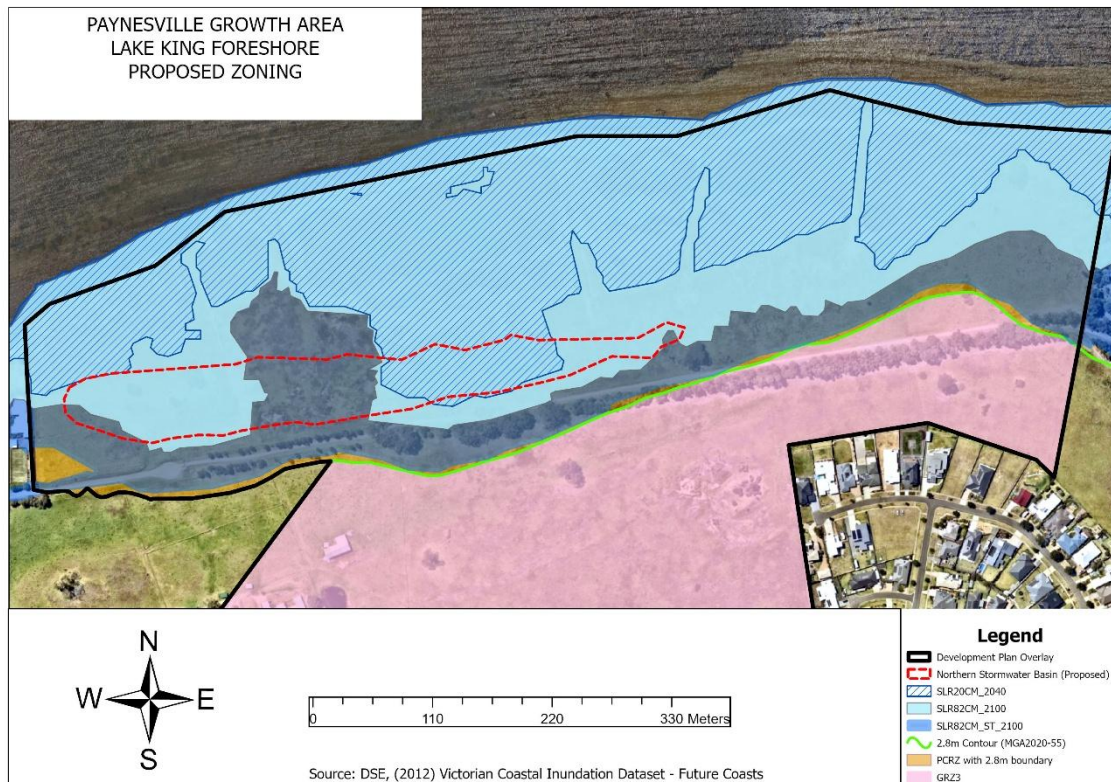
²¹ 15 Latham Snipe recorded in targeted surveys in the coastal zone during 14/15 Nov 2023 as noted in the Nature Advisory *Flora & Fauna Assessment* (2024). P.29

²² A proposed development on the adjacent 10.7ha property is subject to a “Controlled Action” order under the EPBC Act and currently under review by VCAT Ref: P1514/2023

²³ EGSC Council Meeting Agenda 15 Apr 2025; Officer Report; p.10

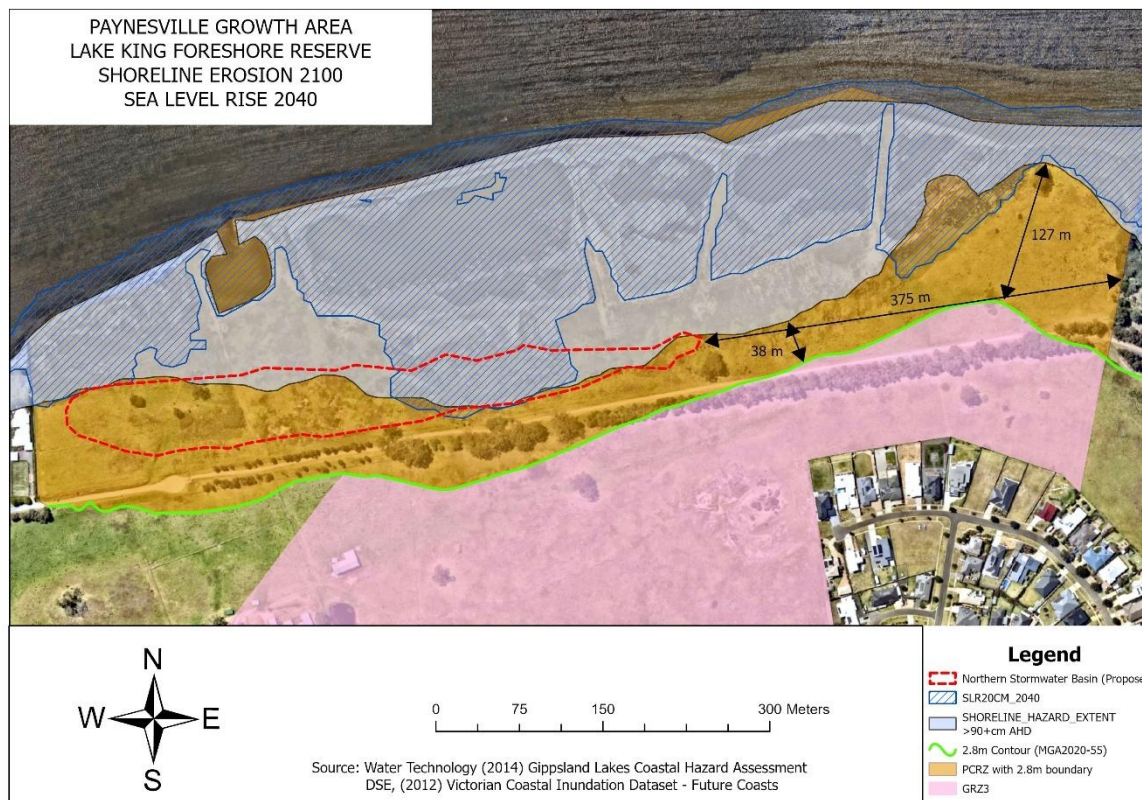
Minimal climate change adaptation buffers have been provided to allow for habitat retreat as sea levels rise and the foreshore erodes and retreats over time, as shown in the map overleaf. The map of projected foreshore inundation from 2040 to 2100, based on the Victorian Coastal Inundation Dataset (2012)- which was derived from the Future Coasts project - specifically as a conservative strategic decision support tool for coastal planners, highlights the inherent coastal hazard risks of the Lake King coastal zone.

Without mitigation measures such as sea walls or levees, a projected 20cm sea level rise is



likely to permanently inundate about 11.63ha or about 51.05% of the proposed 22.79ha future Public Conservation Resource Zone (PCRZ). By 2100, over 17ha or 74.76% of the proposed PCRZ will be permanently inundated by a projected 82cm sea level rise if no protective measures are taken to hold back the lake waters. Around 22ha or 97% of the conservation reserve will be impacted by the projected 82cm sea level rise and increasingly frequent storm and tide surges by the turn of this century.

Adopting the far more optimistic SLR methodology of the LCHA (2014) shoreline erosion mapping report (shown below), the projected loss of Lake King foreshore is still severe.



It is clear that the proposed adaptation buffers remain inadequate to effectively protect high-conservation coastal habitats (as per the map below). At its widest point the PCRZ in 2100 is 127 m from the 2.8 m AHD line, and just 38 m from GRZ boundary at its closest point. Given the length of the proposed drainage basin, by 2100 only around 39% (385 m of the 985 m long) foreshore reserve is not projected to be impacted by coastal squeeze. Interestingly, the Victorian Coastal Inundation _Future Coasts layer showing the projected extent of a 20cm Sea Level Rise (SLR) by 2040 in blue crosshatch protruding past the LCHA 2100 projected shoreline over on the eastern bluff. The different inundation extents resulting from the two projects highlights the complexities and uncertainty inherent in SLR modelling, given both the LCHA (2014) and Vic Inundation datasets (2012) used the same 1m Coastal DEM with a vertical accuracy of +/- 10 cm.

The overall extent and condition of native habitats and species diversity within the reserve are expected to experience a catastrophic decline unless :

- adequate adaptation setbacks are put in place incorporating all suitable gently sloping foreshore land to ensure endangered habitats can migrate further upslope as sea levels rise.
- costly defensive sea walls are built, and continually raised, to effectively keep rising sea levels at bay for ever. This option however will impede natural coastal processes and cause worsening erosion to adjacent, unprotected coastal habitats

Clause 12.02-2S – Marine and Coastal Crown Land

This clause gives policy effect to the *Marine and Coastal Policy 2020* and the *Marine and Coastal Strategy 2022*, which together articulate a clear planning directive to “*protect and enhance the marine and coastal environment.*”

While these are non-statutory policy documents, their integration into the Planning Policy Framework gives them practical force in guiding land use and development decisions under the *Planning and Environment Act 1987*.

The inclusion of the term “enhance” signals a proactive policy intent - decision-makers are directed not only to safeguard existing environmental values but also to actively improve ecological conditions where degradation has occurred. This is particularly relevant to the Lake King foreshore and adjoining catchment, which have been substantially modified. The clause further mandates the protection and enhancement of “natural features, landscapes... and public visual corridors,” reinforcing the expectation of ecological and landscape improvements through revegetation and restoration, especially in areas adjoining coastal reserves.

The amendment is not consistent with the requirement that use and development on or adjacent to marine and coastal Crown land demonstrates need, has a coastal dependency, maintains public benefit, and minimises the loss of public open space. These objectives are especially critical given the subject area is exposed to significant coastal hazard risks, particularly sea level rise, erosion and inundation.

The foreshore zone within the amendment area includes a narrow strip of existing Crown land at the waterfront, with the remainder proposed for eventual transfer and rezoning to the Public Conservation and Resource Zone (PCRZ). However, this entire foreshore area is at serious risk of long-term inundation, shoreline retreat and erosion, due to projected sea level rise of at least 0.8 m by 2100. DELWP coastal hazard mapping confirm that much of this low-lying land—comprising unconsolidated Holocene dune and swamp deposits—is likely to be intermittently or permanently inundated by storm surge and tidal events within the planning horizon.

Despite these risks, the amendment does not apply any coastal hazard overlay or enforce a precautionary setback that would preserve more of the foreshore’s public open space into the future. Instead, it relies on a fixed 2.8 m AHD exclusion line, derived from outdated modelling, which closely abuts the upper extent of the projected 2100 inundation zone. This approach leaves no margin for error or allowance for dynamic shoreline processes, and fails to preserve inland retreat areas necessary for ecosystem migration, public access, or community benefit. As previously noted, without a wider adaptive buffer, by as early as 2040, around 51% of the PCRZ is likely to be permanently inundated by a projected 20cm sea level rise; with the majority of the future PCRZ expected to become unusable or unsafe by the end of the century.

Further, Clause 12.02-2S requires that coastal Crown land uses must minimise loss of public open space and maintain or enhance public benefit. Yet, the amendment facilitates residential development directly adjacent to this vulnerable zone without securing alternative inland areas for recreation, foreshore access, or ecological restoration. This creates a path dependency where future adaptation options—such as retreat, habitat restoration, or public infrastructure

realignment—are foreclosed by fixed residential boundaries set too close to a dynamic shoreline.

In summary, the amendment does not align with Clause 12.02-2S because:

- It fails to plan for the long-term public use and accessibility of coastal Crown land that is highly vulnerable to inundation and erosion;
- It does not provide for adaptive buffers that would support public benefit, safety, or ecosystem retreat;
- It permits public and community infrastructure development in locations that may become unviable or unsafe within the planning horizon;
- It relies on outdated hazard modelling and defers meaningful coastal hazard assessment to the Development Plan stage, undermining the precautionary intent of the clause.

Clause 12.03-1S – River and riparian corridors, waterways, lakes, wetlands and billabongs

This clause aims to “*to protect and enhance waterway systems including river and riparian corridors, waterways, lakes, wetlands and billabongs*”. Again, the policy goal here is to improve upon lake and wetland values rather than just conserving them in their current condition, reinforcing the strategic intent of clauses 12.01-1S and 12.02-1S. Clause 12.03-1S seeks to protect and enhance Victoria’s waterways, lakes, wetlands and riparian corridors as significant environmental, cultural, and landscape assets. However, these values are increasingly threatened by the impacts of climate change—particularly sea level rise, increased wetland inundation, and shoreline erosion. These coastal hazards will directly compromise the integrity of Lake King’s foreshore parklands, wetland habitats, and surrounding landscape features. Without proactive intervention, many of the lake’s low-lying ecological and recreational areas—most of which lie below 2.8 m AHD—will be periodically and then permanently inundated as sea levels rise, resulting in the loss of both environmental values and public amenity. Attempting to restore or enhance foreshore values after these areas have been submerged or eroded is neither practical nor consistent with the clause’s directive to enhance, not merely conserve, waterway systems.

To meet the clause’s policy objectives, any development proposal in proximity to Lake King must demonstrate a long-term, climate-resilient approach to waterway and foreshore management. Achieving a balance between public use and the protection of fragile lake-edge and wetland habitats demands the reservation of much wider coastal buffers, including land well above 2.8 m AHD. Such buffers provide space for nature-based adaptation, including habitat retreat, bank stabilisation, and the inland migration of riparian vegetation communities. Development “in sympathy” with adjoining Crown land—particularly public foreshore reserves—must not undermine the long-term viability of those public assets. This includes acknowledging the risks to foreshore values posed by intensifying climate hazards and

associated infrastructure pressures such as road realignments, stormwater drainage, and defensive works that disrupt natural geomorphology.

Furthermore, retaining safe and equitable public access to the lakeshore and foreshore parklands—as envisaged under Clause 12.03-1S—will become increasingly difficult as low-lying land is rendered unsafe or permanently inaccessible due to flooding or erosion. The strategic objectives to enhance parklands, recreational green spaces, and pedestrian/cycling linkages will be fundamentally compromised unless sufficient land is set aside now—before rezoning occurs—to allow for long-term environmental protection and passive public use. If these areas are not proactively protected through adequate buffers and zoning, there is a real risk that public foreshore land will be incrementally lost to coastal hazards or functionally privatised as safe, accessible areas retreat behind development boundaries. In such a scenario, costly protective works may be required merely to retain minimal access—an outcome that is neither environmentally sustainable nor economically defensible.

Clause 12.05-1S –Environmentally sensitive areas

The amendment appears inconsistent with Clause 12.05-1S, as its key planning response to climate risk is speculative and deterministic, and is likely to fall short of adequately protecting the environmental and recreational values of the Lake King foreshore area over the long term. The development proceeds in advance of appropriate hazard and ecological assessments and does not establish sufficient coastal buffers to account for sea level rise, inundation, or erosion.

By permitting development in close proximity to a vulnerable and dynamic shoreline, the amendment risks long-term degradation of the foreshore’s ecological function and public amenity. This approach undermines the intent of Clause 12.05-1S, which explicitly seeks to prevent development that would diminish the environmental conservation or recreational values of the Gippsland Lakes and its foreshore.

Clause 12.05-1L - Environmentally sensitive areas

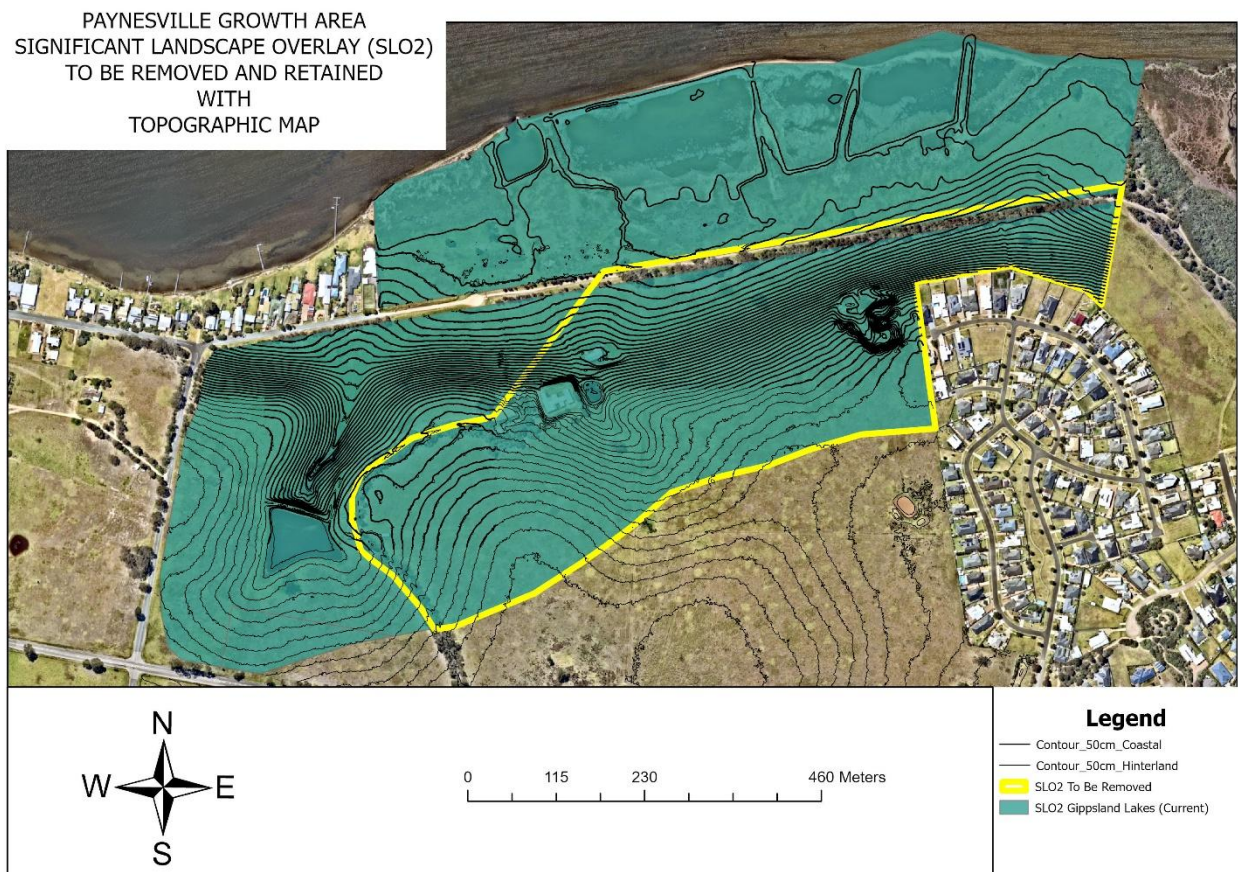
The amendment is inconsistent with the objectives and strategies of Clause 12.05-1L, which seeks to protect and enhance the environmental, cultural, and aesthetic values of East Gippsland’s most sensitive landscapes. The subject land includes foreshore areas and north-facing slopes that directly interface with Lake King—a region clearly identified in the planning scheme as having high environmental sensitivity and landscape value, further reinforced by the application of the Significant Landscape Overlay (Gippsland Lakes) over this foreshore area.

However, the amendment facilitates development in advance of comprehensive visual landscape, ecological, biophysical, and geomorphological assessments. This pre-empts informed decision-making and risks undermining the very landscape character and environmental integrity the clause is intended to protect. The proposed design and siting of development are not demonstrably sympathetic to the coastal character of the area, nor do they ensure the preservation of key aesthetic and ecological features, including significant lakefront vistas, prominent ridgetops and saltmarsh wetlands in an environmentally sensitive area.

Moreover, the amendment fails to minimise impacts on adjacent Crown land and public reserves, contrary to the explicit strategy to protect areas bordering crown land. The long-term viability of these areas—particularly the foreshore reserve—is threatened by inadequate consideration of coastal hazard risks, including erosion, inundation, and sea level rise. These risks are compounded by the absence of a strategic adaptation buffer above 2.8 m AHD to foster greater climate resilience, and allow for the inland migration of significant habitats and to maintain landscape amenity and public access. In its current form, the amendment disregards the cumulative visual and environmental impacts on a region mapped and recognised for its high landscape sensitivity, and fails to uphold the strategic direction to design development that is responsive, adaptive, and protective of East Gippsland’s most valued environmental assets.

Clause 12.05-2S – Landscapes

The amendment includes a number of provisions that are designed to achieve the policy objectives to this clause; which seek to protect and enhance significant landscapes and open spaces that contribute to the region’s character, identity, and ecological function. The most sensitive landscape within the Paynesville Growth Area (PGA) is without doubt the Lake King foreshore, adjoining north-facing slopes and ridgetops which form part of a broader coastal landscape that is visually prominent, environmentally sensitive, and integral to the identity of the Gippsland Lakes system, which is reflected by Schedule 2 to Clause 42.03 Significant Landscape Overlay (Gippsland Lakes) that currently applies on the subject land (see map



below). This clause acknowledges the landscape character of the coastal interface to Lake King, which is a lake of state significance .

The amendment relies almost exclusively on the proposed DPO10 conditions to achieve landscape character, environmental and visual amenity objectives. The DPO10 conditions that are most relevant to achieving these landscape-related objectives are:

Land Use and Township Character provisions:

- Design guidelines to inform three-dimensional building envelopes to include consideration of:
 - Views to and from Lake King through the management of maximum building heights from natural ground level.
 - Side boundary setbacks to avoid continuous built form.
 - Viewing corridors from the road network and public realm, including public open space, towards Lake King.
 - Reasonable sharing of views from dwellings to Lake King.
 - Setbacks from sensitive foreshore areas.
- Landscape buffers and ‘other mechanisms’ for sensitive interfaces with rural land
- Streetscape treatments and landscaping
- Ensure that the subdivision provides appropriate linkage and interface treatments to adjoining land.

Foreshore Improvement and Management Plan provisions (apply to all land below 2.8 m AHD):

- Vegetated buffers
- Demonstrate how the visual impact of development when viewed from Lake King is minimised.
- A coastal hazard vulnerability assessment with recommendations to mitigate any identified risks

Flora and Fauna Assessment (applies all land)

- To include recommendations in relation to subdivision design and make appropriate links to the Foreshore Improvement Management Plan

The amendment proposes the use these planning tools to achieve key neighbourhood character and visual amenity objectives. Among the most relevant tools, are guidelines relating to lot size, three-dimensional building envelopes, and street layout. The amendment also includes a landscaping requirement (tree planting) to ‘soften’ the visual impacts of future development. Each of these visual amenity planning tools are assessed below:

Lot size

The Structure Plan (p.21) provides specific guidance on lot size through three Urban Land Use Guidelines (see G1, G2 and G3). These guidelines serve to establish the preferred lot size range

of 500-1000m², permit lots smaller than 500m² in areas adjacent to open space and natural features and seek to cap maximum lot size to 1000m² unless their form enables further subdivision without battle-axe lots.

We submit the central purpose of these guidelines is generally to support higher density residential developments wherever feasible. We note that higher density development is less feasible and desirable on the coastal fringe of the growth area because it does not ‘reinforce the local character of a small lakeside town’; particularly along the prominent ridgeline and north-facing slopes overlooking the Lake King foreshore area. This would be consistent with the approach taken in amendment C171egip for the neighbouring coastal settlement of Eagle Point, which introduces minimum lot sizes for residential land in sensitive environmental locations that is commensurate with the environmental quality and capacity of the land.²⁴

Larger lots along the ridgelines overlooking Lake King

Larger lot sizes simply provide the necessary space to implement design elements that can minimise visual bulk and continuous built form to protect and enhance visual amenity.²⁵ We submit that larger lots enhance the effectiveness of three-dimensional building envelopes in meeting specific design objectives. In this instance, the preservation of coastal character and the reasonable sharing of views. The greater scope for view sharing that larger lots offer was recently demonstrated by a residential subdivision in the neighbouring 10.7ha property on the growth area’s north eastern boundary. During the compulsory conference in VCAT²⁶, those objectors adjacent to the largest lots (1018m²-1688m²) resolved their view sharing dispute by negotiating for a decrease in the building envelopes. However, the objectors abutting the smaller lots (600 m²-829 m²) did not settle, as the smaller lot size most likely made substantive reductions in building envelopes unviable for the developer.

The design flexibility afforded by larger lots, allows for:

- wider setbacks
- more substantial landscaping
- vegetated screening
- reduced building density.

We submit that the visually prominent ridgetops and north-facing slopes of the northern growth area are unsuitable for 500m²-1000m² lots. This is consistent with clause 11.03-4S (Coastal Settlement) which seeks to limit development on ridgelines, the shorelines of estuaries and identified coastal hazard areas, all of which apply to the northern growth area. Lot sizes in excess of 1000m² however, have much greater scope to protect visual amenity in both the public realm (landscape character) and private realm (view sharing).

Three-dimensional building envelope guidelines

The Development Plan Overlay requires that landowners / developers prepare the detailed design guidelines which will inform the preparation of three-dimensional building envelopes on

²⁴ Amendment C171egip – Explanatory Report, p.5

²⁵ See Knox City Council Residential Design Guidelines (2019); Moorabool Shire Urban-Design-Guidelines (2024); and Good Design and the Coast – Issue 3 (2023)

²⁶ VCAT ref. no. P1438/2023

affected lots. The guidance given to drafting the guidelines provided by the DPO pertains to consideration (where required) of:

- Views to and from Lake King through the management of maximum building heights from natural ground level.
- Side boundary setbacks to avoid continuous built form.
- Viewing corridors from the road network and public realm, including public open space, towards Lake King.
- Reasonable sharing of views from dwellings to Lake King.
- Setbacks from sensitive foreshore areas.

Minimum setback and maximum height guidelines are critical tools for managing spatial form, scale, and their visual impact. We submit that undefined building envelopes with no minimum requirements run the risk of undermining landscape quality objectives and compromising the character, functionality, and visual amenity of both public and private spaces. This outcome is contrary to the strategies of 12.05-1L (Environmentally Sensitive Areas), namely:

Design development in significant landscape areas including those referenced on the map to this clause that is sympathetic to the character of the area and preserves its aesthetic values.

Protect and enhance landscapes, important vistas and visual and environmental qualities of coastal, lakeshore and river-frontage areas, townships, recreation activity centres through responsive siting and design.

Protect areas of high landscape sensitivity including visually prominent ridgelines, areas adjacent to the coastline, lakes or rivers and remnant vegetation in cleared areas, views from significant lookout points and scenic roads including those referenced on the map to this clause.

Deferring the preparation of building envelope guidelines, shifts the focus from a transparent and strategically driven framework, to a piecemeal and potentially reactive process, where decisions might prioritize short-term developer interests over long-term community needs. We refer to the example provided by adjoining ridgetop properties along Eagle Bay Terrace and Fullarton Drive just east of the growth area, which have lot sizes ranging from around 800m²-1375m².

We submit that despite the larger lots and the application of building envelopes restricting heights to 7.5 meters, the continuous built form and obtrusive visual bulk of the dwellings is clearly visible from Lake King, the foreshore walking track, and from as far away as the lake foreshore at the Eagle Point Hub. The net result of this sprawling ridgetop development has been significant visual impacts to an important coastal landscape, as shown in the photo below.



Landscaping

In addition to building envelopes, the Structure Plan (p.18) adopts requirement R7 which states:

Native tree planting shall be implemented on the foreshore reserve and adjacent streets to soften the visual impact of development when viewed from Lake King while providing reasonable opportunities for view sharing from residential lots north of Paynesville Road and complying with bushfire management requirements.

R7 seeks to preserve both private *and* public visual amenity using planted native vegetation, whilst simultaneously seeking to reduce bushfire risk. This requirement is unlikely to be achieved for two main reasons:

1. Planting native trees large enough to screen visual bulk *from* the lake (public amenity) is likely to impact residential views *to* the lake (private visual amenity).
These two distinct visual amenity objectives are to a large extent, mutually exclusive.
2. Planting a sufficient number and density of large native trees common to the area, so as to effectively screen or ‘soften’ the visual bulk of development from Lake King, has the potential to increase bushfire risk.

Again, these two objectives are not complimentary, since native trees can potentially become a significant fire hazard. Resolving these contradictory policy goals without sacrificing the ‘tree lined and vegetated coastal character’ of Paynesville requires less emphasis on landscaping to do the ‘heavy lifting’ with regards to protecting visual landscape amenity. A greater density of native trees can be more safely achieved if minimum lot sizes are increased along the ridgetops overlooking Lake King. Larger and fewer lots along the prominent ridgetops would reduce housing density in the PGA’s most visually sensitive landscape, ensure building envelopes have the space they need to be more effective.

Street layout

Another Structure Plan (p.19) guideline (G1) seeks to design street networks that maximise “long distance views to the water” but not *from* the water. This guideline omits any

consideration of the visual impacts that dwellings may have on landscape quality when viewed from the waters of Lake King or nearby popular foreshore areas, being inconsistent with clause 12.02-1L (Protection of coastal areas) which seeks to:

Manage the coastal foreshore for environmental protection, preservation of landscape quality.

We submit inadequate consideration is given to protecting a landscape of state significance, with Lake King recognised as one of the most prominent water features in this landscape.²⁷ We fear that the proponent derived visual amenity provisions (i.e., building envelopes and vegetated screening) and the uniform application of GRZ3 is unlikely to be effective at achieving key neighbourhood / township character and visual amenity objectives. We submit that the DPO does not adequately rationalise the DDO14 and SLO visual amenity controls. Furthermore, the DPO does not sufficiently decant relevant, measurable requirements into the GRZ schedule 3 nor decant the more subjective requirements effectively and transparently into the DPO.

In this respect, a Neighbourhood Residential Zone that specified minimum lot sizes along with an expanded foreshore reserve along the north-facing slopes would provide a more robust mechanism to protect Paynesville's coastal town character, visual amenity, and significant landscape values. Overall, the Neighbourhood Residential Zone is significantly more sympathetic to the limited development capacity and coastal landscape character values of the exposed ridgetops overlooking Lake King, than the application of the General Residential Zone.

Provision for a Landscape Impact Assessment as part of DPO10

Significantly, the DPO conditions do not require land owners / developers to undertake a **Landscape Impact Assessment**, making the effectiveness of the building envelope guidelines difficult to model and assess. We submit that a landscape impact assessment be undertaken which models the effect of various minimum lot sizes, building envelopes, street layouts and tree plantings on the sensitive coastal landscape. The landscape assessment results would provide a more objective evidence-base on which to make coastal planning decisions, particularly in relation to zoning, foreshore buffers, minimum lot size, street layouts, landscaping and building envelope guidelines. We submit that a landscape impact assessment combined with mandatory minimum building envelope setbacks and height requirements would more likely achieve the neighbourhood character objectives of clause 15.01-5S (Neighbourhood Character) to:

Ensure development responds to its context and reinforces a sense of place and the valued features and characteristics of the local environment and place by respecting the:

- *Pattern of local urban structure and subdivision.*
- *Underlying natural landscape character and significant vegetation.*
- *Neighbourhood character values and built form that reflect community identity.*

²⁷ Victorian Government (2006) *Coastal Spaces Landscape Assessment Study*, p.86

In considering the appropriateness of the mandatory provisions, we have had regard to *Planning Practice Note No. 23*. PPN 23 stipulates that though mandatory provisions are the exception:

*...they may be used to manage areas of consistent character [and] sensitive environmental locations such as along the coast.*²⁸

We believe that that establishing minimum mandatory set back and maximum height provisions, guided by a robust and comprehensive Visual Impact Assessment provides a more transparent, evidence-based approach, to achieving important landscape and character objectives.²⁹ At present, the amendment has not adequately demonstrated its visual landscape provisions are sufficient to effectively preserve the visual landscape qualities and ecological functioning of this significant landscape.

As noted previously, the amendment facilitates development without well-defined and critical planning inputs, including:

- a comprehensive **Visual Impact Assessment** to guide and inform zoning and overlay decision making,
- the establishment of adequate coastal buffers based on a comprehensive coastal hazard risk assessment ; and
- a **Coastal Adaptation Plan** that effectively responds to long-term coastal hazards and supports community resilience.

A Visual Impact Assessment is need for land from which the SLO2 is being removed

The absence of these planning measures undermines the amendment's ability to manage environmental risks effectively, efficiently and sustainably. Orderly planning that intends to achieve specific visual amenity objectives, should be informed by appropriate technical studies, of which a visual impact assessment is but one. However, integrating the results of a detailed visual assessment with other key planning inputs, notably the Foreshore Improvement Management Plan will more likely “improve the landscape qualities” or enhance the environmental performance of the foreshore and adjacent public open space. Moreover, the DPO10 provision for the FIMP to “demonstrate how the visual impact of development when viewed from Lake King is minimised” should be extended to include all the land from which the SLO2 is being removed. This would ensure thar at least some of SLO objectives to protect the coastal character of the Gippsland Lakes might be retained, and more importantly, some measure of visual analysis and evidence can inform the design of the lots, roads and street scape in the sensitive coastal zone.

²⁸ Planning Practice Note 23 | Applying the Incorporated Plan and Development Plan Overlays (2022), p.55

²⁹ Planning Practice Note 23 | Applying the Incorporated Plan and Development Plan Overlays (2022), p.55

Evidence-based approach to protecting significant landscape amenity and coastal values

Without such a study, we face the uncertainty that future development will visually and physically encroach on a landscape recognised for its aesthetic value and ecological sensitivity. The failure to proactively designate sufficient land above 2.8 m Australian Height Datum (AHD) to minimize exposure to coastal hazards beyond 2100, and to accommodate nature-based adaptation responses, ecological migration, and future recreational access to the foreshore, undermines both the intent and strategies of Clause 12.05-2S. This clause emphasizes the protection and enhancement of significant landscapes and open spaces that contribute to character, identity, and sustainable environments. Specifically, it includes strategies to ensure that development does not detract from the natural qualities of significant landscape areas and to improve landscape qualities, open space linkages, and environmental performance in significant landscapes and open spaces, including green wedges, conservation areas, and non-urban areas.

By not allocating adequate land above 2.8 m AHD for these purposes, or making provisions for a Visual Landscape Assessment for the SLO2 area, planning decisions may conflict with the directive to protect and enhance important natural features and ensure development does not detract from the environmental and visual qualities of the landscape, as outlined in Clause 12.05-2S. This shortfall could lead to both a despoiled coastal landscape facing increased vulnerability to coastal hazards and a diminished capacity for ecosystems and communities to adapt to climate change impacts.

Moreover, the proposed future application of the Public Conservation and Resource Zone (PCRZ) to the foreshore further fragments the planning approach, deferring protection measures rather than integrating them into the current rezoning. This piecemeal sequencing does not “improve the landscape qualities” or enhance the environmental performance of the foreshore and adjacent public open space. Instead, it allows for potential development that will visually and physically encroach on a landscape recognised for its aesthetic value and ecological sensitivity.

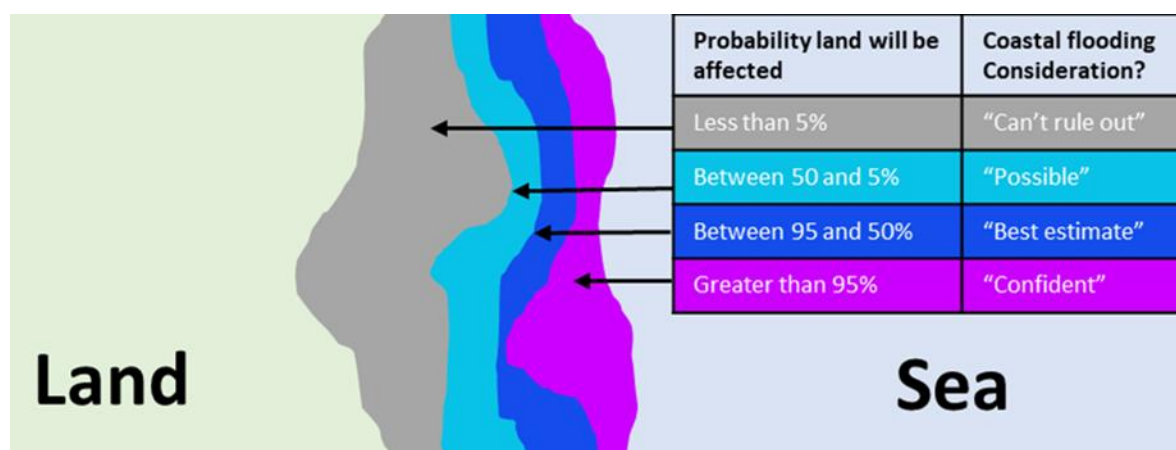
The failure to proactively designate sufficient land above 2.8 m Australian Height Datum (AHD) to minimize exposure to coastal hazards beyond 2100, and to accommodate nature-based adaptation responses, ecological migration, and future recreational access to the foreshore, undermines both the intent and strategies of Clause 12.05-2S. This clause emphasizes the protection and enhancement of significant landscapes and open spaces that contribute to character, identity, and sustainable environments. Specifically, it includes strategies to ensure that development does not detract from the natural qualities of significant landscape areas and to improve landscape qualities, open space linkages, and environmental performance in significant landscapes and open spaces, including green wedges, conservation areas, and non-urban areas.

By not allocating adequate land above 2.8 m AHD for these purposes, planning decisions may conflict with the directive to protect and enhance important natural features and ensure development does not detract from the environmental and visual qualities of the landscape, as outlined in Clause 12.05-2S. This shortfall could lead to increased vulnerability to coastal hazards and a diminished capacity for ecosystems and communities to adapt to climate change impacts.

Clause 13.01-1S – Climate Change Impacts

The conceptualisation and assessment of coastal inundation and erosion risks is central to achieving the objectives of Clause 13.01-1S within the Victorian Planning Policy Framework. Clause 13.01-1S explicitly requires planning authorities to identify, avoid, and mitigate natural hazard risks to communities, infrastructure, and ecosystems through robust risk-based planning practices. Proper conceptualisation of risk involves thoroughly understanding the interaction between climatic processes—such as sea-level rise, storm tides, extreme weather events—and the geomorphological features of coastal areas. This includes identifying critical thresholds where natural coastal buffers, such as fringing vegetation, become overwhelmed, potentially leading to sudden, significant shifts in hazard exposure. Effective assessment thus relies on dynamic modelling approaches that realistically simulate coastal processes over both near-term and distant future scenarios, acknowledging uncertainties inherent in climate change projections. The adoption of a fixed 2.8 m AHD exclusion does not adequately identify nor address all these individual, overlapping and concurrent or compound risk factors, including the low-probability/high-impact events and emerging threats such as accelerating Antarctic ice sheet disintegration associated with the highest emissions scenarios.

By the expert’s own admission, the 2.8 m line was not devised on the basis of a **structured, comprehensive, and dynamic risk assessment**, but rather on a simple, single mathematical calculation based on limited evidence (2 m peak flood level + 0.8 m SLR). The 2.8 m line does not explicitly assess, quantify nor plan for the full coastal risk spectrum — from minor to rare and catastrophic events. According to ISO 31000:2018 risk assessment hierarchy, risk is defined as the “effect of uncertainty on objectives”. The standard encourages planners to identify and evaluate all relevant risks—not just the most frequent or most obvious—across the continuum of probability and severity. Best practice dynamic risk assessments model thousands of possible future outcomes using advanced stochastic analysis and then present this data in easy to comprehend maps, showing inundation extent as variable range rather than a single, deterministic value (see example below):



The fixed contour line strategy cannot respond flexibly and proportionately to all potential risks as it does not involve an assessment of the likelihood or frequency or probability of occurrence of all those dynamic coastal processes listed above. The fixed line approach to risk management also ignores the magnitude of risks or the severity of consequences, from minor to major events. It also involves no consideration of timing & duration – Whether the effects are

short-term and predictable or long-term and extended. Finally, the 2.8 m contour does not address compound or cascading effects—those multiple risks occurring simultaneously or sequentially, amplifying impacts, such as major floods and 1% AEP storm events occurring at the same time.

A holistic approach ensures no area is overlooked—from the imminent to the unforeseen and addresses future uncertainties such as accelerating rates of shoreline erosion as sea levels rise or the possibility of a 1:500 year flood event occurring before 2100. Accurately conceptualising these risks ensures that strategic planning and development decisions are informed by the best available science and evidence, aligning closely with principles from the *Victorian Marine and Coastal Policy*—particularly evidence-based decision-making, which recognises that while future scenarios carry uncertainty, planning must incorporate the best current understanding of potential hazards. This approach supports the identification of areas where development may exacerbate risk or where adaptation strategies like establishing wider setbacks, buffers, or ecosystem-based management approaches could build resilience and reduce vulnerability.

Maladaptation

Without timely and comprehensive assessments, planning decisions may underestimate future hazards, potentially resulting in a range of maladaptive planning outcomes, including:

- **Public infrastructure exposed to climate risk**, increasing susceptibility to damage during extreme events.
- **Poorly located developments**, exacerbating coastal squeeze—where natural habitats are trapped between rising seas and fixed infrastructure.
- **Irreversible loss of environmental values**, including critical wetlands and biodiversity areas.
- **Heightened long-term costs**, such as those associated with emergency response, litigation and coastal infrastructure remediation .

Critically, comprehensive hazard assessments directly support the effective implementation of Clause 13.01-1S strategies, such as designing development to minimise environmental harm and actively promoting adaptation measures that reduce vulnerability to coastal hazards. Such assessments underpin proportionate and precautionary planning responses, ensuring that:

- Low-probability but high-impact future scenarios—such as recent CSIRO projections indicating plausible sea-level rise of over 3 meters by 2140—are explicitly acknowledged and addressed.
- Proactive hazard identification through accurate conceptualisation also aligns with the precautionary principle, ensuring that the absence of complete certainty does not become a rationale for postponing necessary mitigation measures.

Therefore, robust conceptualisation and assessment of climate risks are fundamental to strategic planning, not only to achieve the objectives of Clause 13.01-1S, but also to foster more resilient and sustainable coastal communities capable of adapting effectively and more efficiently to evolving climatic conditions.

However, we submit that:

- The amendment has notably failed to adequately identify, conceptualise, and comprehensively assess the inherent coastal hazard risks present along the Lake King foreshore.
- Its approach to climate change impacts fundamentally downplays the severity and long-term likelihood of coastal inundation and erosion, particularly neglecting the full spectrum of their economic, social, and ecological consequences.
- Specifically, the risk assessment underpinning the amendment narrowly considers hazards only in terms of their direct impacts on only selected built infrastructure, development, and property assets, while systematically overlooking impacts on critical coastal processes and foreshore values such as habitat connectivity, biodiversity resilience, ecological migration pathways, recreational amenity, and landscape integrity.
- The amendment entirely disregards low-confidence yet high-consequence scenarios, such as those involving sea-level rise exceeding the nominal 0.8 m by 2100. Recent scientific analyses, including CSIRO's high-end projections, indicate plausible scenarios involving rapid Antarctic ice sheet disintegration that could produce sea-level rise exceeding three metres by as early as 2140, which—despite lower probability—carry catastrophic consequences.³⁰ The omission of such scenarios reflects a serious methodological gap, undermining a truly risk-based and precautionary approach to coastal hazard management.

Moreover, the amendment's reliance on a simplistic static benchmark—a single contour line at 2.8 m AHD—highlights another major shortcoming. This contour was chosen by adding an allowance of 0.8 m for projected sea-level rise by 2100 to a modelled 1% Annual Exceedance Probability (AEP) peak flood level of 2.0 m AHD,³¹ without adequately considering dynamic coastal processes, underlying geology or changing storm characteristics. Research by McInnes et al. (2015) explicitly identifies that static benchmarks are inadequate for coastal hazard assessment, as they fail to capture the dynamic interactions between rising sea levels, shifting coastal geomorphology, increased storm intensities, and altered hydrodynamic processes.³²

Contemporary best-practice coastal planning strategies emphasise flexible, adaptive approaches firmly grounded in the precautionary principle and ecosystem-based adaptation.³³ Such strategies include proactive managed habitat retreat, generous coastal setbacks, adaptive spatial planning, and nature-based defences (e.g., wetlands and swamp scrub). According to recent CSIRO research, effectively mitigating long-term coastal risks demands flexible planning frameworks explicitly designed to accommodate future coastal change and

³⁰ DeConto, R. M., & Pollard, D. (2016). Contribution of Antarctica to past and future sea-level rise. *Nature*, 531(7596), 591–597. <https://doi.org/10.1038/nature17145>

³¹ Grayson, R. (2004). *Gippsland Lakes Flood Level Modelling Project: Final Report*. Centre for Environmental Applied Hydrology, University of Melbourne.

³² McInnes, K. L., Church, J., Monselesan, D., Hunter, J. R., O'Grady, J. G., Haigh, I. D., & Zhang, X. (2015). Sea-level rise projections for Australia: Information for impact and adaptation planning. *Australian Meteorological and Oceanographic Journal*, 65(1), 127–149. <https://doi.org/10.22499/2.6501.009>

³³ Morris, R. L., Boxshall, A., & Swearer, S. E. (2020). Climate-resilient coasts require diverse, flexible, and adaptive nature-based solutions. *One Earth*, 2(4), 320–323. <https://doi.org/10.1016/j.oneear.2020.04.006>

uncertainties, rather than relying on static lines or fixed hazard extents that are not informed by local conditions, especially geomorphology and coastal habitat values.³⁴

Managed habitat retreats and other ecosystem-based strategies not only buffer coastal communities from extreme events but also preserve and enhance coastal ecological processes and foreshore values, directly aligning with the objectives and strategic intent articulated in Clauses 13.01-1S and 13.01-2S. In sharp contrast, the simplistic and uniform 2.8 m AHD contour exclusion zone adopted by the amendment is fundamentally incompatible with these contemporary planning principles, particularly those emphasizing dynamic (stochastic) risk assessment and adaptive management.³⁵

Avoiding coastal squeeze -the case for wider coastal buffers

Effective coastal planning also requires sufficiently wide coastal buffers or setbacks from the foreshore to enable ecosystems to migrate inland, preserving their ecological functions as sea levels rise. Research has repeatedly demonstrated that constrained coastal ecosystems, unable to migrate landward due to insufficient space or hard infrastructure, suffer from coastal squeeze—where vital habitats such as wetlands, saltmarshes, and fringing reedbeds are lost entirely.³⁶

Little consideration appears to have been given to the long-term fate of the sensitive foreshore area once coastal inundation and increasingly frequent and intense storms exceed the 2.8m AHD contour level. Beyond 2100, projections of sea-level rise become increasingly uncertain and potentially severe, especially when considering low-probability but high-impact processes such as marine ice sheet instability (MISI) and marine ice cliff instability (MICI).³⁷ These mechanisms, associated with the potential rapid collapse of parts of the Antarctic ice sheet, could significantly amplify global sea-level rise.³⁸

The ‘ecosystem-based approach’ to coastal planning urges decision-makers to avoid both direct and incremental impacts, work with natural processes and build resilience to climate change wherever possible. In the context of the amendment’s undeveloped foreshore zone, resilience and working with natural processes requires an adequate understanding of coastal inundation, storm/tide surge and shoreline retreat as sea levels rise. Moreover, evidence-based decision making begins by recognising the limitations of the existing evidence base,³⁹ and undertaking the necessary background studies of local conditions and constraints. In the current context, this should include a detailed mapping of the foreshore zones’ topography, bathymetry, geology and soils to ensure coastal planning is based on the ‘best available and

³⁴ McInnes, K. L., Church, J., Monselesan, D., Hunter, J. R., O’Grady, J. G., Haigh, I. D., & Zhang, X. (2015). Sea-level rise projections for Australia: Information for impact and adaptation planning. *Australian Meteorological and Oceanographic Journal*, 65(1), 127–149. <https://doi.org/10.22499/2.6501.009>

³⁵ For best practice example refer to McInnes, K.L. et al. (2022) Port Phillip Bay Coastal Hazard Assessment. Report to Department of Environment, Land, Water and Planning

³⁶ Leo, K. L., Gillies, C. L., Fitzsimons, J. A., Hale, L. Z., & Beck, M. W. (2019). Coastal habitat squeeze: A review of adaptation solutions for saltmarsh, mangrove and beach habitats. *Ocean & Coastal Management*, 175, 180–190. <https://doi.org/10.1016/j.ocecoaman.2019.03.019>

³⁷ Intergovernmental Panel on Climate Change (IPCC). (2021). *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report*. Cambridge University Press. <https://www.ipcc.ch/report/ar6/wg1/>

³⁸ DeConto, R. M., & Pollard, D. (2016). Contribution of Antarctica to past and future sea-level rise. *Nature*, 531(7596), 591–597. <https://doi.org/10.1038/nature17145>

³⁹ see discussion of the limitations of the Water Technology (2014) hazard assessment in Appendix A

relevant' local environmental information. It's unclear how the amendment can meet the requirements of clause 13.01-1S, 12.01-2S and PPN53 without considering the results of a geotechnical investigation, flora & fauna assessment, and updated coastal hazard modelling based on **local conditions** prior to rezoning decisions being locked in.

Taking a more risk-averse, conservative planning approach

Recent CSIRO assessments and other high-end studies indicate sea-level rise could exceed 3 meters by as early as 2140, under extreme, yet plausible, scenarios involving rapid Antarctic ice sheet disintegration (Grose & Webb, 2023; van de Wal et al., 2022).⁴⁰ These alarming projections underscore the importance of incorporating a wide range of potential outcomes into coastal planning and risk assessments. Such projections highlight the critical importance of adopting precautionary and flexible approaches in coastal land use planning, recognizing that even unlikely scenarios must be accounted for given their catastrophic risk potential for coastal communities and infrastructure.⁴¹ While such high-risk scenarios are considered low probability, their high impact necessitates a precautionary approach to coastal development and infrastructure planning.⁴² Clause 13.01-1S's directive to design development to minimise environmental harm and cannot be satisfied without establishing far wider, more conservative and risk-averse coastal setbacks or buffers- an element that is clearly absent from the current amendment.⁴³

The planning proposal compounds these problems adopting the 2014 *Gippsland Lakes Local Coastal Hazard Assessment* (LCHA) as the definitive risk assessment for the site, thereby significantly undermining risk-based planning. While the study provides foundational insights, the limitations in scenario scope, hydrodynamic modelling, data calibration, sensitivity analyses, storm surge assessment, wind and wave climate considerations, and vegetation dynamics indicate substantial potential for underestimation of risks.⁴⁴ Addressing these gaps through enhanced stochastic scenario analysis (example shown below), advanced hydrodynamic modelling, updated data calibration, robust sensitivity and uncertainty assessments, detailed storm surge and extreme event modelling, integration of vegetation and sediment dynamics, and adaptive benchmarks is imperative.

Implementing these improvements will lead to a more accurate and scientifically robust coastal hazard assessment, ultimately supporting more effective, long-term coastal management and adaptation planning. Current guidance from the CSIRO stresses the necessity of periodically updated hazard assessments, particularly given the rapid evolution of

⁴⁰ Grose, M., & Webb, L. (2023). *Ice sheet tipping points and sea-level rise*. CSIRO Climate Science Centre. https://www.pacificmet.net/sites/default/files/inline-files/documents/PICOF%2016%20Session%204_%20Sea%20level%20tipping%20points_CSIRO_0.pdf; van de Wal, R. S. W., Nicholls, R. J., Behar, D., Church, J., Hinkel, J., & Kopp, R. E. (2022). *A high-end estimate of sea-level rise for practitioners*. World Climate Research Programme (WCRP). Retrieved from <https://www.wcrp-climate.org/news/science-highlights/1955-new-sea-level-projections-2022>

⁴¹ CSIRO. (n.d.). *Future sea level changes*. CSIRO Sea Level, Waves and Coastal Extremes. Retrieved June 2, 2025, from <https://research.csiro.au/slrwavescoast/sea-level/future-sea-level-changes/>

⁴² Hansen, J., Sato, M., Hearty, P., Ruedy, R., Kelley, M., Masson-Delmotte, V., ... & Lo, K. W. (2016). Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 C global warming could be dangerous. *Atmospheric Chemistry and Physics*, 16(6), 3761-3812.

⁴³ *ibid*

⁴⁴ Refer to Appendix A: Review of the 2014 Gippsland Lakes Local Coastal Hazard Assessment (LCHA)

coastal risk factors including sea-level rise and storm surge.⁴⁵ Outdated hazard data and modelling results in maladaptation—poorly informed decisions that inadequately address evolving hazards—directly contravening the objectives of Clause 13.01-1S.⁴⁶

Disorderly coastal planning

Finally, the disorderly approach of rezoning land first and then conducting detailed hazard studies afterward- fundamentally contradicts the strategic intent of Clause 13.01-1S, which demands integrated planning. This sequencing places future residents, infrastructure, and natural assets at heightened risk, failing to ensure development occurs only in locations and through methods that minimise hazard risks. Comprehensive, strategic hazard assessments must precede rezoning decisions to ensure long-term safety and resilience, as supported by national adaptation policy frameworks.⁴⁷ Thus, the current amendment's planning process is demonstrably inconsistent with established national best practice and the explicit directions of Clause 13.01-1S

Clause 13.01-2S Coastal Inundation and Erosion

The PGASP's reliance on the 2.8 m AHD exclusion zone is not supported by updated coastal erosion or inundation modelling and fails to account for dynamic coastal processes such as shoreline retreat, sediment transport, and wetland migration. Critically, the 2.8 m AHD contour closely abuts the projected 2100 sea level rise and storm-tide surge extent projections for the Gippsland Lakes region, displaying an elevated rather than conservative risk threshold. This leaves virtually no margin for error and leaving little safety buffer for more intense and frequent episodic events, erosional variability, or future climate uncertainty. The minimal safety margin is visually well captured by the map overleaf, showing how little PCRZ is left when the Victorian Coastal Inundation layers for the projected 82cm SLR and Storm/ tide scenario for 2100 is applied. Such an approach does not satisfy the precautionary principle outlined in Clause 13.01-2S of the Planning Policy Framework, which requires planning authorities to adopt risk-based responses that account for scientific uncertainty in the escalation of extreme weather events, erosion rates and sea level rise conditions over time.

To ensure climate-resilient and ecologically responsible land-use planning, the structure plan should apply wider setbacks that include the full extent of low-lying land adjacent to the foreshore that's particularly suitable for habitat retreat and some of the elevated slopes. The setbacks would help define the coastal buffer zone- an area set aside as a safeguard or an 'insurance policy' against model underestimation, and facilitate the inland migration of coastal

⁴⁵ McInnes, K. L., White, C. J., Haigh, I. D., Hemer, M. A., Hoeke, R. K., Holbrook, N. J., & Westra, S. (2016). Natural hazards in Australia: Sea level and coastal extremes. *Climatic Change*, 139(1), 69–83. <https://doi.org/10.1007/s10584-016-1647-8>

⁴⁶ *ibid*

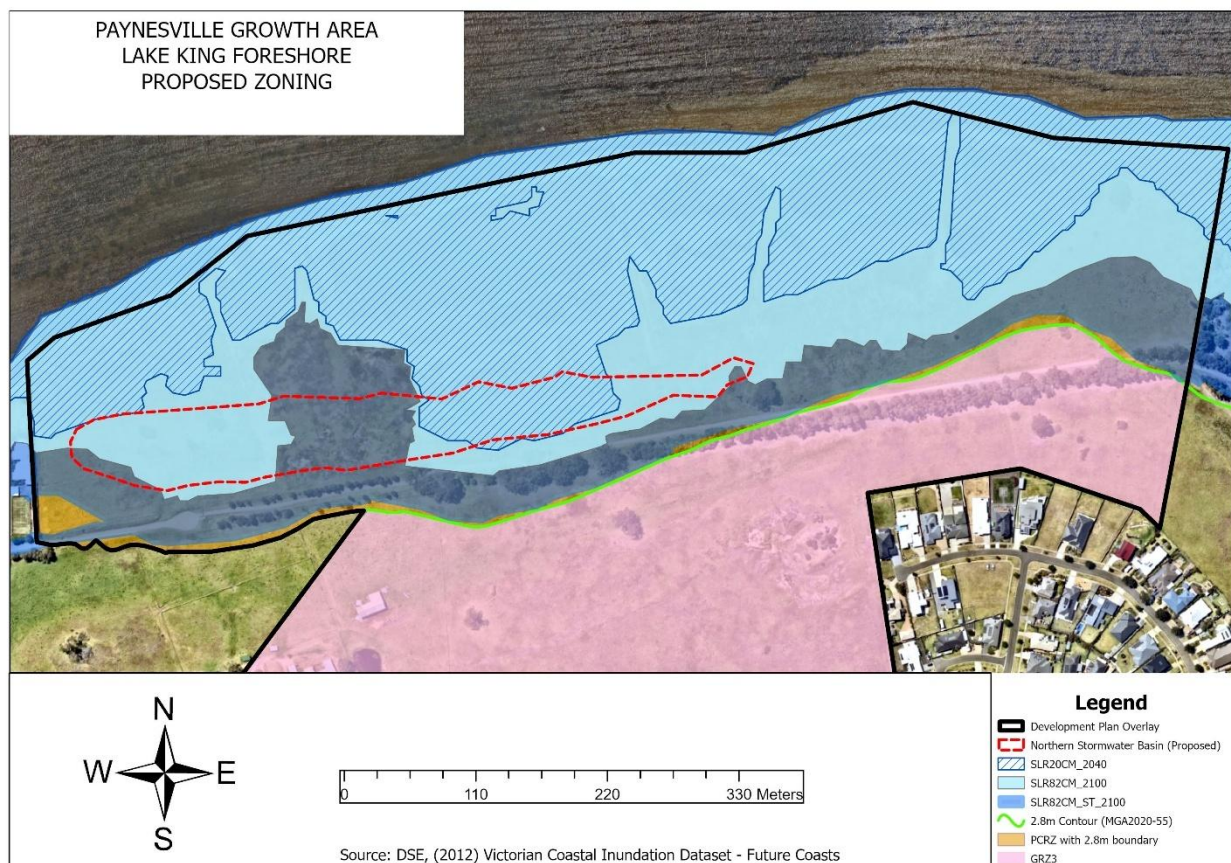
⁴⁷ Kellett, J., Balston, J., & Western, M. (2015). *A local government framework for coastal risk assessment in Australia*. National Climate Change Adaptation Research Facility (NCCARF). Retrieved from <https://coastadapt.com.au>

ecosystems such as saltmarsh, reed beds, and other fringing vegetation communities, as sea levels rise and the shoreline retreats further inland.⁴⁸

Nature-based approach to hazard mitigation

Static exclusion lines based on simplistic modelling assumptions do not offer the flexibility required to accommodate coastal processes and are an inadequate substitute for adaptive frameworks that integrate nature-based solutions like foreshore restoration and managed habitat retreat. These adaptation strategies are increasingly recognised as low-cost, long-term methods of hazard mitigation and biodiversity protection⁴⁹. They are also widely recognised **low-regret forms of climate adaptation** because they can provide ongoing protection and ecological services with minimal maintenance or capital renewal costs.

These nature-based adaptation approaches, often referred to as ‘nature-based coastal defence’ or ‘living shorelines’, need to be wide setbacks to buffer human settlements from coastal processes while delivering co-benefits such as biodiversity conservation, carbon sequestration, and recreational amenity well beyond this century. Unlike engineered hard



⁴⁸ Doerr, V. A. J., McGinness, H. M., & Doerr, E. D. (2018). *Managing natural systems for adaptation: A synoptic overview and recommendations*. *Climate Risk Management*, 19, 1–18.

<https://doi.org/10.1016/j.crm.2017.12.001>

⁴⁹ Temmerman, S., Meire, P., Bouma, T. J., Herman, P. M. J., Ysebaert, T., & De Vriend, H. J. (2013).

Ecosystem-based coastal defence in the face of global change. *Nature*, 504(7478), 79–83.

<https://doi.org/10.1038/nature12859>

structures (e.g. sea walls, levees), nature-based defences are dynamic systems that evolve over time, allowing for the natural migration of ecosystems inland in response to sea-level rise.

In the context of the Lake King foreshore, the use of nature-based methods offers a particularly valuable opportunity. The area includes a mosaic of sensitive coastal habitats—such as saltmarsh, scattered remnant trees, and fringing reedbeds—that can serve as natural buffers against storm tides and shoreline erosion if allowed to expand landward. The extension and creation of new wetlands within the Lake King foreshore reserve will be critical, as coastal wetland habitats are progressively lost to sea levels rise, and the foreshore recedes further inland. However, to enable these functions, **adequate setbacks** must be secured now, before new development is locked in place through rezoning. Failure to reserve sufficient space for habitat migration will result in ‘coastal squeeze’, where natural ecosystems are trapped between rising waters and hard development edges, leading to their progressive loss.

Incorporating a nature-based approach into the Paynesville Growth Area Structure Plan—and securing sufficient foreshore setbacks as part of the rezoning process—is therefore a strategically sound, economically efficient, and ecologically resilient response to the area’s long-term coastal hazard exposure. It also aligns with Clause 13.01-2S (Coastal Inundation and Erosion) and PPN53 (Managing Coastal Hazards and the Coastal Impacts of Climate Change), which explicitly call for the use of natural defences in preference to built-structures wherever possible.

Notably, the early implementation of multi-step, hierarchy approaches is mirrored in the *Guidelines for the removal, destruction or lopping of native vegetation* (Department of Environment, Land, Water and Planning, 2017), an incorporated policy document in the planning scheme. As noted by DEECA in their referral advice to the amendment:

“The three-step hierarchy approach set out in the Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017) (the Guidelines) of avoid, minimise and offset should be considered at the strategic planning stage. Areas of high-quality native vegetation and biodiversity values should be identified at the strategic planning stage, considered for retention and incorporated into the plans.”

Recommendations for Integrated, Adaptive Coastal Planning

In the absence of detailed, high-resolution LiDAR mapping and stochastic scenario analysis to produce more accurate and detailed hydrodynamic modelling of coastal inundation risk, large coastal setbacks are warranted. If the detailed investigations indicate smaller setbacks are sufficient, then it’s far easier to reduce setbacks than enlarge them once rezoned and encumbered by development assets. We submit that given the significant uncertainties around the adequacy of the 2.8m AHD line, **all relatively fat, low-lying land** adjacent to Lake King should be reserved to properly assess its biodiversity and hazard mitigation value. Importantly, this land often extends well beyond the 2.8m AHD contour. This relatively flat land, comprised of unstable geology on erodible soils, forms part of the low-lying coastal zone.

This land is ideally suited for habitat retreat as sea levels rise, providing valuable habitats for hazard risk reduction, open space for recreation, and enhancing biodiversity values. Increasing foreshore setbacks past the 2.8m AHD contour in places to include less hazard prone land, presents a number of strategic opportunities. Firstly, greater setbacks support a coastal

landscape with reduced flood risk. Secondly, they facilitate more resilient and biodiverse environmental assets along the Lake King foreshore. Finally, wider foreshore setbacks can ensure a continuous walking and cycling link from Paynesville to Eagle Point beyond 2100. Given the Planning Policy Framework directs planners to plan for sustainable coastal development, taking a long-term view of the amendment's potential impacts on public open space, landscape values and the coastal environment, is necessary if we expect coastal habitats and settlements to continue to exist well beyond 2100.

Clause 13.04-2S – Erosion and Landslip:

Policy: This clause seeks to “To protect areas prone to erosion, landslip or other land degradation processes.” Strategies relevant to this clause include:

Identify areas subject to erosion or instability in planning schemes and when considering the use and development of land.

Prevent inappropriate development in unstable areas or areas prone to erosion.

Promote vegetation retention, planting and rehabilitation in areas prone to erosion and land instability.

Analysis: The area in question shows some signs of erosion, particular along the foreshore zone. According to soil mapping,⁵⁰ there is potential for the areas soil types to be prone to both tunnel and wave action erosion that could impact the wetlands, the Gippsland Lakes, future infrastructure and owners of property along the slopes.

Planning Implications of unstable geology and erosive soils

The proposed development area, comprising **Haunted Hills Formation (Nlh)** overlain by **Brown Sodosols**, presents a high erosion susceptibility when assessed against multiple geotechnical and environmental factors relevant to coastal hazard exposure. Brown Sodosols are well-documented as structurally unstable under conditions of periodic saturation and saline intrusion. Brown Sodosols possess a dispersive, sodic B horizon that, when wet, is prone to structural collapse and tunnel erosion.⁵¹ When coupled with the variably sorted and weakly consolidated sand, silt, and gravel, with oxidised, patchy ironstone layers, these soils pose moderate to high geotechnical and environmental challenges.

Their sodic subsoils are highly dispersive, with low infiltration capacity and poor cohesion, making them particularly vulnerable to tunnel erosion, gully formation, and slope instability when exposed to increased runoff or wave-induced saturation (Isbell & National Committee on Soil and Terrain, 2016; McKenzie et al., 2004). They compromise stormwater management, foundation stability, and increase sedimentation risks to receiving waters such as Lake King. The presence of such sodic profiles typically triggers the need for early land capability assessments—particularly where development may alter surface hydrology, compact soils, or

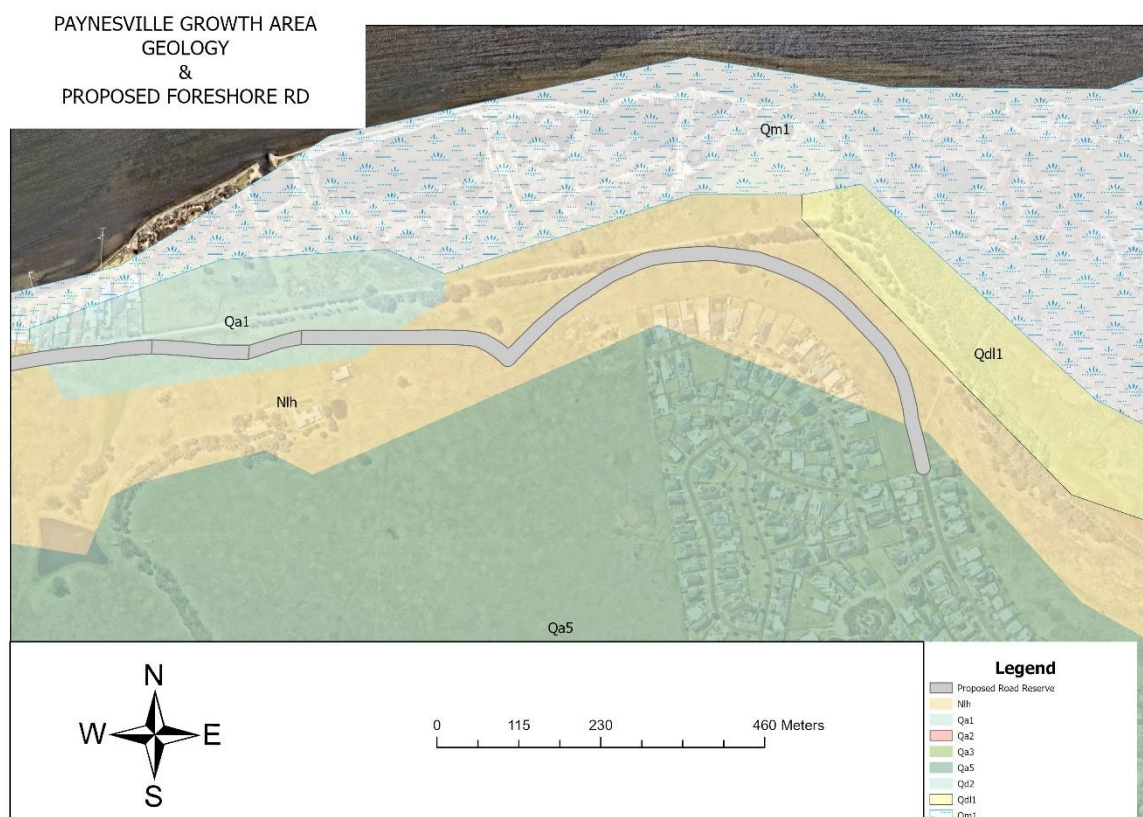
⁵⁰ Robinson, P & Sargent, J (21010) Tunnel erosion in East Gippsland, Report by Department of Primary Industries

⁵¹ Rengasamy, P. (2002). Transient salinity and sodicity effects on soils and plants. *Agronomy Journal*, 94(5), 1040–1047. <https://doi.org/10.2134/agronj2002.1040>

increase impermeable surfaces.⁵² It is unclear if geotechnical studies have informed the zoning, which would align more closely with best practice planning, the objectives of Clause 13.04-2S (Erosion and landslip), and the early intervention approach articulated in the *Precinct Structure Planning Guidelines* (VPA, 2021)

Projected climate change impacts—particularly rising sea levels, intensifying storm surges, and increasing rainfall intensity—further elevate the area’s erosion vulnerability. Coastal inundation and periodic saturation reduce soil cohesion and elevate groundwater levels, increasing the frequency of erosive events and the likelihood of long-term instability (CSIRO & BOM, 2022). In the absence of engineered stabilisation or robust vegetative buffers, the cumulative effect of these pressures renders the subject land geotechnically unsuitable for urban development or permanent infrastructure. The Planning Policy Framework, particularly Clauses 13.01-1S (Natural Hazards and Climate Change) and 13.04-2S (Erosion and Landslip), clearly requires decision-makers to avoid development in areas prone to instability and erosion. The evidence from both soil science and hazard modelling supports a precautionary planning approach in this location.

Foreshore road at risk of coastal inundation and erosion



The area proposed for a new connector road to the main Foreshore Road is underlain by Qa1 alluvial floodplain deposits—geologically recent, unconsolidated sediments comprising clay,

⁵² McKenzie, N., Jacquier, D., Isbell, R., & Brown, K. (2004). *Australian soils and landscapes: An illustrated compendium*. CSIRO Publishing.

silt, sand, and gravel.⁵³ These soils are typically low-lying, poorly drained, and exhibit low bearing capacity and high compressibility, making them geotechnically unsuitable for conventional road foundations without costly mitigation.⁵⁴ Their susceptibility to seasonal inundation and long-term instability is compounded under projected climate change scenarios, which forecast increased rainfall intensity and flood recurrence.⁵⁵ Locating permanent road infrastructure on such terrain contravenes Clause 13.03-1S (Floodplain Management) of the Planning Policy Framework, which requires planning authorities to avoid development that may compromise the natural flood mitigation functions of floodplains or increase flood risk to life, property, and the environment. Further, the *Precinct Structure Planning Guidelines* urge early identification and resolution of land capability constraints—such as unstable floodplain soils—prior to zoning and infrastructure layout decisions.⁵⁶ Proceeding with the road alignment without adequate geotechnical and hydrological assessment risks embedding path-dependent, maladaptive infrastructure that will be expensive to maintain and vulnerable to future climate-induced flood hazards⁵⁷.

Erosion risks not adequately considered prior to zoning

Despite the location, underlying geology and soils, no appropriate survey data that includes complete contours and drainage paths, not just in the immediate project disturbance area, but areas surrounding the proposed development site, have been included in the amendment documentation. Similarly, no geotechnical assessment showing soil characteristics and hydrological calculations information and its interpretation for selection and use of permeant or temporary erosion control measures appears to have informed the amendment's zoning, particularly in determining the suitability of the 2.8m AHD contour line in response to coastal inundation and erosion hazards.

It's notable that the Water Technology Coastal Hazard Vulnerability Assessment (2024) did not make any reference to the underlying geology or soils in its assessment. In summary, the presence of Haunted Hills (Nlh) and Quaternary Alluvium (Qa1) deposits, compounded by sodic subsoils, further amplifies the need for a more precautionary planning approach that incorporates updated science, adaptive buffers, and land capability assessments at the **rezoning stage**. The current amendment does not adequately meet these requirements and therefore risks contravening key PPF clauses including 13.01-2S, 12.02-1S, and 13.04-2S.

⁵³ Geological Survey of Victoria. (2016). *1:250,000 Map Series – Lakes Entrance (SJ55-04)*. Department of Jobs, Precincts and Regions, Victorian Government.

⁵⁴ Chittoori, B. C. S., & Puppala, A. J. (2011). Engineering behavior of soils contaminated with water treatment residuals. *Journal of Geotechnical and Geoenvironmental Engineering*, 137(6), 573–582.

⁵⁵ CSIRO. (2022). *State of the Climate 2022*. Commonwealth Scientific and Industrial Research Organisation and Bureau of Meteorology.

⁵⁶ Victorian Planning Authority (VPA). (2021). *Precinct Structure Planning Guidelines 2.0*. Victorian State Government.

⁵⁷ Bates, B. C., Kundzewicz, Z. W., Wu, S., & Palutikof, J. P. (Eds.). (2008). *Climate Change and Water* (Technical Paper of the Intergovernmental Panel on Climate Change). IPCC Secretariat.

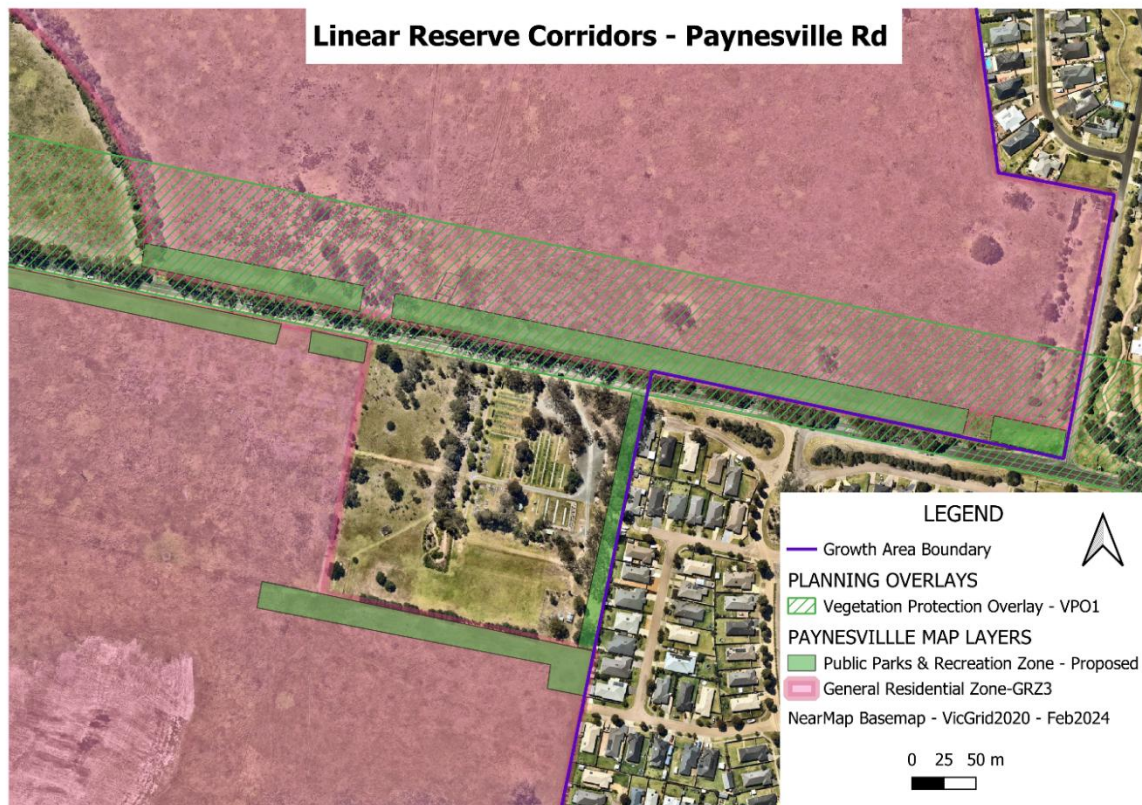
Clause 19.02-6s Open Space

Clause 19.02-6s directs planners to “develop open space to maintain wildlife corridors and greenhouse sinks” and to “ensure that urban open space provides opportunities for nature conservation, to connect with nature and peace and solitude.” The clause also directs decision makers to “plan open space areas for multiple uses, such as....active transport routes and wildlife corridors.”

The proposed amendment is inconsistent with these policy objectives and strategies in the manner outlined below.

Movement - Wildlife Corridors

Wider wildlife and movement corridors in urban areas are crucial for supporting biodiversity, particularly for bird species. Research indicates that wider corridors tend to support a greater number of bird species, especially forest specialists that are less common in suburban gardens.⁵⁸ These specialists are more likely to move through and inhabit broader corridors (due to less edge effects), highlighting the importance of corridor width in urban planning.



Narrow movement corridors are problematic for the following reasons:

- The proposed minimum 15m wide movement corridors (walking and cycling trails) located next to busy roads are far too narrow to create a sense of peace and solitude in nature
- The trail network lacks high amenity

⁵⁸ <https://www.environment.nsw.gov.au/resources/nature/landholdernotes15wildlifecorridors.pdf>

- The 15m linear reserves are too narrow to function effectively as wildlife corridors or green house sinks
- A far wider corridor would be more beneficial for both walkers/cyclists and wildlife

A flora and fauna assessment could support the design of an appropriate minimum corridor width and/or determining the optimal dimensions of a natural features reserve. These assessments would identify target fauna and flora species and aide planners in designing vegetated corridors / natural features reserves that help protect identified values.

The siting and design of largest public open space recreation reserve is not responsive to coastal hazard risks. Sea Level Rise and coastal inundation and erosion will make it difficult to achieve the open space objectives and strategies of clause 19.02-6S in the long term. The clause directs planners to “plan for regional and local open space networks for both recreation and conservation of natural and cultural environments.”

The proposed regional conservation reserve is located on low-lying land along the foreshore to Lake King abutting the Point Fullarton Ramsar wetlands. The foreshore is projected to be significantly impacted by sea level rise and coastal erosion, forcing the shoreline to recede further inland. By 2100, over 17ha or 74.76% of the PCRZ could be permanently inundated by a projected 82cm sea level rise if no protective measures are taken to hold back the lake waters. Around 22ha or 97% of the conservation reserve will be impacted by the projected 82cm sea level rise and increasingly frequent storm and tide surges by the turn of this century. The provision of public open space along the foreshore is therefore only temporary, unless far larger reserves are created to account for projected foreshore erosion and inundation.

Furthermore:

- The 1ha tree reserve excludes remnant, large East Gippsland Redgums (*Eucalyptus tereticornis* subsp. *mediana*), an endangered tree species important to the coastal / rural character of the town as well as native wildlife (refer to Clause 12.91-1S for more detail).
- The foreshore is projected to be significantly impacted by sea level rise and coastal erosion, forcing the shoreline to recede towards the recreational reserve and road.
- The distribution of local parks does not ensure accessibility within 400m of at least 95 percent of all dwellings, which is contrary to Standard C13 of clause C56.05-2. This is evident in the map shown below, which applies a 400m buffer from all proposed local park reserves.

Paynesville Growth Area Structure Plan Public Open Space- Local Parks provision



Are there any competing PPF objectives and how are they balanced?

Bushfire Protection vs. Wildlife Corridors and Public Open Space (Clause 13 vs Clause 12 and 19)

Planning policy in Victoria strongly prioritizes human life in bushfire-prone areas, even over environmental objectives. Clause 13.02-1S requires new developments to mitigate bushfire risk by providing adequate defensible space. In the context of Amendment C172, this has meant planning for “appropriate setbacks primarily achieved by adequate roadside management along Grandview Road, setback of development from the grassland edge and responsive landscaping of open space and drainage reserves.”⁵⁹ The bushfire hazard assessment of the Structure Plan did not specify what ‘adequate roadside management’ involves nor what was an “appropriate setback” distance. The bushfire assessment further explains that “open space can be collocated with these corridors to decrease the vegetation hazard to the interface, thus utilising the ‘setback’ for managed green space, paths, roads and front setbacks in an urban parkland setting.” It also noted how “tree-lined road corridors and parkland corridors are an appropriate means of enhancing the amenity of the growth area without increasing the risk of bushfire.” This suggests native trees and vegetated parkland can coexist if ‘appropriate’ setbacks from future development are put in place.

⁵⁹ Bushfire Planning Considerations Report (2024) p.22

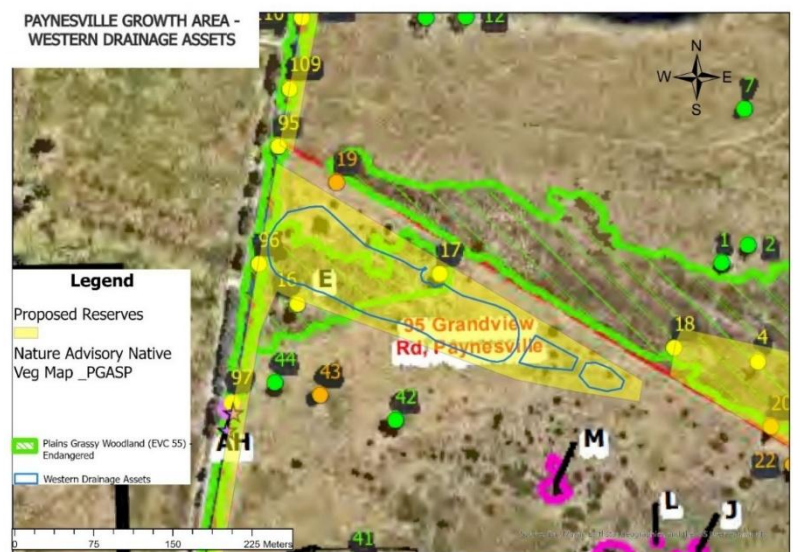
At the same time, Clause 12.01-1S (Protection of Biodiversity) emphasizes conserving biodiversity and establishing wildlife movement corridors. To be effective as corridors for wildlife, they need to be as wide as possible. Along the western growth area boundary and Lake King foreshore, the Structure Plan and local policies seek to maintain and enhance habitat connectivity. For example, the Paynesville Growth Area Structure Plan proposes widening the Lake King foreshore reserve and creating vegetated corridors for fauna movement. To reconcile this with bushfire needs, local planning controls will require design responses to reduce fire risk. Possible design responses could include:

- Siting new lots behind a perimeter road or firebreak that borders the wildlife corridor.
- Using low-fuel landscaping and fire-resistant indigenous plant species along the edge of the corridor near development. This creates a gradation – lower vegetation or grass closest to houses (maintaining defensible space), transitioning to thicker native vegetation further away.

To effectively balance these conflicting policy goals, a far wider buffer than the 15 m proposed for Grandview Rd will be required to ensure adequate fire buffer distances do not compromise the ecological requirement for a wide, vegetated corridor with trees and understory vegetation to suite a variety of birds and other native fauna species.

Stormwater Infrastructure vs. Open Space vs Biodiversity Protection

As noted in Clause 12.01-1S (Protection of Biodiversity) the amendment proposed locations for the northern and western stormwater treatment assets conflicts with the high conservation values of the both reserves. The northern assets impact endangered EVCs and EPBC-listed migratory bird species habitat (Latham's Snipe). The western stormwater basin also impacts endangered FFG-listed Plains Grassy Woodland and identified Latham's Snipe habitat. In the context of the western stormwater dam (reproduced again below), almost the entire PPRZ is encumbered by the drainage infrastructure, reducing the reserve's contribution to public open space.



Does the amendment use the most appropriate VPP tool to achieve the strategic objective of the planning scheme?

The amendment applies the General Residential Zone – Schedule 3 uniformly across the entire growth area, except for the north western coastal land parcel at the entrance of town that's reserved for "Future Tourism". In making this zoning recommendation, the purpose and objectives of the Structure Plan for urban land use and town character and identity must be considered.

The purpose and objectives of the Structure Plan aim to:

- Plan the structure of the growth area previously established in the Urban Design Framework for Paynesville which identified land for the foreseeable long-term urban growth of Paynesville (up to 35-40 years)
- Establish a pattern of residential development across the growth area that supports good access, neighbourhood cohesion and reinforces local identity.
- To accommodate medium density residential development, aged care and retirement accommodation and a Local Activity Centre in locations consistent with the Preferred Urban Structure.
- Support a strong sense of place and local character that builds on Paynesville's existing character and sense of place
- Ensure the scale and location of land uses and activities support the preferred future character of Paynesville
- Provide for a spacious residential character with a variety of lot sizes and housing types to meet community needs
- Provide for different types of housing and a range of lot sizes and densities that will provide for diversity and greater choice in the future community.

There are clearly competing directions and objectives here, which seek to both accommodate growth and medium density residential development, while also protecting environmental and landscape values and existing town character.

The proposed Schedule 3 to clause 32.08 'General Residential Zone' applies the following neighbourhood character objectives:

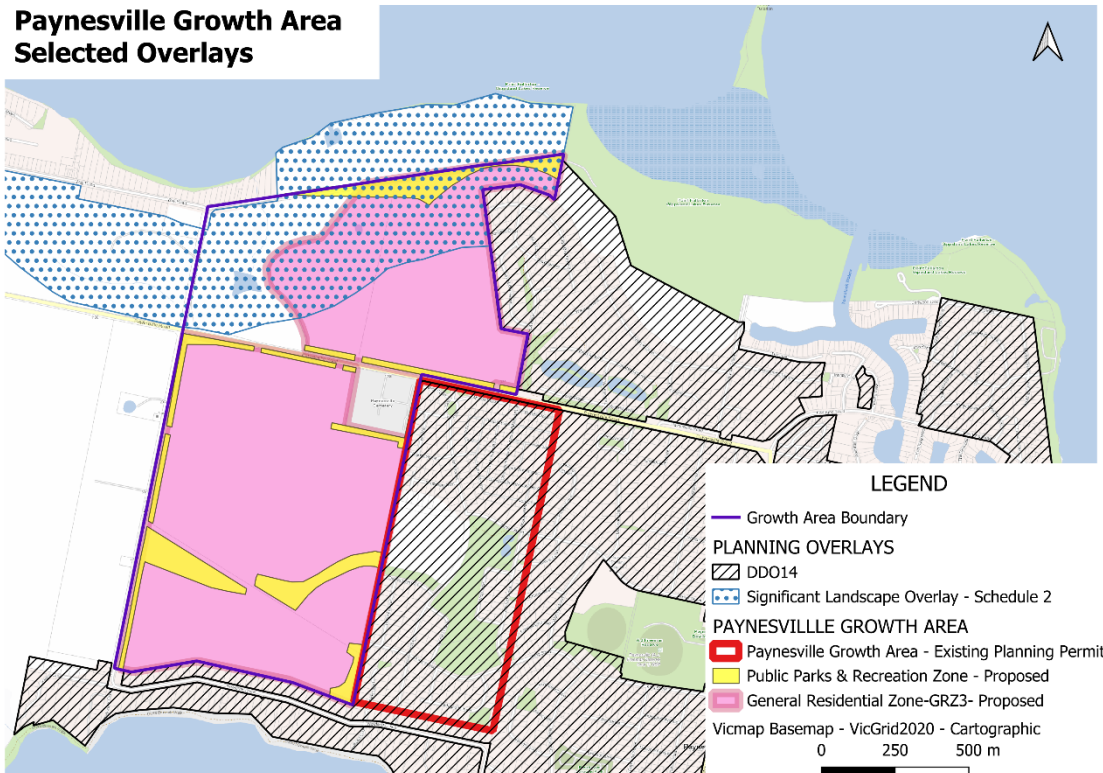
- *To establish a pattern of residential development across the growth area that supports good access, neighbourhood cohesion and reinforces the local character of a small lakeside town.*
- *To provide for diverse types of housing and a range of lot sizes and densities including medium density housing, aged care and retirement accommodation.*
- *To ensure a high standard of design for housing development that reinforces Paynesville's character and environmental values and meets contemporary standards for efficiency and sustainability.*
- *To establish native planted corridors in key locations and create distinctive tree-lined street environments that frame road corridors and major entry points, provide open space connections for cyclists and pedestrians and enhance the visual appearance of the built environment.*
- *To ensure the provision of suitable infrastructure and utilities to efficiently service development and that are designed to enhance local character.*

We note that none of these objectives clearly define local character; nor align with or expand on the previously delineated local character zones of Paynesville.⁶⁰ This may reflect the lack of detailed neighbourhood character assessments, which could have more clearly guided the development of the Structure Plan and its accompanying planning controls.

⁶⁰ Paynesville Urban Design Framework (2007), Appendix F – Paynesville Design Guidelines, p.105

In considering the appropriateness of a single residential zone for the entire township's growth area, we have had regard to *Planning Practice Note No. 91: Using the Residential Zones*. *Planning Practice Note No. 91* describes the following role and application for the General Residential Zone:

*Applied to areas where housing development of three storeys exists or is planned for in locations offering good access to services and transport.*⁶¹



We note that Schedule 3 of the GRZ does not provide any ResCode variations or alter maximum building height. While a mandatory 3 storey, 11 metre height limit is set out within the zone, the eastern section of the growth area previously rezoned General Residential Zone – Schedule 1, is also affected by a Design and Development Overlay - Schedule 14; where a mandatory building height limit of 7.5 metres applies to the entire “Town expansion area.” Moreover, the Framework Plan also includes a ‘Foreshore and wetlands’ requirement (R8) that states:

Development must be generally consistent with the requirements of Design and Development Overlay Schedule 14 – Residential Development in Coastal Settlements: Paynesville.

Significantly, none of the amendment's zoning or overlay control schedules refer to requirement (R8). Furthermore, the DDO14 is not applied in the planning scheme amendment. It is therefore unclear if the 7.5m mandatory height limit applies to the entire growth area or only to unspecified areas close to the foreshore and wetlands? It's imperative that the requirements

⁶¹ Planning Practice Note No. 91, p. 2.

and structure of a planning scheme provision be clear and unambiguous.⁶²

The amendment introduces the requirement for three-dimensional building envelopes for land on north-facing slopes overlooking Lake King via the introduction of a Development Plan Overlay – Schedule 10. A Development Plan will identify areas on the north-facing slopes which will require building envelopes. As previously noted in Clause 12.05-2S, the Development Plan will:

Provide design guidelines to inform the preparation of three-dimensional building envelopes on individual lots, where required, to include consideration of:

- Views to and from Lake King through the management of maximum building heights from natural ground level.
- Side boundary setbacks to avoid continuous built form.
- Reasonable sharing of views from dwellings to Lake King.
- Setbacks from sensitive foreshore areas.

It is assumed the Development Plan design guidelines will be generally consistent with the 7.5m height limit set out by the Structure Plan's Foreshore and wetlands requirement (R8). This effectively imposes a double storey limit on any residential development located on the north-facing slopes overlooking Lake King. The existing residential development pattern in adjoining neighbourhood areas conforms to the height limits established by the Design and Development Overlay – Schedule 14. All homes in the adjoining neighbourhoods are single or double storey and restricted to 7.5m in height in accordance with this overlay.

We note that the Practice Note states that it is *inappropriate* to apply the General Residential Zone to areas where a planning authority seeks to respect the existing single and double storey character of an area.⁶³

The Practice Note further observes that:

As a general principle, applying a residential zone should align with either existing building heights if they are sought to be maintained, or align with future building heights identified in strategic work⁶⁴.

It continues to state that:

If an area has an existing single and double storey character that is sought to be maintained, applying the GRZ is likely to be inconsistent with this preferred neighbourhood character outcome.⁶⁵

Within this context, and acknowledging the Structure Plan's direction and objectives for development to respond to the existing scale and character of development, we consider that

⁶² Practitioner's Guide to Victoria's Planning Schemes (June 2024), p.19

⁶³ See Principle 4 in Planning Practice Note No. 91.

⁶⁴ Planning Practice Note No. 91, p. 6.

⁶⁵ Planning Practice Note No. 91, p. 6.

the Neighbourhood Residential Zone is a more appropriate zone for the prominent ridgetops overlooking Lake King than the proposed General Residential Zone.

Applying the Neighbourhood Residential Zone along the sensitive coastal zone

Ensuring housing and neighbourhood character plans are consistent and align with another is an important principle underpinning the application of residential zones.⁶⁶ The role and application for the Neighbourhood Residential Zone is described in the Practice Note as follows:

Applied to areas where there is no anticipated change to the predominantly single and double storey character. Also, to areas that have been identified as having specific neighbourhood, heritage, environmental or landscape character values that distinguish the land from other parts of the municipality or the surrounding area.⁶⁷

It is noted that the amendment proposes to remove the Significant Landscape Overlay – Schedule 2 ‘Gippsland Lakes’ which recognises the significant environmental and landscape character of the prominent ridgetops, north-facing slopes and foreshore areas of Lake King. We also note the NRZ has been applied across townships and in growth areas in conjunction with a Development Plan Overlay in other municipalities,⁶⁸ and is consistent with the Paynesville Growth Area Structure Plan policy priorities, particularly in relation to both public and private visual amenity, and town character.

The Neighbourhood Residential Zone mandates a 9m maximum building height and two storey limits. The challenge associated with the application of the General Residential Zone is that it allows 3 storey development of up to 11 metres. A development of this scale, close to the foreshore and on the main entrance to the town seems incongruent in the context of the broader environs and neighbourhood character objectives. On that basis, we submit the use of the Neighbourhood Residential Zone is more appropriate.

The Development Plan Overlay recognises the limited development capacity of the ridgetops and north-facing slopes abutting the Lake King foreshore via the requirement for three-dimensional building envelopes. This requirement is secured via an Agreement under section 173 of the Act. The Agreement imposes a three-dimensional building envelope to the north-facing slopes; which can lower the maximum 11m building height, effectively limiting dwellings to just two storeys. Side and rear setback controls further restrict development on land affected by the section 173 Agreement.

The General Residential Zone conflicts with the strategic directions outlined in the Municipal Planning Strategy and Planning Policy Framework, as detailed in the 'Strategic Context' section. It's noted that clause 02.03-2 'Environmental and landscape values' of the Municipal Planning

⁶⁶ Planning Practice Note 91 – Using the Residential Zones, p.2

⁶⁷ Planning Practice Note No. 91, p. 2

⁶⁸ Refer to planning Amendment C74 - Appollo Bay (10 Oct 2014); C80 Daylesford (23 Nov 2021) and C69moyn Port Fairy (3 Oct 2024)

Strategy is particularly relevant and worth highlighting again here. It describes Council's strategic directions for environmental and landscape values as including:

Protecting areas of environmental, landscape, heritage or scenic value, particularly coastal/lakes areas; the Nicholson River; the Tambo River; Princes Highway; ridgelines and roadside vegetation.

Protecting sites of significance by encouraging sensitive development, sympathetic to the character of the area and its aesthetic values.

As explained in *Planning Practice Note 91*:

The 'test' is whether the residential zone implements the relevant strategic framework plan or residential development framework plan in the MPS.

The right residential zone will reflect the true development capacity of the land. If land is impacted by special attributes or physical constraints that are identified in the MPS and PPF, then a residential zone should be applied that aligns with these attributes or constraints.⁶⁹

We submit that the role and purpose of the Neighbourhood Residential Zone is more consistent and aligns more closely with the special attributes and physical constraints of the northern growth area.

Another key feature of the Neighbourhood Residential Zone that makes it more appropriate than the General Residential Zone, relates to future subdivision potential. Minimum subdivision area provisions can apply to the NRZ whereas the GRZ has no restrictions on further subdivision. We submit that given the limited development capacity of the exposed ridgetops, slopes and the low-lying Lake King foreshore area, any further subdivision on this land is inconsistent with the Structure Plan's policy objectives.

Applying the Neighbourhood Residential Zone along with expanded recreational reserves in areas where the Significant Landscape Overlay applies, would better align with neighbourhood character objectives and protect the scenic and environmental values of the Lake King foreshore and wetlands. We submit that the less intensive and low-scale development supported by the NRZ is more sympathetic to the Significant Landscape Overlay decision guidelines:

Whether buildings are designed near lakes and waterways to be low scale and set back a sufficient distance to allow for the protection or rehabilitation of a substantial zone of riparian vegetation (e.g. over 100 metres)

The impact of developments visible from all key viewing corridors (e.g. touring routes, highways) and scenic lookouts on the open rural character of these views, and the

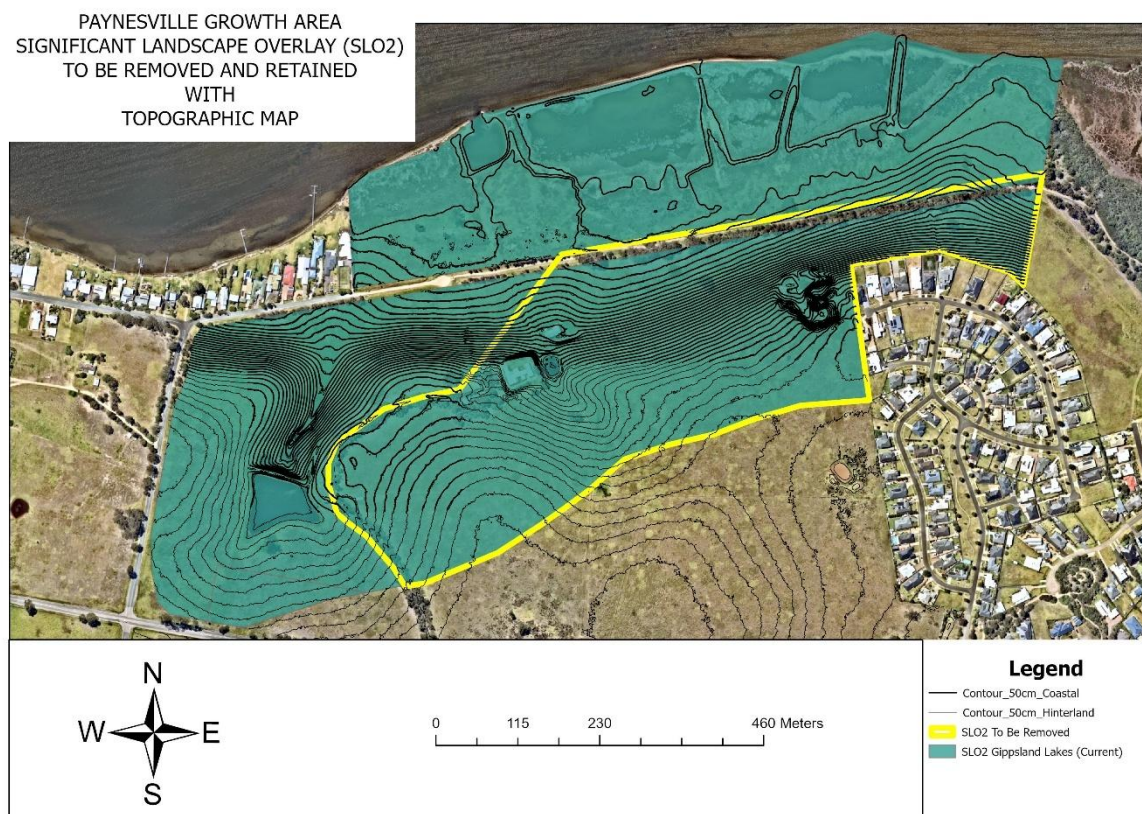
⁶⁹ Planning Practice Note 91 – Using the Residential Zones, p.5

availability of scenic views lakes and waterbodies.

Overall, the Neighbourhood Residential Zone is significantly more sympathetic to the limited development capacity and coastal landscape character values of the exposed ridgetops overlooking Lake King, compared to the General Residential Zone.

Does the amendment affect, conflict with or duplicate another existing provision in the planning scheme that deals with the same land, use or development?

The amendments' blanket application of the GRZ, including in the sensitive coastal interface with Lake King conflicts with the objectives and strategies of the existing SLO



Relevant character objectives to this clause include:

*To strengthen the presence of native and indigenous vegetation throughout the landscape, particularly adjacent to lakes, rivers and other waterbodies as well as along roadsides, **and in settlements** and riparian strips [emphasis added].*

To protect locally significant views and vistas that contribute to the character of the landscape, including scenic lookouts and recreation locations with views over the Gippsland Lakes.

To protect locally significant views and vistas, including expansive open views across the inland lakes and natural and unbuilt views along Ninety Mile Beach.

*To ensure that **development in and around existing settlements** does not impact on the characteristics of the landscape, particularly the natural and unbuilt character at the edge of the Gippsland Lakes [emphasis added].*

To manage the impact of new development on the sense of space and openness in the rural landscape.

Council's Planning Submission – Part B asserts that:

The SLO is applied to natural landscapes, not land designated for urban development. It is therefore good practice to remove it to ensure the efficient administration of the planning scheme.

The Significant Landscape Overlay (SLO) is not limited to rural landscapes – it can apply wherever a landscape's character or features warrant protection, including peri-urban areas and land proposed for residential zoning. There is clear **policy guidance and precedent** for retaining (or introducing) SLOs in growth areas or newly developing residential communities if the landscape or cultural values are significant.

Policy guidance:

- PPN7 confirms that landscape overlays “can be used to protect and manage vegetation in urban areas”
- An SLO may be applied (or retained) on land inside a settlement or transitioning to a General Residential Zone (GRZ) if that land contains valued visual, environmental or cultural landscape elements identified in policy. There is no blanket policy requiring SLOs to be removed once land is earmarked for urban or residential use.
- The SLO's purpose is “*to identify significant landscapes, and to conserve and enhance their character*” and this remit can certainly extend into peri-urban town edges or newly rezoned residential land where important landscape features (scenic vistas, canopy trees, ridgelines, cultural landscape elements, etc.) remain.
- Planning Practice Note 91 likewise cautions that when applying new residential zones, any “special attributes or physical constraints” of the land identified in policy should still be addressed through appropriate zones or overlays

Policy precedent:

Several **practical examples** illustrate that SLOs can apply to land proposed for residential development. In Whitehorse and Boroondara (established suburban councils), broad SLO controls cover all residential zoned land to protect urban tree canopy and neighbourhood landscape character:

Retaining SLO in Coastal Towns

- The City of Greater Geelong's Amendment C349 introduced a new SLO (Schedule 15) over an existing township area of Ocean Grove, concurrently with rezoning to residential, in order to protect its “*unique coastal/bush landscape character*” and significant vegetation

- Ocean Grove’s existing “Hillside Area” SLO7 (protecting coastal hill vistas and vegetation) was retained and *strengthened* during rezoning amendments, rather than removed.

Retaining SLOs in Growth Areas and New Developments

- Yarra Ranges, Mornington Peninsula, Melton use SLO schedules to cover visually sensitive hill faces, skylines, and cultural landscapes even as these areas undergo subdivision.
- The Melton Significant Landscape Features Strategy (2016) identified that for new precincts, valued landscape elements could be managed via a combination of Precinct Structure Plan design guidelines and SLO/ESO overlays for long-term assurance

All these examples affirm that retaining an SLO (or implementing a new one) in growth areas is an accepted practice when a landscape’s natural or cultural qualities remain significant. In essence, if an area on the urban fringe has important view lines (e.g. to a lake or mountain), notable vegetation, or cultural heritage significance, those **landscape values do not cease to matter upon rezoning**. Councils and panels have ample scope to keep using SLO controls in such areas so that urban development is tempered by landscape conservation objectives.

Translating Landscape Objectives into Other Planning Tools

If a decision is made to remove or not apply an SLO at the point of rezoning, best practice is to ensure the SLO’s landscape protection objectives are carried into other planning controls. In this case, incorporating relatively weak and ambiguous landscape amenity provisions in DPO10 that are unlikely to protect the sensitive hill faces and ridgelines overlooking Lake King.

The only SLO2 strategy likely to be met by DPO10 is *“To strengthen the presence of native and indigenous vegetation throughout the landscape, particularly adjacent to lakes”* given the strong emphasis on vegetation

The DPO10 drafted built-form and undefined design guidelines to retain *“landscape character and view lines to and from the Lake”* are likely to be ineffectual given the zoning and the minimum lot size cap of 1000m² will render 3D building envelopes ineffectual at reducing visual bulk sufficiently to succeed. Similarly, the lack of minimum widths for critical foreshore landscape buffer is another potentially fatal flaw.

Recommendations:

Development Plan to include explicit view analysis and height limits to preserve those views, The landscape’s significance warrants stronger visual landscape objectives applied to hilltop lots such as *“maintain a natural skyline”*.

DPO10 should specify stronger design guidance to ensure relevant SLO objectives relating to public amenity are not lost but rather enhanced through the rezoning process, for instance the DPO10 could include a condition that the Development Plan *“will include scenic lookouts and recreation locations with views over the Gippsland Lakes”*

The DPO10 should aim higher, to create and protect “*locally significant views and vistas, including expansive open views across the inland lake*” that support the visitor economy and ensure visual amenity is not effectively privatised by future residents as has been the case with all previous hill top and waterfront developments in the locality, such as Fullarton Drive, Eagle Bay Terrace, Bay Rd Eagle Point strip development, and the canal estates that have effectively privatised the waterfront and spectacular views and vistas to the lakes.

Only one chance to get this right or the skyline will be forever transformed by built form and massing.

Conclusion

In conclusion, the Council’s blanket claim that an SLO should generally be removed from land zoned or intended for urban/residential use is not supported by Victorian planning policy or practice. There is no rule in the planning scheme that urban land cannot have an SLO. The decision to drop SLO2 must be accompanied by strong, enforceable and transparent alternative measures to uphold those same values. This approach ensures consistency with the Victorian planning objective of protecting significant landscapes even as land uses change, and it aligns with the guidance of DELWP and Planning Panels that the planning controls for a site should faithfully implement the relevant strategic objectives.

Overall, the evidence suggests that removing an SLO solely because land becomes “urban” is not a standard or recommended practice. Instead, one should ask: *what important landscape features are present, and how will we continue to protect them under the new zoning?*

In this context, the Significant landscape overlay provisions have not yet been sufficiently reconciled by DPO10.

Is the amendment consistent with any relevant planning practice note?

PPN53: Managing coastal hazards and the coastal impacts of climate change

PPN53 provides clear guidance on strategic planning and rezoning for urban purposes in coastal areas:

*It is important to avoid future development or intensification in coastal areas outside of existing settlements that are likely to be impacted by projected coastal hazards. Where development is appropriate, it should be sited and designed in a way that protects future communities **and assets** from coastal hazard risk [emphasis added].*

The expert reports from Water Technology, including the Draft Coastal Hazard Vulnerability Assessment (2024) and Mr Bishop’s Expert Statement (2025), and Council all are in agreement that drainage infrastructure can be located in a coastal hazard prone area and/or that such assets does not constitute urban development from a planning point of view. We strongly

disagree with this view, for it seems to overlook the fact that drainage infrastructure is a public asset that is integral to and inseparable from urban development. No urban development can proceed without such critical public infrastructure being approved, constructed and maintained. The distinction that only private property and roads should form the benchmark for risk assessments is likely to lead to costly maladaptive development outcomes.

Key inconsistencies with PPN53

The Water Technology Draft Coastal Hazard Vulnerability Assessment (2024) treatment of coastal erosion is fundamentally flawed and inconsistent with the expectations outlined in Planning Practice Note 53. Specifically, shoreline erosion extent was not properly modelled but rather approximated through a simplistic comparison two unreferenced aerial images of vastly different quality, with Google Earth image being much lower resolution than Nearmap aerial image (see below). Resolution discrepancies aside, these images are not orthorectified nor directly comparable for photogrammetry purposes, meaning they have not been corrected for terrain distortions, sensor tilt or scale variations.



Figure 2-1 Erosion Hotspot

As such, they provide low spatial accuracy and are not suitable for measuring shoreline change over time. This approach fails to meet PPN53's clear requirement that "data sets should be analysed to identify any critical data gaps" and that existing, relevant datasets—such as the 2014 *Gippsland Lakes Local Coastal Hazard Assessment (LCHA)*—should be identified and used to inform the assessment (PPN53, p.11).

Although the 2014 Water Technology Local Coastal Hazard Assessment (LCHA) underpins the amendment's overall approach to coastal hazards, its detailed shoreline erosion modelling appears to have been disregarded. No justification is provided for why the updated erosion hazard extent is significantly narrower, despite using an assumed erosion rate of 1 metre per year—double the maximum rate of 0.5 metres per year applied in the 2014 modelling. This discrepancy suggests a lack of methodological transparency and raises serious concerns about the validity of the revised hazard mapping. Compounding these deficiencies, no site-

specific geological or geomorphological data was used to verify local erosion processes, nor were bathymetric datasets or wave climate data included—which is inconsistent with best practice outlined in PPN53 and the specific requirements of Clause 13.01-2S.

The proposed constructed wetland, intended to serve as a key stormwater treatment and flood attenuation asset for the future residential development, is at significant risk of long-term functional failure due to its proposed siting within a low-lying coastal hazard zone. Constructed wetlands typically have a design lifespan of 75 to 100 years, meaning any asset established today must remain functional through to 2100 and beyond.⁷⁰

While specific Australian guidelines, such as those from Melbourne Water, may not explicitly state a fixed design lifespan, they underscore the importance of robust design and ongoing maintenance to ensure the long-term functionality of constructed wetlands. Therefore, when planning and assessing constructed wetlands, especially in the context of long-term environmental and infrastructural considerations, it's prudent to account for a design lifespan of up to a century, aligning with both international studies and best practice guidelines.

Clause 13.01-2S (Coastal Inundation and Erosion) and Planning Practice Note 53 require that infrastructure be assessed for its risk exposure over its entire design life, including under sea-level rise of at least 0.8 m, increased storm surge, and dynamic erosion processes (DTP, 2023, pp. 3–4; DELWP, 2020). If located below 2.8 m AHD or within a projected 2100 storm-tide hazard extent, the wetland would be highly vulnerable to **frequent inundation**, **saline intrusion**, and **elevated groundwater**, all of which compromise its treatment performance, structural stability, and vegetation health (McInnes et al., 2016; CSIRO & BOM, 2022). The wetland's failure would significantly affect stormwater compliance, public investment, and downstream ecological values—particularly in the context of the Gippsland Lakes Ramsar site.

No detailed erosion modelling, updated storm-tide mapping, or geotechnical investigation has been provided. The siting therefore fails to meet the precautionary planning principles embedded in Clause 13.01-2S, the Marine and Coastal Policy, and PPN53, all of which require the use of the best available science and expert assessment at the strategic planning stage (DTP, 2023, p. 10). The requirement to consider the “*role of natural coastal processes and the need to allow for such processes to continue as a cost-effective form of coastal defence against climate change*” was effectively ignored, again inconsistent with PPN53 directives.

Further, the revised mapping, interpretation and analysis on ecological impacts appear to have been undertaken without peer review or input from qualified geomorphologists or wetland ecologists, again breaching PPN53's recommendations that coastal hazard assessments be based on the best available science, undertaken and peer reviewed by appropriately qualified experts.

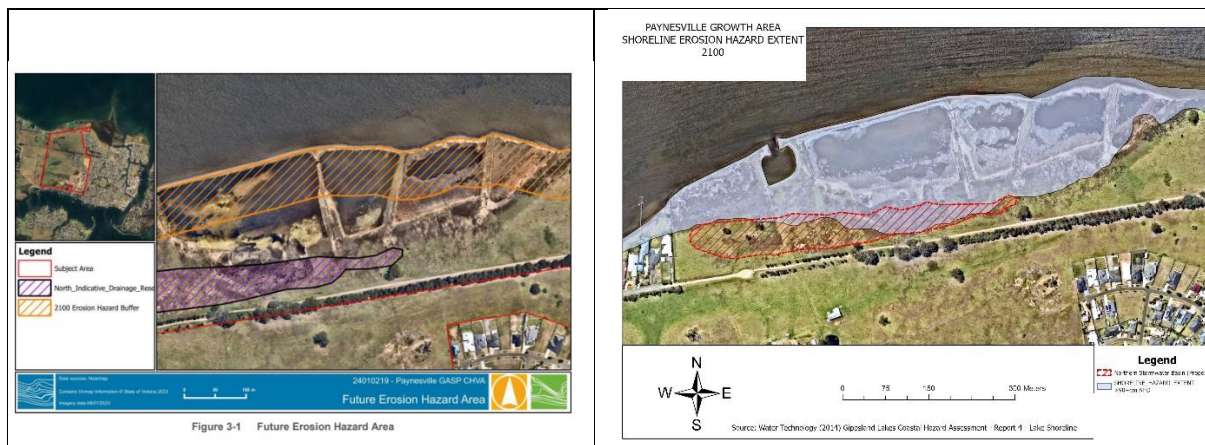
PPN53 (p.11)

The consultant identifies and compiles existing data from a range of sources (external to project partners' libraries) that can provide background context and inform project

⁷⁰ The [New South Wales Engineering Design Specification D09](#) specifies a design service life of 100 years for all stormwater infrastructure, including constructed wetlands.

outputs. Once compiled, the data sets should be analysed to identify any critical data gaps

Surprisingly, Water Technology’s previous erosion modelling work was not referenced or seemingly identified as relevant to the vulnerability assessment, despite the LCHA 2014 study forming the basis of the amendment’s response to coastal hazard risk. Crucially, as previously noted, shoreline erosion extent was **not modelled** but derived deterministically via abstraction derived from comparing just two aerial images (2005-2024). The vulnerability assessment simply multiplied the presumed erosion rate of 1 m per year and multiplied it by 75 years to reach 2100. Therefore, the report applied a 75m erosion rate *uniformly* (shown in orange crosshatch) as the ‘conservative’ shoreline erosion extent by 2100. Compared to the LCHA(2014) shoreline erosion modelling (shown right) the results are incongruous. Such erosion mapping does is inconsistent with best practice hazard modelling and therefore is inconsistent with the requirements of PPN53.



The Draft Coastal Hazard Vulnerability Assessment (Water Technology, 2024) supporting Amendment C172egip exhibits fundamental methodological shortcomings, undermining its credibility as a robust basis for informed coastal hazard planning decisions. Specifically, the simplistic, image-based approach used to approximate shoreline erosion—by comparing non-orthorectified and mismatched aerial imagery—falls significantly short of the rigorous, evidence-based methodology explicitly required by Planning Practice Note 53 (PPN53). Furthermore, reliance on an unjustified erosion rate (1 metre/year)—twice that modelled in the foundational 2014 Gippsland Lakes Local Coastal Hazard Assessment (LCHA)—compromises transparency and raises critical concerns regarding the validity and conservatism of hazard extents presented.

Moreover, essential localised geotechnical, geological, geomorphological, bathymetric and wave-climate data sets—integral to accurately modelling erosion processes—were notably absent from the assessment. This is not only inconsistent with best practice as articulated in PPN53 and Clause 13.01-2S (Coastal Inundation and Erosion), but also substantially undermines confidence in the assessment’s reliability and robustness. The omission of peer review or specialist input further compounds this deficiency, directly contravening guidance that coastal hazard assessments be based on peer-reviewed science and expert verification.

The proposed siting of critical stormwater infrastructure, specifically the constructed wetland, within an identified coastal hazard zone poses significant risks to infrastructure functionality,

environmental compliance, and long-term public investment. Given the extended operational lifespan typical of constructed wetlands (up to 100 years), locating such infrastructure below the 2.8 m AHD contour exposes it unnecessarily to frequent inundation, saline intrusion, groundwater impacts and erosion—conditions likely to be exacerbated by future sea-level rise and increased storm activity. The failure to provide detailed erosion modelling, updated storm-tide mapping, or robust geotechnical studies further compromises the capacity of the Amendment to adequately manage these risks.

Additionally, the vulnerability assessment and subsequent planning response fail to adequately protect high-value environmental assets, notably Ramsar-listed wetlands and associated habitats, from the impacts of projected coastal hazards. This omission contradicts the Marine and Coastal Policy (2020) and Clause 12.01-1S (Protection of biodiversity), which mandate proactive, strategic protection of ecological systems through evidence-based hazard mapping and precautionary buffers. The approach taken represents reactive planning that is neither strategic nor aligned with contemporary best-practice principles for biodiversity conservation or coastal adaptation.

Finally, from a public amenity and landscape perspective, the poorly justified hazard extents and inadequate foreshore setbacks threaten significant degradation of community open spaces, visual character, and coastal vistas, potentially leading to irreversible losses of public assets and community enjoyment of natural landscapes. This constitutes a notable departure from the policy intentions underpinning Victoria’s coastal management and planning frameworks, notably Clause 12.02-1S (Protection of coastal areas).

In summary, the identified deficiencies in the Draft Coastal Hazard Vulnerability Assessment critically undermine the strategic and scientific basis of Amendment C172egip. To ensure alignment with best-practice coastal risk management, ecological protection, and public amenity preservation principles, the following urgent actions are recommended:

Recommendations:

1. **Reject** the existing shoreline erosion methodology employed in the vulnerability assessment due to fundamental methodological flaws. Require preparation of updated erosion modelling based on contemporary, peer-reviewed methods.
2. **Commission** comprehensive site-specific geotechnical, geomorphological, bathymetric, and wave climate assessments to inform revised coastal erosion and inundation hazard extents.
3. **Apply** probabilistic coastal inundation and erosion hazard modelling using the latest available CSIRO coastal inundation data (2024), consistent with contemporary best-practice outlined in PPN53.
4. **Establish** precautionary foreshore setbacks and buffers based on rigorous, scientifically robust hazard mapping that adequately accounts for uncertainty, ensuring the long-term protection of Ramsar wetlands and critical ecological habitats.
5. **Mandate** detailed lifecycle cost-benefit and risk assessments for proposed infrastructure (such as constructed wetlands), explicitly considering hazard exposure and resilience requirements over their full design lifespan (up to 100 years).

6. **Require** rigorous peer-review by independent coastal geomorphology and ecology specialists of all updated coastal vulnerability modelling and hazard assessments.
7. **Enforce** compliance with the three-step hierarchy approach (avoid, minimise, offset) under the Guidelines for the removal, destruction or lopping of native vegetation, ensuring no net loss of biodiversity values due to coastal hazard impacts.
8. **Incorporate** strategic visual landscape and community amenity assessments into future hazard mapping and infrastructure siting decisions to safeguard open space, visual quality, and public access to coastal landscapes.
9. **Update** Amendment documentation and supporting reports to explicitly align with Planning Practice Note 53, Clause 13.01-2S, Clause 12.02-1S, and the Marine and Coastal Policy (2020), ensuring policy consistency, clarity and transparent evidence-based decision-making.
10. **Establish** a robust adaptive management framework with clearly defined triggers and periodic review mechanisms for hazard assessments, infrastructure resilience, and ecological management, thereby proactively responding to evolving climate change impacts and coastal hazard science.

References: See Appendix A

Thank you for the opportunity to comment on Amendment C172egip.

Appendix A: Critical Review of the 2014 Gippsland Lakes Local Coastal Hazard Assessment (LCHA)

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Executive Summary

Purpose and Relevance of the LCHA

The Gippsland Lakes Local Coastal Hazard Assessment (LCHA), completed in 2014 by Water Technology, aimed to broadly identify coastal flooding and erosion risks around the Gippsland Lakes and the 90 Mile Beach region. The assessment generated maps illustrating areas potentially impacted by moderate (10% Annual Exceedance Probability - approximately a 1-in-10-year event) and major (1% AEP - approximately a 1-in-100-year event) flood scenarios, incorporating (+0.2 m, +0.4 m and +0.8 m) Sea-Level Rise (SLR) projections by 2100 for 10% AEP floods and a single (+0.2 m) SLR scenario for the 1% AEP flood (Water Technology, 2014).

Despite its stated limitations, the LCHA has become highly influential in regional planning, providing the basis for critical land-use controls, most notably the adoption of the fixed 2.8 m Australian Height Datum (AHD) contour as a primary benchmark for managing flood risks. Areas below this elevation are widely designated as hazard-prone, guiding significant decisions about zoning, development approvals, and infrastructure planning.

Crucially, however, the LCHA itself explicitly notes that it is "not appropriate for, nor intended to provide [flood] levels suitable for planning purposes. Further refinement of the design flood cases and additional calibration would be required to meet the requirements of a full flood study." (Water Technology, 2014, Report 2, p. 67). This executive summary critically evaluates whether the LCHA's methods and assumptions are sufficiently robust and current to justify the extensive reliance placed upon it in contemporary planning contexts.

Key Methodological Limitations

Limited Range of Sea-Level Rise Scenarios

The LCHA assessed flooding and erosion using only three discrete increments of sea-level rise (0.2 m, 0.4 m, and 0.8 m by 2100). Importantly, it did not explore scenarios beyond 0.8 m, despite authoritative bodies such as the Intergovernmental Panel on Climate Change (IPCC, 2021) and the CSIRO highlighting plausible higher-end scenarios of up to 1.1 m or even 1.4 m by 2100 under intensified emissions trajectories (Oppenheimer et al., 2019). Moreover, the assessment's horizon was limited strictly to 2100, neglecting longer-term impacts and ongoing sea-level rise thereafter.

Given these restrictions, the LCHA presents an incomplete and possibly misleading picture of risk. It excludes plausible higher-end scenarios that planners should consider, particularly when designing infrastructure with lifespans beyond the current century. Thus, it likely understates potential hazards, fostering an unwarranted sense of security in long-term planning.

Simplistic and Deterministic Flood Modelling Approach

The LCHA adopted a deterministic methodology, offering single-value predictions without systematically exploring uncertainties. Flood hazard assessments typically employ probabilistic approaches or Monte Carlo simulations that vary key model inputs such as wind conditions, storm surge heights, rainfall intensities, and river flows. Such methods generate probabilistic hazard maps, indicating ranges and likelihoods rather than single, fixed boundaries.

In contrast, the LCHA provides no explicit confidence intervals or sensitivity analyses, leaving planners without insights into how sensitive the predicted flood extents might be to variations in critical assumptions. Consequently, the study's results convey an unjustified precision that does not reflect inherent uncertainties in climate projections and hydrodynamic responses.

Static and Overly Simplistic Erosion Modelling

The LCHA employed a static erosion model using fixed contour lines (primarily the 0.9 m AHD contour), based on assumed uniform erosion rates borrowed from very limited historical observations. It neglected dynamic coastal processes, including episodic storm-driven erosion events ("storm bite") and feedback effects such as vegetation loss or sediment redistribution. Coastal erosion science consistently highlights that shoreline retreat is often episodic and non-linear, driven largely by storm events interacting with rising sea levels (Bruun, 1962; Stive et al., 2009; Zhang et al., 2004).

By ignoring dynamic coastal processes, the LCHA substantially underestimates the extent and speed of shoreline recession that might realistically occur under projected sea-level rise conditions, particularly along highly erodible shores like those found in the Paynesville Growth Area.

Lack of Compound Event Simulation

Critically, the LCHA did not adequately account for "compound events," scenarios where extreme conditions (such as severe storm surges, heavy rainfall, and high river flows) occur simultaneously. These combined events, although relatively rare, represent some of the most severe flooding hazards in coastal environments. Current best-practice guidelines, including those articulated in Engineers Australia's "Australian Rainfall and Runoff" manual, explicitly warn that neglecting these compound events typically results in significantly underestimating true flood extents and depths.

By not including compound event scenarios, the LCHA potentially fails to capture realistic worst-case flooding outcomes, placing developments approved under these projections at greater risk than currently perceived.

Outdated Calibration Data

The LCHA's hydrodynamic models were calibrated using observational data up to 2012, thus excluding critical flood and storm events from recent years, notably major events in 2016, 2021, and 2022. Given that these recent events demonstrated distinct characteristics—such as unusual storm trajectories and extreme rainfall intensities—excluding them could potentially impact the accuracy and relevance of model predictions. As climate patterns evolve, incorporating recent extreme events becomes increasingly crucial for reliable model calibration and hazard prediction.

Implications for Planning Decisions

The methodological shortcomings outlined above carry significant implications for planning and infrastructure decisions:

1. Underestimation of Hazard Risks:

Collectively, the LCHA's limitations strongly suggest that current hazard mapping underrepresents true future flood and erosion risks. As a result, areas currently considered safe or marginally impacted by future hazards may face greater-than-anticipated risks.

2. **Overreliance on a Static Benchmark:**

The use of the 2.8 m AHD contour as a fixed hazard benchmark, without adaptive triggers or periodic review mechanisms, neglects the dynamic and ongoing nature of climate-driven coastal hazards. Given evolving climate science and rising sea-level trajectories, such fixed benchmarks risk becoming outdated, potentially compromising future community safety and asset security.

3. **Misalignment with Best-Practice Planning Principles:**

By neglecting probabilistic methods, dynamic erosion modelling, and compound event scenarios, the LCHA diverges significantly from current best-practice coastal hazard assessment methods. This divergence potentially exposes planning processes to substantial risk, highlighting the urgent need for updating and improving the regional hazard framework.

Recommendations

In light of these critical limitations, the following recommendations are made for enhancing future coastal hazard assessments around the Gippsland Lakes region:

1. **Broaden Scenario Analysis:**

Future assessments should include a wider range of sea-level rise scenarios, particularly higher-end projections (e.g., 1.1 m or 1.4 m by 2100), and extend analyses beyond the year 2100 to reflect ongoing risks accurately.

2. **Employ Robust Probabilistic and Sensitivity Analyses:**

Hazard modelling should adopt probabilistic methodologies, explicitly testing variations in wind speeds, rainfall intensities, storm trajectories, and coastal processes to generate realistic uncertainty bounds and confidence intervals for planning purposes.

3. **Incorporate Dynamic Erosion and Vegetation Feedbacks:**

Future erosion modelling must integrate dynamic shoreline processes, including storm-driven erosion and vegetation responses, rather than relying on simplistic fixed-line approaches. Employing advanced shoreline recession models (e.g., SBEACH or CoSMoS-COAST) is recommended to realistically capture erosion dynamics.

4. **Explicitly Model Compound Events:**

Updated flood assessments should simulate compound flooding events—simultaneous storm surges, heavy rainfall, and high river flows—to ensure realistic predictions of extreme hazard scenarios.

5. **Adaptive Planning Framework:**

Planning benchmarks (such as the 2.8 m AHD flood line) should be replaced or complemented by adaptive management frameworks incorporating triggers for periodic review, ongoing monitoring, and flexibility to revise benchmarks as new climate and hazard information becomes available.

6. Regular Data Updates and Model Recalibration:

Hydrodynamic models and hazard assessments should be regularly updated (every 5–10 years) to incorporate the latest observational data, including recent extreme events and updated climate projections, ensuring ongoing alignment with best-available science.

Conclusion

While the 2014 Gippsland Lakes LCHA has been influential in shaping local planning, its critical methodological limitations significantly undermine its reliability as a basis for detailed land-use and infrastructure decisions. Given these shortcomings, planners and decision-makers should treat the LCHA outcomes with caution and seek updated, comprehensive assessments incorporating robust probabilistic analyses, broader scenario ranges, dynamic erosion modelling, and adaptive planning frameworks. By adopting these recommendations, future planning decisions can better safeguard communities, ecosystems, and investments around the Gippsland Lakes, ensuring resilience and sustainability in the face of ongoing climate change.

Introduction and Background

The Gippsland Lakes/90 Mile Beach LCHA (Water Technology, 2014) was commissioned to identify coastal inundation and erosion hazards around the Gippsland Lakes system. It

produced mapping of 10% AEP flood extents for various sea-level rise scenarios (0, 0.2, 0.4, 0.8 m) and 1% AEP flood extents for 0 and .2m SLR scenario. For each of these flooding scenarios, the study identified areas at risk from storm surge, catchment flood, and coastal erosion processes. Alongside the landmark Grayson (2004) flood study, the LCHA’s findings have since informed local planning and development controls – including the use of a 2.8 m Australian Height Datum (AHD) contour to delineate future flood risk around the Lakes. Given the critical role of this study in planning, it is essential to examine its robustness. This technical appendix reviews the LCHA’s methodology and data, highlights limitations, and discusses implications in light of more recent science and data (2015–2022). All references are cited, and original quotes from the LCHA are preserved to ensure accuracy.

Hydrodynamic Modelling limitations

Depth-Averaged Model Limitations: The LCHA employed MIKE21, a two-dimensional hydrodynamic model of the Gippsland Lakes that was depth-averaged (2D), simulating water levels and flows across the lakes and entrance. This approach assumes the water column is well-mixed vertically. However, as with many estuaries, the Gippsland Lakes develop a layered water column with “*denser more saline water underneath a freshwater layer*” during stratified periods (East Gippsland CMA, 2024, p.32). Similarly, the CSIRO (2000) Gippsland Lakes Environmental Study found that salinity varies both horizontally and vertically from the entrance, with Lake Wellington having the lowest salinity and eastern Lake King having the highest. A more recent 3D model of the Gippsland Lakes confirmed the CSIRO’s original findings. Figure 51 overleaf shows the variation in salinity stratification from Lake Wellington through to Lakes Entrance on 17/04/2021 - when salinity was relatively stable. The salinity stratification in the Gippsland Lakes during this stable period was most pronounced for Lake King South - east of McMillan Strait to Metung – with salinity becoming progressively deeper from 3 to 5 metres over a distance of around 1 km.

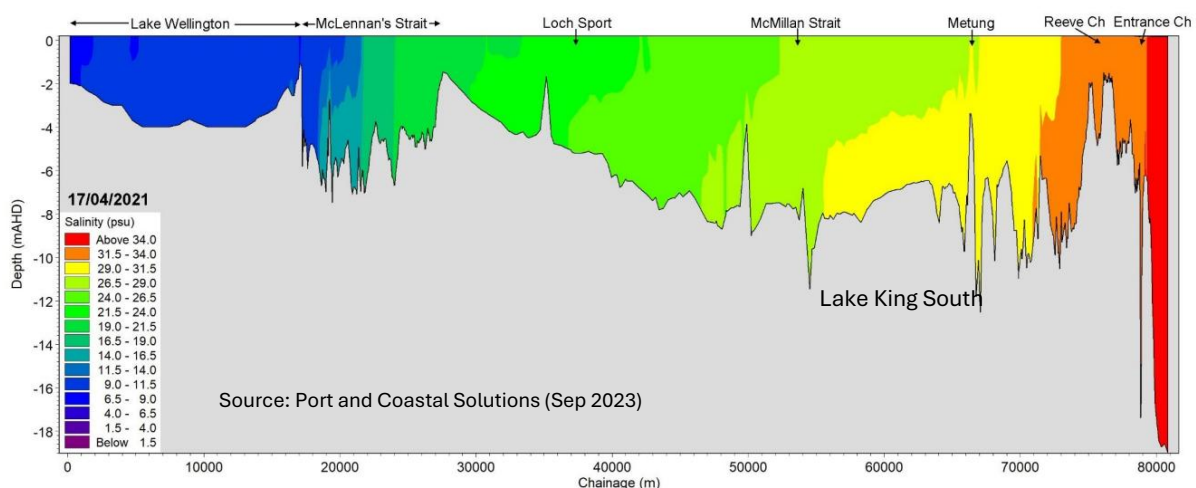


Figure 51. Modelled salinity through the water column along a long section through Gippsland Lakes from Lake Wellington to offshore of Lakes Entrance on 17/04/2021 when the salinity was relatively stable.

Source: CSIRO (2000) Gippsland Lakes Environmental Study -Hydrodynamic Modelling

Salinity time series data from 1997 to 1999 for Lake King East (shown in Figure 33 below), found salinity to be relatively uniform between 1 and 5 metres in depth (except just after flood events). From 6 metres and below, salinities tend to increase significantly with depth – with this behaviour seen throughout the deeper parts of the Lakes (CSIRO, 2000).

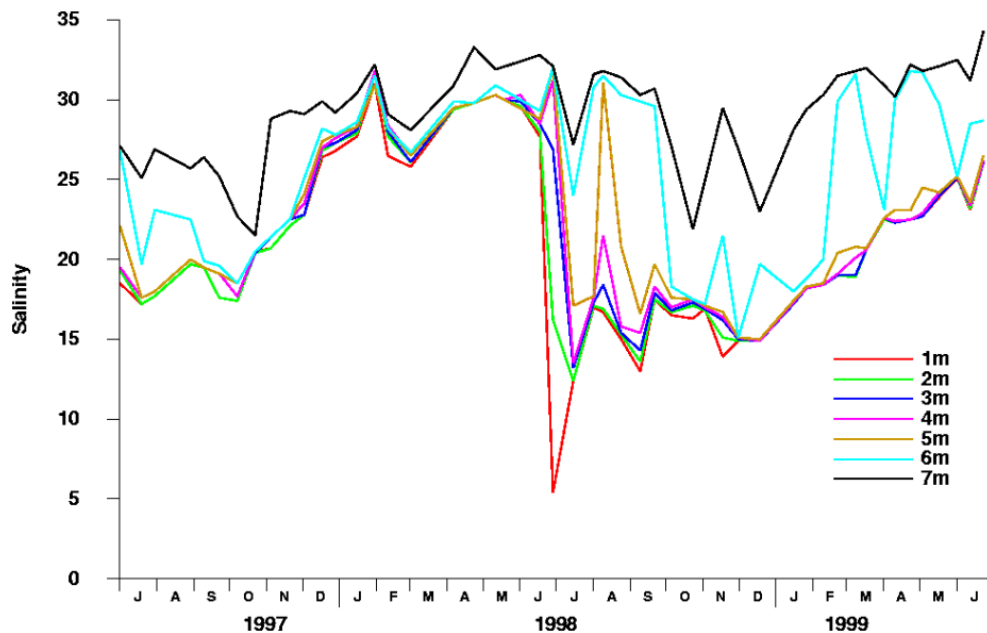
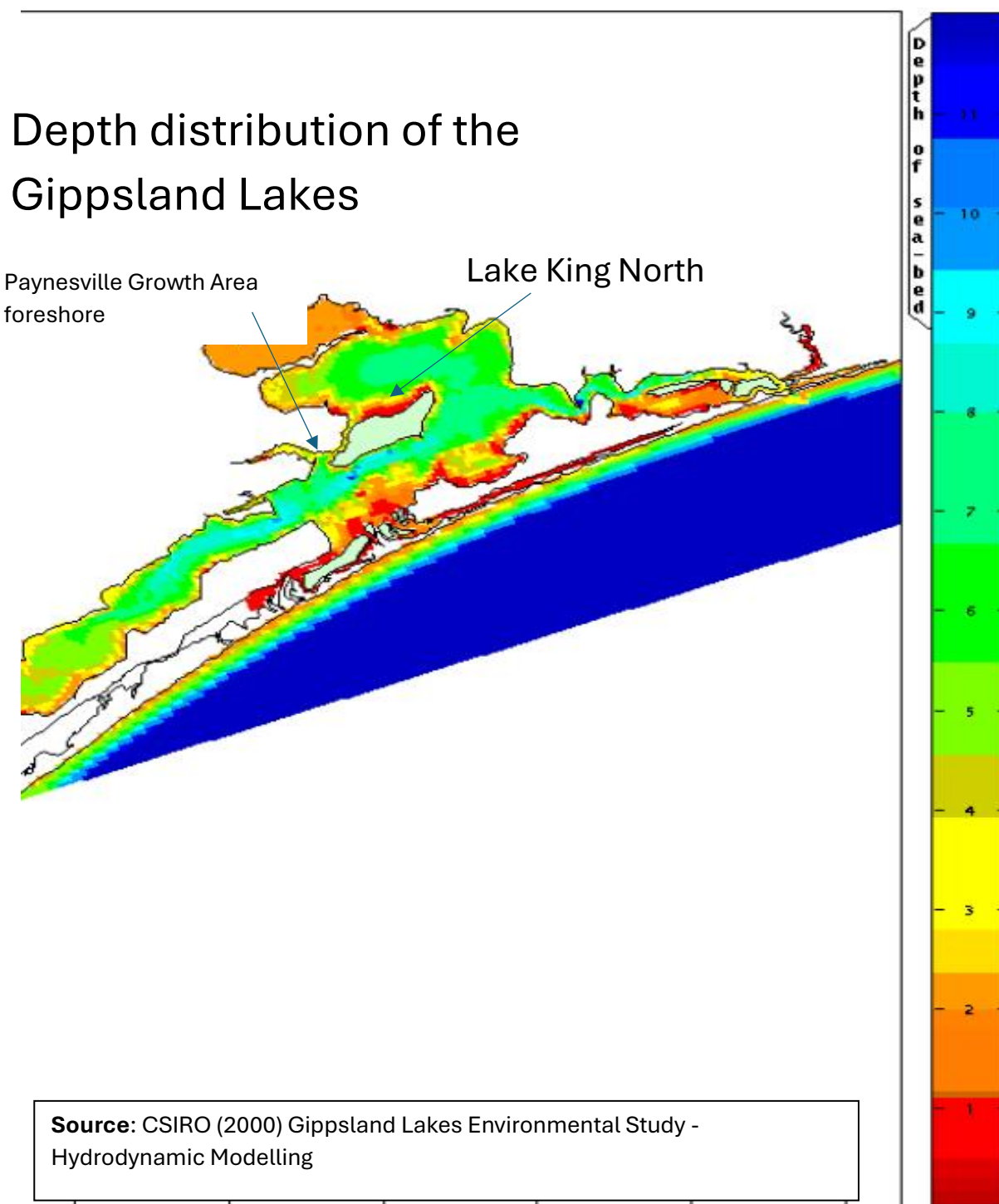


Figure 33. Salinity at 7 depths (1 – 7 metres) at MAFRI site 2 (eastern Lake King).

Source: CSIRO (2000) Gippsland Lakes Environmental Study -Hydrodynamic Modelling

Bathymetry- Lake King (North)

Lake King North - the closest section of the Gippsland Lakes to the subject area - frequently experiences salinity stratification, as demonstrated by long-term EPA vertical salinity profile monitoring data.⁷¹ A 2D hydrodynamic model cannot reproduce this layering; instead, it will dilute salinity and potentially misrepresent flow dynamics as explained in the following section:



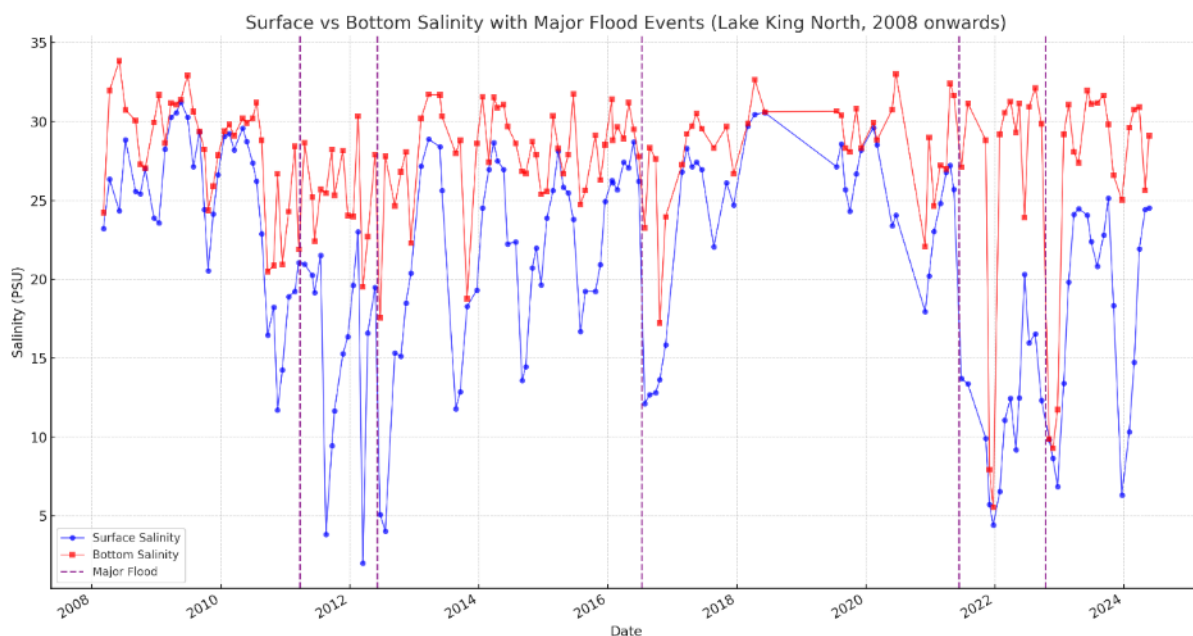
⁷¹ <https://discover.data.vic.gov.au/dataset/gippsland-lakes-water-quality-data-1990-2024> accessed 10/6/2025.

Salinity Stratification – Lake King North

Lake King North, within the Gippsland Lakes system, exhibits significant potential for vertical stratification due to its moderate depths close to the subject site (4–8 m), limited wave exposure, and restricted tidal exchange via a narrow ocean entrance, which promotes prolonged residence times and sustained density gradients (CSIRO 2000). Stratification is particularly pronounced following freshwater inflow events, where freshwater overlays denser saline waters, creating a pronounced halocline (CSIRO 2000; Ye et al., 2020). Such vertical density gradients can considerably influence hydrodynamic behaviour by limiting vertical mixing, altering circulation patterns, and potentially affecting surface floodwater elevations and residence times of floodwaters (CSIRO 2000; Wu et al., 2011; Ye et al., 2020). Neglecting this vertical complexity could result in the underestimation of flood extents, durations, and especially ecological impacts.

Source: EPA Gippsland Lakes Water Quality Data 1990 – 2024 ([WMIS Portal](#))

Water quality data from the EPA Victoria Marine Fixed Site Network within the Gippsland Lakes strongly suggests that catchment flooding significantly alters the lake's salinity profile, driving



substantial vertical stratification. Data collected between 2008 to 2024 (shown above) from the EPA Lake King North monitoring site shows salinity differences between surface and bottom waters average approximately 6.48 PSU, commonly exceeding 8.98 PSU (75th percentile), and peaking at nearly 24 PSU during significant flood events. Major freshwater inflows from events such as those in 2011, 2012, 2016, 2021, and 2022 correspond directly to pronounced drops in surface salinity, resulting in a persistent freshwater layer atop denser saline waters. This longitudinal data confirms the findings of the CSIRO (2000) Gippsland Lakes Study.

Flood modelling in stratified estuaries

Although the subject site is partially buffered from riverine inflows by the Mitchell River's extensive silt jetties, these barriers only moderately delay or diffuse freshwater influx during high-flow periods, ultimately being insufficient to prevent strong stratification. The prolonged stratification often evident in Lake King can significantly restrict vertical mixing, alter hydrodynamic circulation, and prolong inundation durations beyond what depth-averaged models like MIKE21 FM can accurately predict (CSIRO 2000). Ishikawa et al. (2022) compared

1D, 2D, and 3D open-source models in a medium-sized stratified lake. All models could reproduce the overall seasonal thermal stratification, but only the 3D model accurately captured flow velocities and density currents under stratified conditions (Ishikawa et al., 2022). This study aligns with other studies' findings that depth-averaged models often mis-locate or weaken density-driven flows, whereas 3D models capture the prolonged residence or flushing times caused by stratification (CSIRO 2000; Gale 2006; WMA Water 2010; Kumbier et al. 2018; Chen et al. 2012).

The LCHA's omission of density-driven circulation means that certain hydrodynamic responses (like how quickly floodwaters evacuate or how salt intrudes back into the lakes) might not be as well captured compared to a 3D model. The report itself does not explicitly discuss this limitation, but it is inherent given the modelling approach used in 2014. More recent hydrodynamic studies of the Gippsland Lakes have used three-dimensional (3D) models to better simulate salinity and stratified flows when determining lake water levels (Gippsland Ports Technical Report Sep 2023). This study showed that soon after a high freshwater discharge event, there is still variability in salinity through the water column in Lake Victoria and Lake King (Gippsland Ports Technical Report Sep 2023; p. 54). This suggests that flood events in the Gippsland Lakes may not fully eliminate salinity stratification, potentially influencing flood dynamics in ways not adequately captured by the 2014 assessment. While the hydrodynamic modelling conducted in 2014 was calibrated effectively to observed water levels, it may have lacked the full physical realism needed to reliably simulate flood behaviour under certain stratified conditions. Thus, caution is warranted when interpreting these results, as greater accuracy in modelling may require consideration of additional physical processes related to stratification.

Calibration Period Constraints: The LCHA hydrodynamic model was calibrated and validated using selected data ranging from 2007 through to 2012. According to Water Technology (2014, Report 2), *"the hydrodynamic model was calibrated to typical conditions over June–August 2011"* and also to several flood events *"including the June 2007 flood event"* and a moderate inflow event in June 2012. These calibration efforts showed the model could reproduce observed water levels for those events (within certain tolerances). The report claims the model *"has been calibrated to a level sufficient to demonstrate it is fit for the purposes of the study"* (Water Technology, 2014, R02, p.74). While the calibration to the 2007 flood (one of the largest on record) is a strength, it is important to note that no events post-2012 were included.

This calibration gap is potentially significant because several substantial flood events have occurred in the Gippsland Lakes region since 2012, notably the events in 2016, 2021, and 2022, which featured distinct hydrological conditions, inflow patterns, and storm-tide dynamics. For instance, the June 2021 flood resulted from a complex low-pressure system bringing heavy rainfall and very strong winds, whereas the Oct 2022 flood was influenced by a hybrid cyclone formed by converging low-pressure systems. Capturing these events in model calibration would assist in accurately representing the full range of hydrodynamic responses, including interactions between freshwater inflows, storm surge dynamics, wind-driven circulation patterns, and stratification impacts, ultimately ensuring the robustness and reliability of flood predictions under both current and future climatic conditions.

Without incorporating recent extreme events and accounting for evolving hydrological and climatic patterns, the model's predictive reliability for current and future flood scenarios is

notably reduced, and there is increased uncertainty when applying this modelling to support critical long-term planning decisions or infrastructure resilience strategies in the Gippsland Lakes area.

Limited Sensitivity and Uncertainty analysis

The LCHA undertook a sensitivity analysis of the potential impact of sea level rise on the tidal, storm surge and wind setup hydrodynamics of the Gippsland Lakes. The hydrodynamic model was simulated over a three-month period (June-Aug 2011) of what the modellers considered ‘typical’ ambient forcing conditions incorporating 0.4 and 0.8m sea level rise scenarios. Such limited sensitivity analysis poses several methodological concerns, namely:

Limited simulation period of “typical” conditions: To evaluate the effects of sea-level rise (SLR) on tides, storm surge, and wind setup, the LCHA (2014, Report 2; p.49) employed only a three-month modelling period (June–August 2011), described as representing “typical ambient forcing conditions.” While this timeframe included moderate streamflow and wind conditions, it notably lacked representation of extreme flood or severe storm events. This limited simulation period restricts the assessment's capacity to reliably capture the true variability and complexity of coastal and hydrological processes, particularly the rare, compound events essential for robust hazard assessments. Best-practice coastal hazard analyses typically utilise probabilistic methodologies—such as joint-probability or Monte Carlo simulations—to explicitly incorporate variations in storm surge height, wind intensity, catchment flood peaks, and tidal timing (Hawke, 2008; Wu, 2018). Thus, relying on only three months of “typical” conditions, regardless of their described dynamism, inevitably underestimates the full range of potential flood scenarios and diminishes the reliability of projections, especially when assessing future risk scenarios under sea-level rise conditions.

Sparse SLR scenarios and limited sensitivity analysis: The sensitivity analysis considered only two discrete sea-level rise increments (0.4 m and 0.8 m) above present mean sea level. These values correspond to minimum planning benchmarks (e.g. 0.8 m by 2100), but no higher-end scenario was examined, nor a lower or interim value beyond the single 0.4 m step. This coarse approach fails to explore the continuum of possible SLR outcomes or the many uncertainties around them, including vertical land movement or subsidence. Parts of the Gippsland Basin are subsiding at ± 10 mm per year (Ng et al., 2015). McInnes notes that subsidence along the Lakes Entrance coastline is occurring and “an assessment of these additional contributions to relative sea-level rise will be important to quantify for coastal adaptation” (McInnes, 2024; p.5).

McInnes *et al* adopted a conservative planning benchmark of 1.1m SLR and 1.4m SLR for sensitivity scenarios, and modelling runs of 20 years to capture a complete 18.6-year tidal cycle as part of the Port Phillip Bay CHA so as to better account for future uncertainty (McInnes et al. 2022). Given that recent projections from the IPCC and CSIRO indicate global mean sea-level rise in the range of 0.6–1.1 m by 2100 under high-emissions scenarios—and explicitly caution that “a rise of two or more metres cannot be ruled out” in worst-case, low-probability ice-sheet collapse scenarios—a precautionary planning approach is strongly recommended and aligns with current best practice (Oppenheimer et al., 2019). Thus, constraining the analysis to 0.8 m SLR misses the upper tail risk (low-probability but high-consequence sea-level scenario) that expert panels now urge us to consider for long-lived infrastructure planning. In sum, to enhance the robustness of future projections, it's prudent and best practice to incorporate additional

sensitivity and uncertainty analyses into the modelling framework, particularly for storm surge, extreme weather, land subsidence and wave modelling parameters (Bastidas, et al 2016).

No simulation of extended and extreme forcing periods: Estuarine and deltaic environments like the Gippsland Lakes are particularly at risk from compound flooding due to their combined exposure to storm tides and riverine discharges (Olbert et al., 2017). Best practice in such environments would model beyond a single season of moderate conditions and cover longer periods and far more varied conditions, including compound events (Kumbier et al., 2018; Iglesias, et al. 2022). Modelling dynamic shoreline adjustment, typically expressed as progressive shoreline recession under conditions of rising sea level, is a critical component of robust coastal planning. Such modelling is especially vital given its direct interactions with various infrastructure and development projects—including roads, housing, recreational amenities, and sea walls—as well as its profound implications for ecosystem integrity and the sustained provision of ecosystem services from valuable natural habitats (Ranasinghe & Stive, 2012; Kinsela et al., 2022).

Traditional methods, such as the Bruun Rule (1962), first highlighted how shorelines dynamically shift landward and upward as a physical response to sea-level rise, rather than remaining static. Contemporary approaches, including equilibrium shoreline models (ESMs) and hybrid process-based models like CoSMoS-COAST, now incorporate complex interactions among sediment budgets, dune erosion, storm impacts, and ecological feedback mechanisms (Vitousek et al., 2021; Kinsela et al., 2022). Increasingly, probabilistic models (e.g., Probabilistic Coastline Recession (PCR) models) quantify these changes explicitly, integrating uncertainties to better inform planning decisions (Ranasinghe & Stive, 2012). Current best-practice frameworks explicitly advocate multi-year, dynamic morphological simulations that account for subsidence, altered sediment supply, and ecosystem feedbacks, ensuring both ecological resilience and sustainable infrastructure siting decisions over long planning horizons (Bastidas, Knighton, & Kline, 2016; Olbert et al., 2017).

At minimum, multi-year simulations that include seasonal variability, a range of storm conditions, and various flood events and ‘what if’ scenarios such as subsidence, should be performed for each SLR scenario (Xu et al. 2023). To ensure best practice for modelling climate change scenarios, a model ought to run for 10–20 years of synthetic or resampled weather data representing the present climate, and then the same for a future climate with SLR (and potentially adjusted storm climatology). This would capture multiple storm surge events, occasional large floods, and even successive events. From such runs, statistics of extreme water levels can be derived (e.g. the 1% annual exceedance level under each scenario). If continuous long-term simulation is computationally heavy, an alternative is to run a suite of targeted event simulations: e.g. (1) a moderate storm, (2) an extreme storm, (3) a moderate flood, (4) an extreme flood, (5) an extreme storm + extreme flood coinciding – each under present and future sea levels. Ensuring that at least one scenario represents a compound extreme (storm + flood + adverse wind) is critical. This addresses the LCHA gap of no “worst-case” simulation.

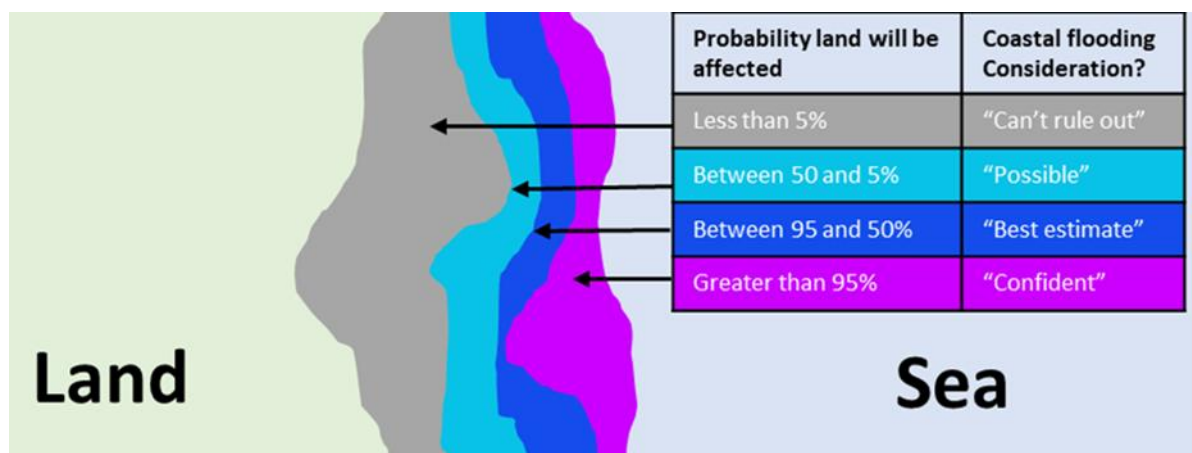
Incorporating compound events can be guided by the joint probability analysis – e.g. choosing a timing offset that is statistically plausible (not necessarily peak-on-peak, but perhaps a large catchment flood 24 hours after a coastal storm peak, to simulate back-to-back compounding). Scenario selection might also consider historical worst events (e.g. the June 2007 flood for catchment input, and an observed high storm surge event for ocean input, even if they didn’t

coincide historically – effectively creating a *hypothetical alignment*). The goal is to test the model and system under stress: if the model remains stable and shows no surprises under these extreme tests, confidence in its predictions increases; if it reveals significantly higher water levels than extrapolated from mild scenarios, that’s a crucial insight for risk management. This approach aligns with the ‘wargaming’ concept favoured by CSIRO expert Dr Kathy McInnes (Schmidt, 2020) – and aids in understanding the implications of compounding climate risk factors. This worst-case scenario modelling approach facilitates stress-testing for councils and planning agencies and offers a much better understanding of risk.

No probabilistic hazard modelling: The LCHA did not employ any probabilistic or ensemble modelling to assess sensitivity of outcomes to uncertain parameters (e.g. variations in storm tracks, wind strength, or inlet conditions) (O’Grady, 2024). There was no Monte Carlo or error-bounding analysis – the study delivered deterministic results without confidence intervals. This is a notable limitation given the inherent uncertainty in climate and geomorphic responses; best practice would incorporate methods to quantify ranges of possible water levels and erosion extent rather than a single outcome per scenario. For instance, the decision to uniformly apply inland wind data was not accompanied by sensitivity or uncertainty analyses to quantify the potential impacts of spatial and temporal variability in wind conditions. Without explicitly testing how differences between inland and coastal wind fields influence hydrodynamic outcomes, there remains significant uncertainty regarding the robustness of model predictions (Ntegeka et al. 2013). Such analyses are necessary to understand if the simplifications introduced by using inland wind data result in systematic biases, especially during critical extreme events.

Future uncertainties and assumptions (bias) in flooding levels should be considered in an assessment of coastal hazard and risk (Hinkel, et al 2021). More recent Coastal Hazard Assessments, such as the Port Philip Bay Coastal Hazard Assessment, incorporate probabilistic inundation layers to assess future uncertainty and stress test different scenarios - showing high to low confidence intervals that land will be affected by coastal flooding. These probabilistic ranges are consistent with the IPCC Global Climate Model (GCM) ensemble estimates, and cover the likely range, representing 90% uncertainty, i.e. the 5th to 95th as illustrated below (McInnes et. al. 2022).

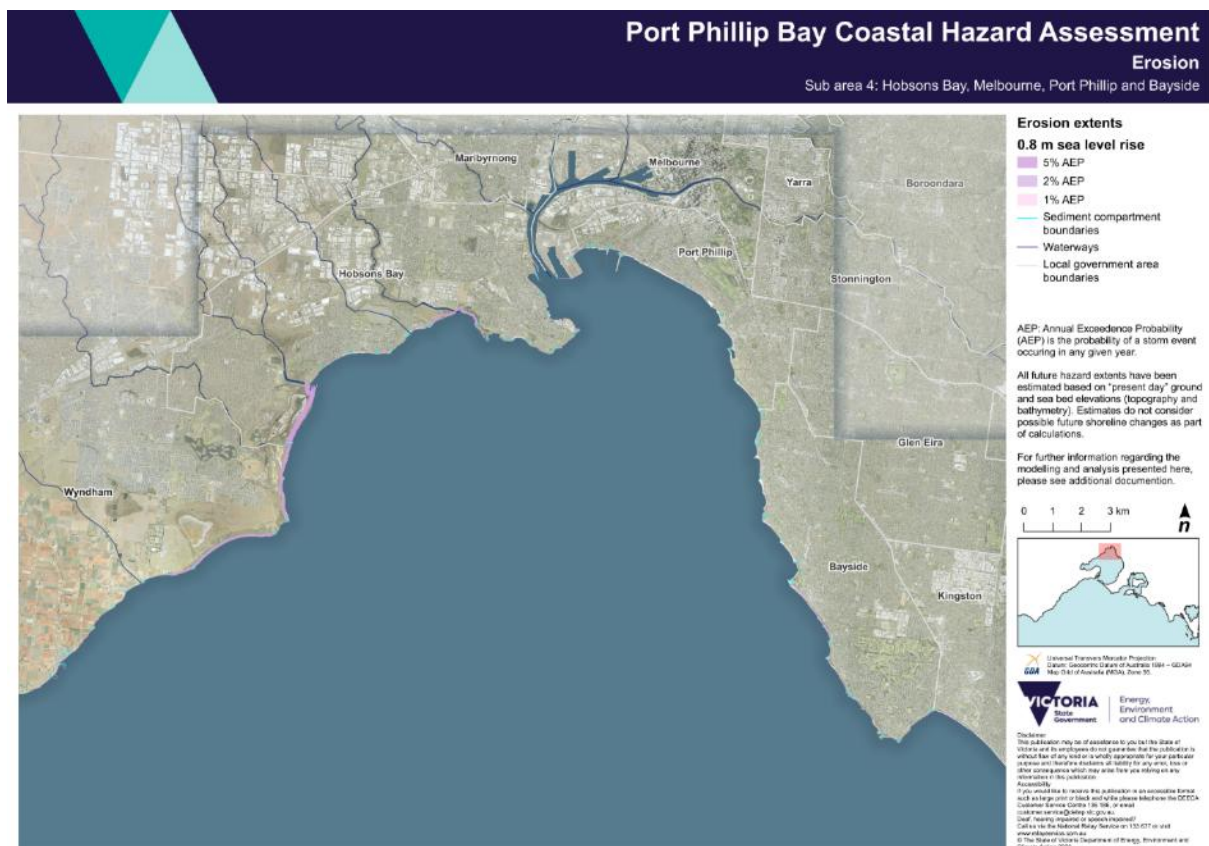
To robustly handle the combination of multiple drivers and extreme value modelling



(storm/tide, wind/wave, rain/runoff etc), coastal hazard assessments should use statistical joint probability methods or Monte Carlo simulation alongside deterministic modelling (Hawke, 2008; Wu 2018). For instance, the Monte Carlo approach could generate thousands of synthetic

events where storm surge height, storm timing relative to tide, catchment flood peak, wind speed, etc., are then varied according to their probability distributions and known correlations. Each synthetic event can be a quick run (or even an analytical calculation if response surfaces are derived from the physics-based model), and the result would be a probabilistic flood level distribution for a given time horizon and SLR scenario (McInnes et al. 2024; Clare, M.C.A et al, 2022). These more recent methodologies combine deterministic approaches with stochastic simulations to define coastal erosion hazard zones. By specifying parameter bounds and employing stochastic simulations, these methods produce probabilistic forecasts of potential hazard extents, offering a more comprehensive understanding of uncertainties and aiding in the development of risk-based planning strategies (McInnes, et al. 2024, O’Grady et al. 2024).

The example below from the Port Phillip LCHA shows erosion extents with 0.8m SLR by storm event likelihood (AEP) -showing planning authorities which areas are potentially affected by short and/or longer-term coastal erosion processes under certain (1%, 2% and 5% AEP) local weather (storm) conditions.

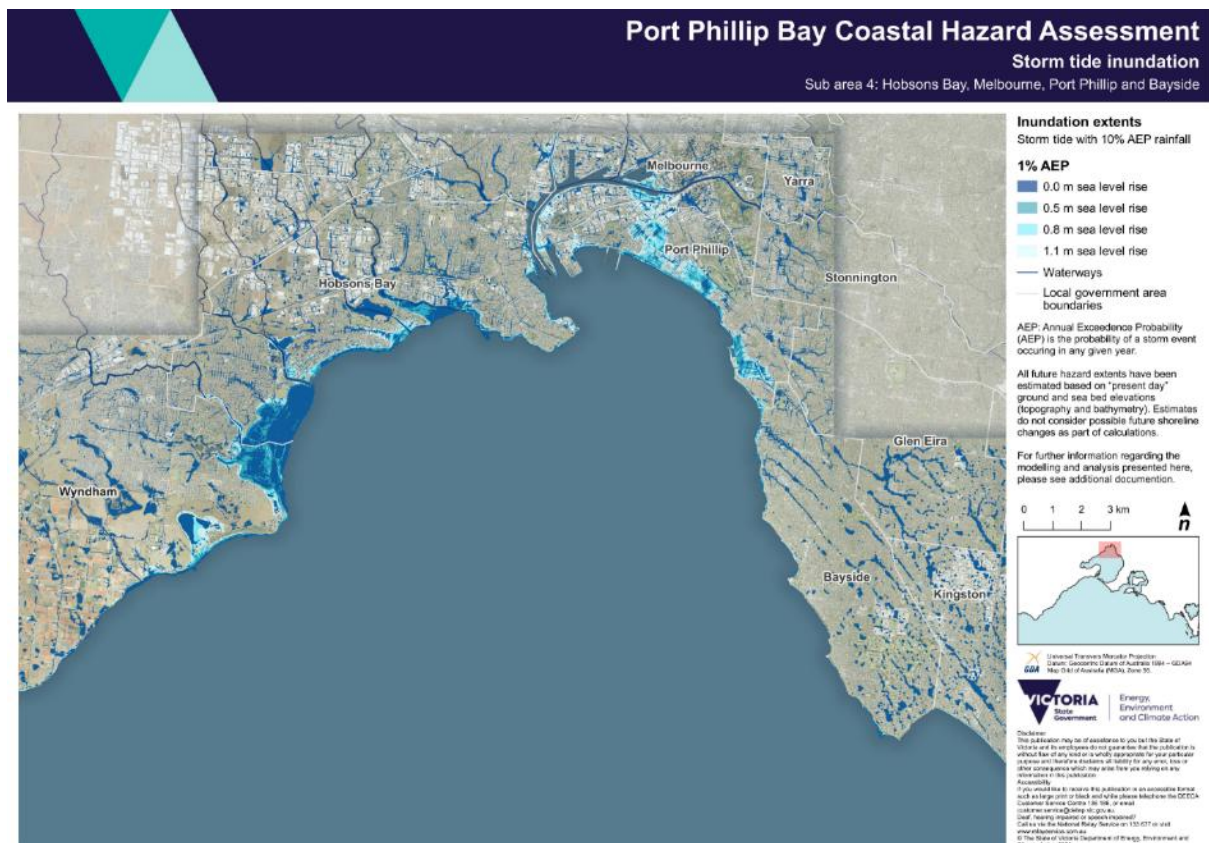


If full Monte Carlo is too onerous, simpler joint probability analyses can be done: e.g. using the Hawkes (2008) or Yue & Rasmussen (2002) bivariate frequency analysis method (commonly referenced in ARR Project 18) to calculate the joint AEP of combinations of coastal and fluvial extremes. The outcome might be a matrix or curve of combined probabilities, which can inform scenario selection (e.g. the event that is “joint 1% AEP” might be a 1% AEP flood with a 50% AEP tide, or a 10% AEP flood with a 5% AEP tide, etc., depending on correlation). Such analysis ensures no plausible high-risk scenario is overlooked. The LCHA’s deterministic approach should be supplemented by these techniques if revisited, to reflect best practice evident in the latest Coastal Hazard Assessments (e.g. Port Phillip LCHA 2023, Mid North Coast NSW LCHA 2023; CSIRO Australia-wide CHA 2024).

Indeed, many modern studies (such as the CSIRO Coastal Inundation Assessments (2024) for LGA's across Australia) incorporate a hybrid approach: running many combinations through an efficient computational framework (sometimes called "ensemble simulation", then fitting an 'Extreme Value Distribution' to the results to estimate design levels probabilistically (Iglesias et al. 2022). This is the emerging standard for flood studies in complex settings and would greatly strengthen the credibility of a hazard assessment for planning purposes. By incorporating these strategies, the hydrodynamic model will be better equipped to simulate future conditions, providing more reliable information for planning and risk assessment.

No explicit compound-event scenarios: The modelling of compound flood events is inherently complex and requires a multidisciplinary approach. Treating catchment floods and ocean storm surges primarily as separate or simplified scenarios, rather than simulating truly compound extremes, fails to adequately capture realistic flood risks and cumulative impacts, especially in estuarine and deltaic environments like the Gippsland Lakes (Leonard et al., 2013; Olbert et al. 2017;). The core flood scenarios in the LCHA relied upon a representative 10% Annual Exceedance Probability (AEP) flood (approximately a 1-in-10-year event) under different sea-level rise (SLR) conditions. While these scenarios likely included concurrent tidal conditions, there is no evidence that the study specifically modelled a significant coastal storm-tide event coinciding with a major flood under future sea-level conditions. Sensitivity analyses for SLR relied solely on moderate winter conditions from 2011, involving minor surges, rather than extreme storm scenarios. Consequently, the assessment did not simulate a "perfect storm" scenario—such as a severe coastal storm surge coinciding with a major flood and strong wind setup during elevated sea levels. This represents a critical methodological gap because the joint probability of such compound events, though low annually, is increasingly relevant in the context of climate change (Zscheischler et al. 2017).

Failing to consider the simultaneous occurrence of extreme river floods and storm surges, for instance, risks significantly underestimating peak water levels in coastal lakes. Contemporary flood modelling guidelines, such as the Australian Rainfall & Runoff Project 18, explicitly warn that assuming independence of these events can underestimate flood levels in coastal areas, directly cautioning against the segmented analysis approach employed by the LCHA. The Port Phillip Bay Coastal Hazard Assessment however demonstrated best practice by modelling 1% AEP storm tide inundation extent with 10% AEP rainfall to show compound flood risk (shown below).



Simplified uncertainty modelling and model scope: The LCHA did include some uncertainty modelling (e.g. barrier overwash scenario, increased river inflows, land subsidence). However, these were handled in a simplified manner that limits their insight. For instance, the LCHA appropriately recognizes significant uncertainty regarding climate-driven changes in catchment flood hydrology, especially increased precipitation extremes projected under future warming scenarios. Current research indicates likely increases in intense hourly and daily rainfall and prolonged dry intervals, resulting in higher rainfall intensity during fewer rainfall events (Clarke, et al 2019; Osburn et al, 2020 Kirono et al, 2022). For instance, projections for Gippsland suggest extreme rainfall intensity on the daily scale (ARI20) could increase substantially—by as much as 57% in autumn by 2040-2059, and by 59% in winter by 2080-2090 (Clarke, 2019).

However, the LCHA adopted a simplified mechanistic approach to assess hydrological uncertainty, assuming a direct linear increase (20%) in flood volume corresponding to a projected 20% increase in rainfall intensity. It then modelled the increased inflows on just a 10% AEP event, without detailed consideration of altered catchment wetness dynamics, infiltration losses, or entrance channel morphology under future sea-level rise conditions. This simplistic modelling found a 20% increase in flood flows are projected to increase water levels at Paynesville by approximately 10.8% (Water Technology, 2014; p.59). Moreover, while modelling a 20% increase in flood flows provides a preliminary indication of how future precipitation changes might impact flood hydrology, it does not capture the complexity or broader range of all potentially significant climate-driven influences.

Other significant climatic variables, notably humidity, evapotranspiration, and changes in storm characteristics such as wind speed, direction, frequency, and duration, were not explicitly modelled. The omission of evapotranspiration is particularly relevant given that higher

temperatures and reduced humidity under climate change can significantly alter soil moisture conditions, potentially reducing runoff volumes or altering peak flood timings. Similarly, excluding changes in storm characteristics such as wind direction and intensity—factors critical to storm surge dynamics, wind-driven water-level variations, and coastal erosion—limits the robustness of the coastal inundation and erosion assessments. Recent studies have found that the combined use of several hydrodynamic models reduces the uncertainty of the results and increases the reliability and consistency of predictions for estuarine regions (Iglesias, et al. 2022a). More robust modelling, incorporating a range of probabilistic regional climatic and hydrological projections, more extreme flood scenarios (e.g. 1% AEP or even 0.2% AEP floods), and explicit treatment of catchment wetness and morphological feedback, would improve the reliability and comprehensiveness of the LCHA flood-risk assessment for Paynesville, and the Gippsland Lakes in general.

In sum, comprehensive uncertainty analysis requires modelling multiple, interdependent climate variables and their interactions, rather than a simplistic increase in inflows alone. Without including these factors, the LCHA likely underestimates the range of future coastal hazard conditions, potentially misrepresenting the severity and frequency of flooding and erosion risks around the Gippsland Lakes (Water Technology, 2014; Clarke et al., 2019; Kirono et al., 2022)

Sea-Level Rise Scenarios and Climate Change Assumptions

Limited Sea Level Rise Scenarios Considered:

The 2014 LCHA was never intended as a full flood study suitable for land use planning.⁷² The table below reproduced from LCHA Report 2 (p.41) highlights how only one (+ 0.2m) sea level rise impact scenario on 1% Annual Exceedance Probability (AEP) peak flood levels was modelled.

⁷² Water Technology (2014), Gippsland Lakes Local Coastal Hazard Assessment Project: Report 1 - Summary; p.xix

Table 5-3 Relative Change in Peak Flood Levels to Sea level Rise at Paynesville

Sea Level Rise Scenario	0.0 m	+ 0.2 m	+ 0.4 m	+ 0.8 m
10% AEP Flood				
Peak Level (m AHD)	1.59 ¹	1.71	1.85	2.13
Level Change (m)	0.0	0.12	0.26	0.54
SLR Response Factor	-	0.58	0.65	0.67
1% AEP Flood				
Peak Level (m AHD))	1.70 ¹	1.83	Not modelled	Not modelled
Level Change (m)	0.0	0.13		
SLR Response Factor	-	0.65		

¹ Note that the modelled 1% and 10% AEP levels for existing conditions are approximate and do not match the declared flood levels at Paynesville.

1% AEP Flood events only modelled a single SLR scenario: The LCHA did not model 1% AEP Flood Scenario Maximum Inundation Extent under Sea-Level Rise scenarios at Paynesville beyond 2040. This means the study did not determine the maximum inundation extent of a 1% AEP flood under a 0.4 m or 0.8 m SLR scenario, nor any scenario beyond 0.8 m SLR. Furthermore, it did not model (nor map the extent of) 1% AEP storm tide surge events occurring independently of catchment flooding. Therefore, the relative change in peak flood levels at Paynesville associated with sea-level rise (SLR) increments of 0.4 m and 0.8 m or the 1% AEP storm/tide surge levels and extent are undetermined by the study.

SLR Response Factor for +0.8 m SLR unknown

The Local Coastal Hazard Assessment (LCHA) only calculated a Sea-Level Rise Response Factor (SLR Response Factor) of 0.65 for the scenario of a 1% Annual Exceedance Probability (AEP) flood combined with a 0.2 m SLR. However, if the results from the 10% AEP flood modelling at Paynesville can serve as an indicative reference, it is likely that the SLR Response Factors for higher SLR scenarios (0.4 m and 0.8 m) would be substantially greater than 0.65. This omission represents a significant gap in hazard assessment, creating uncertainty and undermining confidence in the accuracy and comprehensiveness of the amendment's planning response to climate change impacts.

Moreover, selecting 0.8 m as the upper bound for modelling the 10% AEP flood and mapping shoreline hazard extents does not adequately capture the full range of potential hazard risks or reflect the scientific uncertainties inherent in future sea-level rise projections. Even by 2014, there was recognition that higher rises were possible under high emissions or ice sheet instability, albeit with low probability by 2100 (e.g. AR5 indicated an upper likely range ~0.98 m by 2100 under RCP8.5). Since then, projections have grown more concerning for later this century and beyond. For instance, the State of the Climate 2022 report (CSIRO & Bureau of Meteorology, 2022) confirms global mean sea level continues to accelerate, tracking towards the high end of IPCC scenarios. Global SLR by 2100 under a high-emission scenario (SSP5-8.5)

is about 0.77–1.02 m (median to 95th percentile, IPCC AR6). Including low-confidence ice sheet contributions, “plausible” high-end outcomes could exceed 1 m by 2100 (Fox-Kemper et al., 2021; Garner et al., 2018). Thus, planning solely for 0.8 m ignores plausible high-consequence coastal hazard risk scenarios.

Regional factors can amplify SLR in East Gippsland. The East Australian Current and regional oceanography are projected to cause a slightly higher rise along the Gippsland coast than the global average (McInnes, 2024). According to McInnes, the latest IPCC year 2100 localised (median) projection for East Gippsland is an 0.84 m sea level rise; ranging from a 0.65 m to 1.11 m increase (5th to 95th percentile) (McInnes, 2024, p.1). While the difference may be relatively small (approximately 5–10 cm), it implies that local sea levels could reach heights that global averages would only experience approximately a decade later.

Compound extreme water levels not captured: LCHA did not simulate a truly concurrent extreme (e.g. 1-in-100-year ocean storm tide coinciding with a large catchment flood), and thus may have missed the upper bound of flood levels that the system could experience. The approach of modelling a 10% AEP (10-year ARI) flood with mean ocean conditions, and separately modelling moderate storm surges with no major flood, fails to reveal the outcome if both drivers peak together. While extremely large flood and surge coincidences are rare historically, future climate conditions are projected to alter their timing and frequency (Pepler et al. 2016), and even a *moderate* flood on top of a *high* coastal storm tide can produce new extremes. The Australian Rainfall & Runoff (ARR) guidelines now emphasize that treating flood and surge independently can “underestimate flood levels in coastal areas”, and a nuanced joint probability approach is needed (Engineers Australia, 2014). By not doing so, LCHA likely underestimates the probability and height of extreme joint-events. This is especially pertinent under SLR: as baseline sea level rises, even less-severe storms can cause water levels that previously required a rare combination.

The IPCC’s Special Report on Oceans and Cryosphere (2019) warns that extreme sea level events that were historically rare (once per century) are expected to become common by mid-century under continued SLR (likely even in the 2050s) (Oppenheimer, M et al 2019). It also notes that “the combined impact of hazards like coastal storms and very high tides will drastically increase the frequency and severity of flooding on low-lying coasts” (Oppenheimer, M et al 2019). In the context of Gippsland Lakes, a higher mean sea level means *ordinary* high tides sit higher in the lakes; thus, a storm surge or wind setup on top of those elevated tides will reach further inland. The LCHA’s limited scenarios did not account for this compounding frequency effect. Consequently, peak water levels and flood extents for future extreme events could be higher than LCHA’s projections, which were based on either moderate flood or storm conditions. In practical terms, infrastructure and communities might face worse inundation in a 2100 storm/flood scenario than suggested by LCHA, because that study never modelled such a scenario.

Limited scope of SLR modelling: Perhaps most critically, sea-level rise will not stop in 2100. Recent CSIRO assessments and other high-end studies indicate sea-level rise could exceed 3 meters by as early as 2140, under extreme, yet plausible, scenarios involving rapid Antarctic ice sheet disintegration (Grose & Webb, 2023; van de Wal et al., 2022).⁷³ Even under

⁷³ Grose, M., & Webb, L. (2023). [Ice sheet tipping points and sea-level rise](#). CSIRO Climate Science Centre; van de Wal, R. S. W., Nicholls, R. J., Behar, D., Church, J., Hinkel, J., & Kopp, R. E. (2022). *A high-*

moderate scenarios, SLR continues at an accelerating rate past 2100 (IPCC, 2021). Any development with a long design life (public infrastructure, townships) should consider the longer term. The fixed 2.8 m AHD flood line (approximate 1% AEP in 2100 per LCHA) may be overtopped sometime in the 22nd century. These rather alarming projections underscore the importance of incorporating a wide range of potential outcomes into coastal planning and risk assessments. The CSIRO Probabilistic Coastal Inundation Map of Australia for instance adopts the high-end scenario because it in part addresses the significant uncertainty in the possible SLR estimates (beyond the IPCC likely range) from the contribution of glacial melt, and regional variations in mean sea levels (Fox-Kemper et al 2021). Also the high-end scenario (SSP 5-8.5) covers the range of state government policy [benchmarked SLR allowance](#), which are designed to manage future risk associated with coastal flooding and erosion. For example, South Australia has a sea level planning benchmark of 1 metre by 2100, which is higher than the AR6 upper range value of 0.92 for 2100 for a 4C global warming level (SSP3-7.0).

While Victoria's statewide planning policies, such as the *Marine and Coastal Policy 2020*, mandate planning for a sea-level rise **of not less** than 0.8 metres by 2100, a number of previous and more recent localized assessments and studies have considered higher sea-level rise scenarios, particularly under high-emission pathways. These localized assessments aim to account for the full range of potential hazard risks and scientific uncertainties associated with future sea-level rise. For instance, the Port Phillip Bay Coastal Hazard Assessment (PPBCHA) has explored sensitivity scenarios up to **1.4m** (2100) to test model responses under higher sea-level rise projections. The Port Fairy Coastal Hazard Assessment (2013) adopted a 0.8m SLR (2080) and **1.2m SLR** (2100) planning horizon.

This approach allows for a more comprehensive understanding of potential impacts on coastal infrastructure and ecosystems, facilitating adaptive planning strategies. Strictly relying on the 0.8 m scenario could underestimate late-century flood extents and frequency. Given the likely catastrophic consequences if worst case scenarios eventuate, truly risk-averse planning should consider a higher SLR benchmark or adaptive pathway.

Omission of High-End SLR Scenarios and Adaptive Pathways: Planning panels often ask “what if sea-level rise is worse (or happens faster) than expected?” To answer this, studies should not stop at the likely scenario (e.g. 0.8 m by 2100), but also evaluate high-end SLR cases (e.g. 1.4 m by 2100, or even 2.0 m by 2140 as a stress test). The IPCC now provides projections including an “H+” scenario for adaptation planning (which is low probability but physically plausible) (Barnard et al, 2019). By running the models for such scenarios, one can identify potential tipping points – for example, perhaps at ~1.2 m SLR a second entrance *inevitably* forms, or at ~1.0 m SLR the frequency of lake inundation of the study area foreshore infrastructure jumps dramatically. These insights feed into adaptation strategies (e.g. what amount of SLR necessitates wider coastal setbacks?).

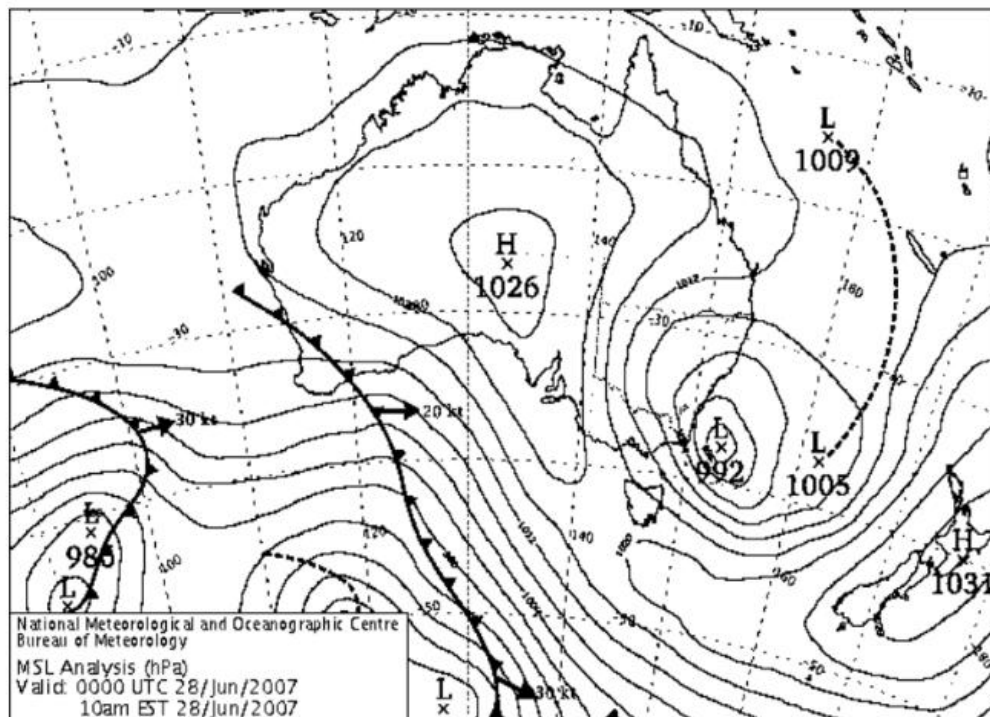
The LCHA’s binary 0.4/0.8 m test would be enriched by additional points on the curve. Furthermore, results across scenarios can be used to develop SLR response factors (which LCHA did for just one 1% AEP flood scenario) and see if system response is linear or accelerates with higher SLR. If non-linear behaviour is detected (as occurred in the 10% AEP SLR modelling), then this needs to be incorporated into the 1% AEP Flood SLR and erosion

end estimate of sea-level rise for practitioners. World Climate Research Programme (WCRP). Retrieved from <https://www.wcrp-climate.org/news/science-highlights/1955-new-sea-level-projections-2022>

modelling. Finally, presenting high-end scenario outcomes is crucial for transparency: stakeholders deserve to know the “upper bound” consequences even if probability is low, especially for critical assets. This aligns with guidance from bodies like Engineers Australia and the CSIRO, which encourage scenario planning including extreme climate futures for long-term projects.

East Coast Lows and Storm Waves – Local Context: East Coast Lows (ECLs), intense low-pressure systems affecting southeastern Australia, significantly influence storm surge, gale force winds, rainfall intensity, and coastal flooding in the Gippsland Lakes region, including Lake King. ECLs often intensify rapidly overnight making them one of the most dangerous weather systems to affect the Australian eastern coast (Holland et al 1987). Climate projections under a high-emission scenario (RCP8.5/SSP5-8.5) indicate a decrease in overall ECL frequency by approximately 10% per degree Celsius of global warming (Pepler, et al., 2016). By 2100, despite fewer storms, the remaining ECLs are expected to be more intense, with significantly enhanced rainfall and potentially higher peak rainfall rates due to increased atmospheric moisture content (~7% per °C increase). Projections suggest the number of extreme rainfall-producing cyclones could double by 2100, raising flood risk substantially around Lake King.

Intense East Coast Lows (ECLs) can cause significant **rapid-onset episodic erosion**, driven by strong onshore winds and powerful wave action. While average meteorological storm surge heights might experience a slight decrease due to a projected poleward shift in storm tracks (Pepler, et al., 2016), the impact of these surges will nonetheless be greatly amplified by an anticipated sea-level rise of between 0.6 and 1.1 meters. Consequently, storm tide levels previously considered rare events are projected to become commonplace by the end of the century, substantially increasing both the frequency and severity of coastal inundation and shoreline erosion events (McInnes, et al., 2016). These projections are further reinforced by



Typical East Coast Low MSLP Pattern Resulting in Large South Easterly Wave Events

findings from the Local Coastal Hazard Assessment (LCHA), which highlight significantly stronger wind speeds for 1% Annual Exceedance Probability (AEP) flood events, typically driven by intense ECL conditions.

Lake Fetch and Wind Changes Not Modelled:

Within the Gippsland Lakes, wind-waves can erode shorelines, especially along Lake King where easterly to south easterly winds associated with an ECL front produce longer fetches, allowing waves to build and hit the subject area shoreline with greater force. If prevailing wind patterns or frequencies change (for example, more frequent northeasterlies in summer, or stronger southerlies in winter), this could change how often the subject area's shoreline is

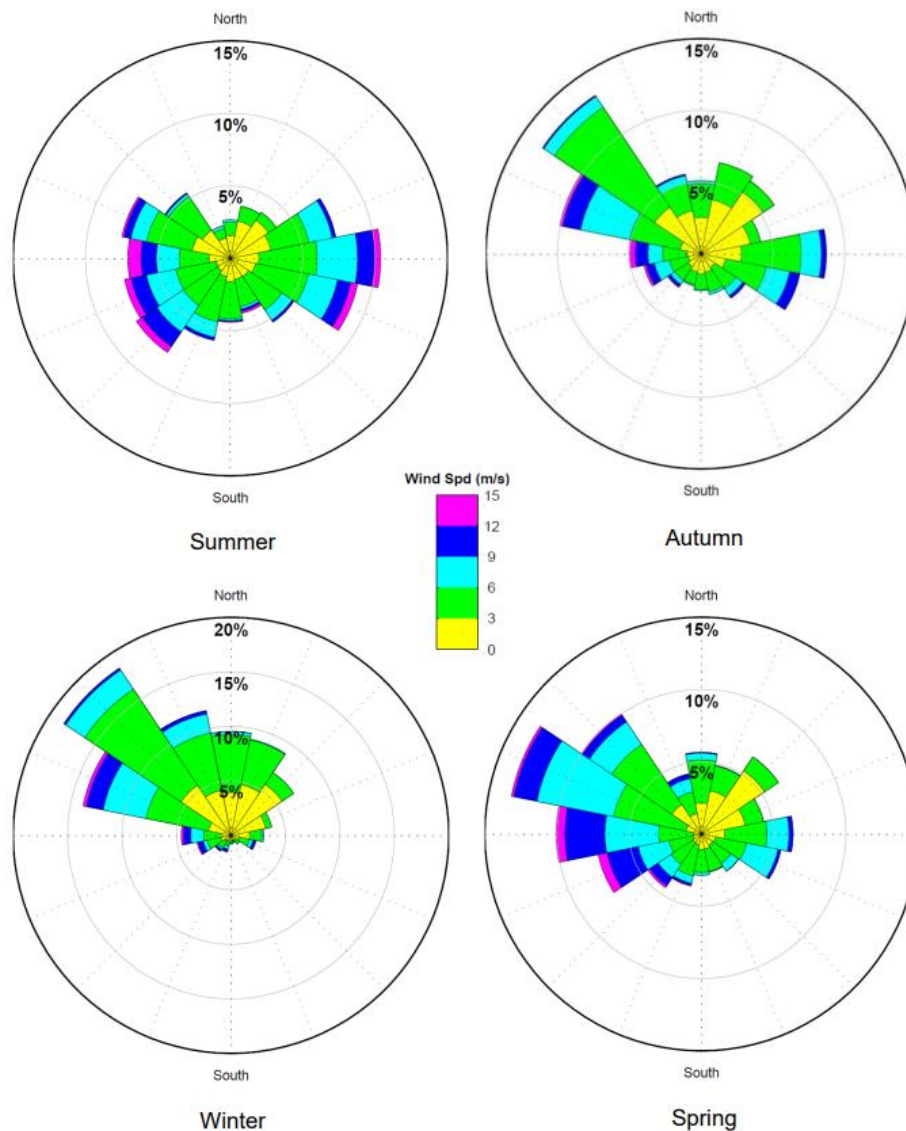


Figure 16. Seasonal wind roses from the Entrance Breakwater.

exposed to direct wave attack. For context, seasonal wind roses at the Eastern Breakwater are shown in Figure 16.

The wind plots show that there is a degree of seasonal variability with a greater dominance in winds from the northern and western sectors during winter and with a greater dominance in winds from the south eastern sectors during the summer months. The seasons with the strongest winds tend to be summer and spring, yet the inundation hazard maps in 2014 didn't

adequately account for shifts in prevailing wind patterns, given the strong westerly bias in the East Sale wind monitoring data. Moreover, though the LCHA acknowledged the potential for climate induced changes to wind speed and direction, it failed to model these changes, simply stating:

“There is currently no reliable guidance available on [wind] changes and therefore this has not been considered as part of this project.”

The lack of sensitivity analysis of changes to wind direction, speed and duration due to future uncertainty is a significant limitation of the LCHA. Testing the sensitivity of uncertain modelling parameters like wind conditions is important because of the impact altered wind conditions could have on coastal inundation levels and erosion rates on previously more protected sites (Gallop et al, 2020).

The science is clear - as the climate warms, large-scale atmospheric circulation is shifting. The Hadley cell expansion is pushing the mid-latitude westerly wind belt further south (CSIRO & BOM, 2022; Nguyen et al., 2018). For southern Australia, this can mean stronger westerlies in winter and changes to seasonal storm patterns. Gippsland’s open coast (90 Mile Beach) predominantly experiences swell and wind-waves from the southwest to southeast quadrant. If westerlies strengthen, waves from the SW (Southern Ocean swells) could slightly increase in energy. Conversely, if high-pressure systems dominate more in certain seasons, local sea-breeze winds might alter.

Notably, Water Technology recommended **improved wind and wave data** collection in the future: “*Wave data within the Lakes would assist in understanding coastal processes... better local wind data for the Lakes would also be beneficial*” (Water Technology, 2014, Report 5, p.22). This indicates there is significant uncertainty in their wave modelling due to sparse observations. Moreover, no local wave buoy exists on the Lakes; the report relied on modelled data.

The next sections expand on the wind and wave considerations in much greater detail.

Wind and Wave Climate Considerations

The wave modelling inputs (wind speeds, directions) were based on an analysis of 44.5 months of wind data from the BOM East Sale Airport from April 2008 to Dec 2011 (reproduced on page 25).

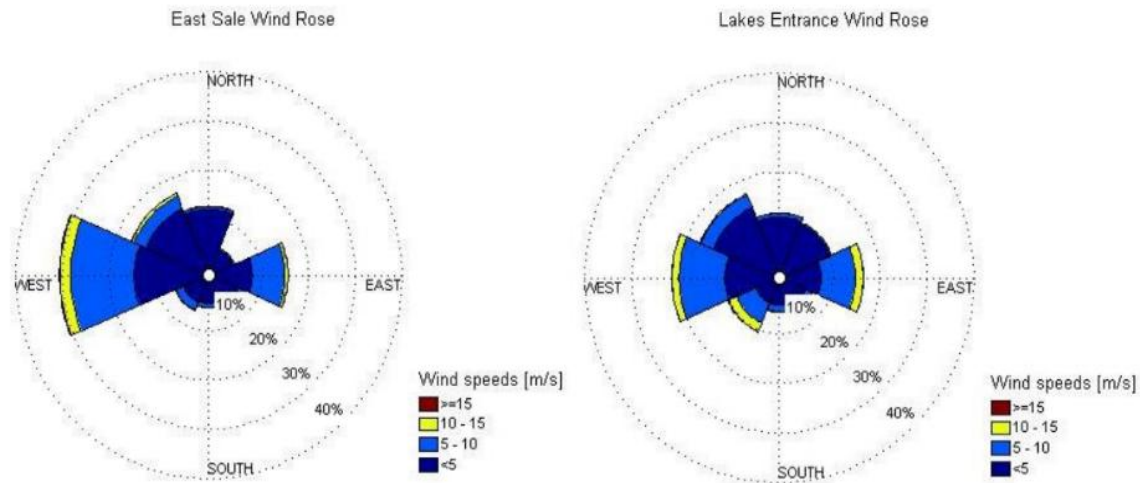


Figure 4-3 East Sale Airport and Lakes Entrance Breakwater Wind Roses for the Period 15th April 2008 - 31st December 2011

The LCHA (Report 2; p20) asserted that the plotted wind data suggested the magnitude and directional distribution of the wind blowing at the two stations “matched closely, with the exception of slightly stronger and more frequent westerly winds at East Sale.” However, more recent hydrodynamic modelling of the Gippsland Lakes has analysed concurrent wind data collected over a 20-month period from three locations across East Gippsland: The Eastern Breakwater at Lakes Entrance (a coastal site approximately 23 km east of the study area), Bairnsdale Airport (approximately 12 km west of the study area), and East Sale Airport (approximately 55 km southwest of the study area). This data challenges the LCHA prevailing wind assumptions.

From the wind roses shown in Figure 15, we observe clear differences and some similarities in wind climate among the three locations:

Prevailing wind patterns and dominant speeds

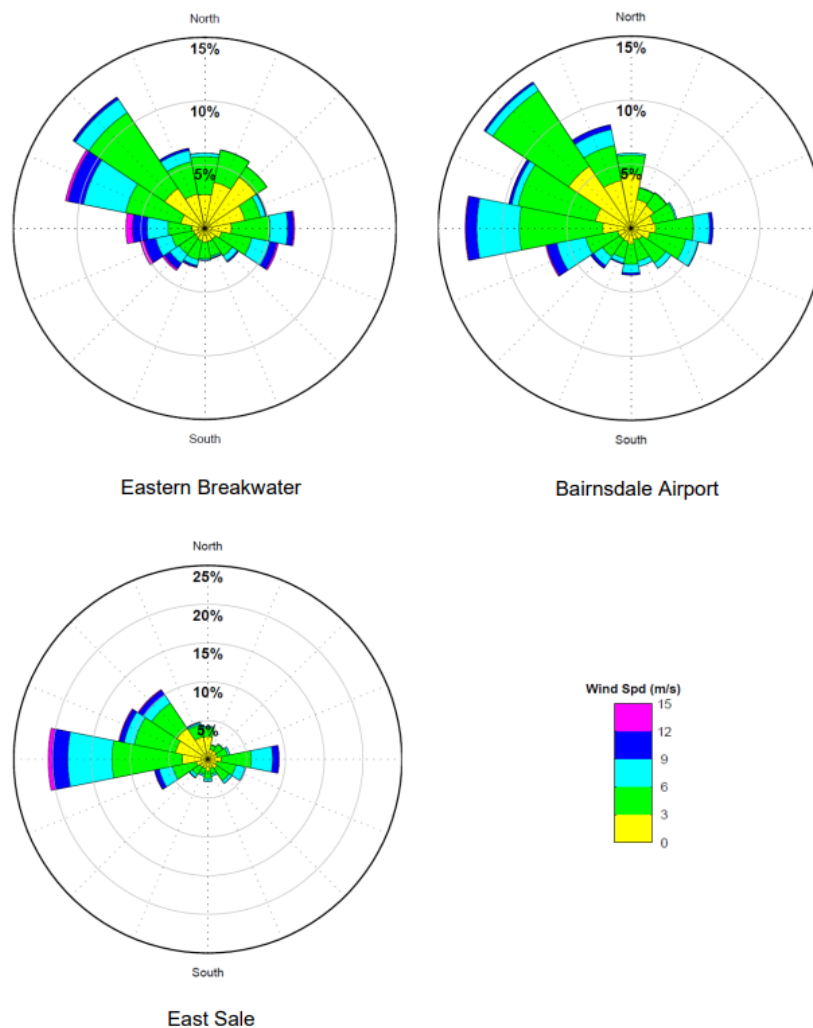


Figure 15. Comparison between wind roses for different location over 20 months of concurrent data.

The wind roses from Lakes Entrance (Eastern Breakwater) and Bairnsdale Airport reveal a bimodal wind climate: significant winds originate from both the western/northwestern sectors and the southern/eastern sectors, depending on seasonal patterns. In contrast, East Sale's wind profile is strongly dominated by westerlies – winds from the west occur far more frequently (and at higher strength) than any other direction. Key observations include:

Eastern Breakwater (Lakes Entrance, coastal approx. 23km East of the study area): This coastal station experiences a broad spread of wind directions. Winter frontal systems produce frequent N–W–SW winds, while summer brings pronounced onshore sea breezes from the S–SE–E sectors. No single direction exceeds ~10–15% occurrence (winds are more variably distributed). However, wind speeds at this site tend to be higher than at the inland stations – the exposed over-water location records stronger winds, especially during onshore flows. For instance, the Eastern Breakwater rose shows a greater proportion of moderate-to-strong winds (e.g. >10 m/s) in the SE–E and W–SW quadrants compared to Bairnsdale. This suggests that coastal gales (like those from East Coast Low events) are well-captured here.

Bairnsdale Airport (inland approx. 12km West of the study area): Wind patterns here are broadly similar to Lakes Entrance in directional distribution. The 20-month dataset indicate a

mix of westerlies and sea breeze-sector winds. West to northwest winds (associated with cold fronts and westerly troughs) and southeast to east winds (sea breezes or coastal lows) both features prominently, each comprising a sizable fraction of the record. Peak wind speeds at Bairnsdale are slightly lower than at Eastern Breakwater (due to land roughness and distance from the coast), but the prevailing direction frequencies align closely. Thus, Bairnsdale is a useful indicator of winds affecting the Point Fullarton area, though it may understate the strength of over-lake winds during storms.

East Sale (further inland, approx. 55km WSW of study area): This inland station shows a strong directional bias – Westerly winds are clearly dominant in both frequency and strength. Over the 20-month period, a large proportion of winds at East Sale blew from the west (with this sector contributing up to ~25% of total wind observations). Other directions (e.g. E or SE) are relatively infrequent here. This reflects the interior location: East Sale is farther from the coast, so it experiences frontal westerlies robustly, but coastal sea-breezes or easterly gale influences diminish with distance. As a result, East Sale’s wind climate, while similar in a broad sense, lacks the balance seen at the other sites and skews toward westerlies. Peak wind speeds at East Sale occur mostly during westerly frontal events.

Seasonal variability underpins the prevailing wind patterns. In winter, winds from the north through west dominate (cold fronts bring strong NW–W–SW winds). In summer, southerly and easterly winds become more common (afternoon sea breezes and high-pressure systems to the east). These seasonal wind shifts are critical for hazard timing: e.g. extreme E–SE winds are most likely during East Coast Lows in the cooler months or late spring, whereas intense W–SW winds accompany winter cold fronts. The available wind rose data show that no long-term trend in average wind directions or speeds was evident over the analysis period – annual variations were smaller than the pronounced seasonal changes. Therefore, the proceeding analysis will consider representative storm scenarios for each key wind sector rather than any emerging trend.

Wind Directions and Lake King Water Level Response

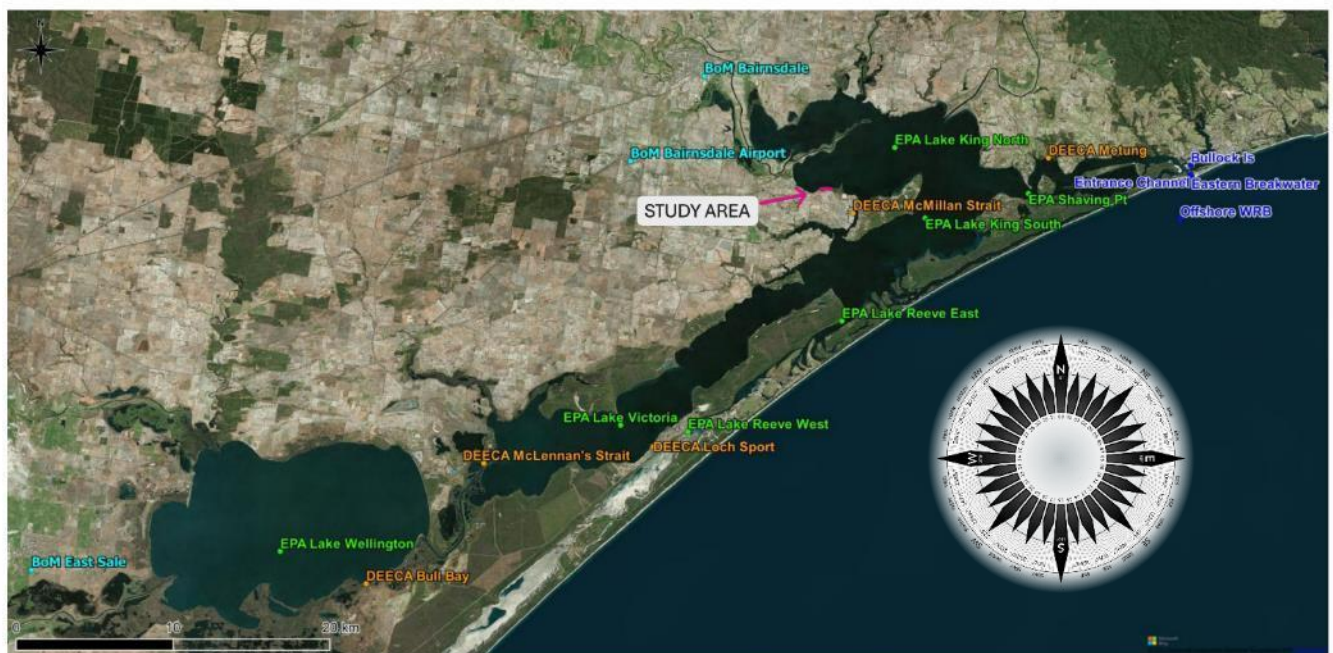
Wind blowing over Lake King can raise or lower the local water level (wind setup or set-down) by pushing water toward the downwind shore. Given the site’s location (western section of Lake King just west of Point Fullarton), winds from **SE–E vs. SW–W** have almost opposite effects on water levels at this foreshore. The analysis below highlights how each of these wind sectors – highlighted by the wind rose data – could drive water level changes and associated hazards at the study area shoreline.

NE and E Winds: Onshore Winds & Wind Setup

Strong winds from the northeast and east blow onshore at the Point Fullarton foreshore (i.e. from the lake toward the land). These winds have a direct elevating effect on water levels along the Lake King frontage of the study area. As the wind exerts shear stress on the lake’s surface, it drags water downwind; in the confined basin of the Gippsland Lakes, water accumulates against downwind shores when wind-driven transport exceeds the return flow. This wind setup can raise the lake level along the study area lake frontage significantly during sustained E/NE gales. The LCHA found wind setups on a SW–NE axis in the Gippsland Lakes can elevate water by up to ~0.5 m over several hours to a day under strong wind conditions (LCHA 2014; Report 2

p.5). These findings are consistent with a wind study of the Gippsland Lakes by Walpole et al (2011) which found wind-induced water level changes of up to 60 cm.

At our site (shown in pink), an Easterly onshore wind aligns with one of the lake's long fetches (Lake King's expanse opens toward the east), allowing mostly uninterrupted wind stress across about 20kms of water. Similarly, northeasterly winds at Point Fullarton blow onshore, with a NE to ENE wind allowing completely uninterrupted wind shear across about 10kms of water to directly impact the study area. Consequently, a high-end **easterly wind** event could elevate water levels by ~0.3–0.5 m above normal along the Point Fullarton foreshore. Whereas a **NE to ENE wind** could potentially elevate water levels by approximately 0.25m at the Lake King frontage of the study area. Moreover, these elevated water levels do not include any potential external surge influences. This is a considerable rise in water levels given most of the study area's lake frontage is comprised of very low-lying shallow lagoons.



In addition to raising static water levels, onshore Easterly winds will drive wind waves toward the coast. With a long over-water path, waves can build up and impact the shoreline of the study area. The foreshore's shallow profile will cause some wave energy to dissipate offshore, but if water levels are elevated (covering normally dry shallows), waves are likely to overwhelm the shallow lagoons and undercut the toe of the marginal bluff, accelerating erosion. Easterly gales, often associated with East Coast Lows, are of particular concern. The wind rose data confirm that Lakes Entrance and Bairnsdale routinely experience strong E–NE-ENE winds during such systems (with Eastern Breakwater recording gusts >12 m/s in this sector). These events combine wind setup with other hazard drivers: an East Coast Low (ECL) typically brings low atmospheric pressure and intense onshore winds, which together cause a storm surge in coastal waters. Some surge propagates into the Gippsland Lakes through Lakes Entrance. Historical records show that during an extreme ECL sequence (Dec 1998), the water level at Paynesville rose ~1.3 m above normal levels - ses.vic.gov.au – a result of both torrential rain runoff and coastal storm surge forcing. Under such conditions, wind setup in Lake King from E/NE/ENE gales would further boost the local water level of the study area, compounding the flood risk.

Implications for Point Fullarton Foreshore: A sustained SE or E storm wind can rapidly elevate the lake against the Point Fullarton shore, reducing freeboard to near zero, flooding the foreshore lagoons and low areas. Even lesser events can inundate the backshores of the study area, with waves causing erosion along most of the exposed shoreline. Thus, flooding and erosional damage are likely during strong E/NE wind events. Shoreline erosion would be driven by wave attack during high water – likely causing scarping of the bluff face and retreat of the foreshore. Importantly, Eastern Breakwater wind data (being coastal) suggest that models must account for higher wind speeds over Lake King than Bairnsdale’s and East Sale’s land stations alone would indicate. In other words, over-water wind stress in an E/NE/ENE gale may be stronger, yielding more setup and wave energy than one might estimate from inland wind measurements.

SW and W Winds: Offshore Winds, Setdown, and Seiche

South-westerly and westerly winds blow *offshore* at the Point Fullarton site (from the land toward the lake). These winds push water away from the western shore, generally lowering the immediate water level at Point Fullarton during the wind event (this effect is known as wind *setdown*). A strong westerly will drive water toward the eastern side of Lake King (and further into Lake Victoria or toward Lakes Entrance). Observations from modelled major floods confirm that under gale-force south-westerlies can result in water levels in Paynesville’s northern shores dropping noticeably – with Walpole predicting setdowns on the order of 15-20 cm recorded during strong westerly bursts (Walpole et al 2011). We can expect a similar temporary drop in water level along the Point Fullarton foreshore during a vigorous W or SW wind event. In one sense this reduces immediate flood risk at the site (the water retreats from the shoreline). However, it introduces other hazard dynamics that must be considered:

Seiche and rebound: The water driven east by a W/SW gale doesn’t disappear – it piles up on the downwind side of the lakes. When the wind slackens or abruptly changes, that piled water can slosh back (a local seiche or oscillation). The result can be a rapid rebound in water level on the western shore. In effect, once a strong offshore wind stops, the previously depressed water level at Point Fullarton can surge upward in a short time, potentially overshooting the normal level. If a SW/W blow coincides with low astronomical tide, the setdown might go unnoticed, but the subsequent rebound could occur as the tide is rising, leading to a sudden high-water episode. This oscillatory behaviour might inundate the foreshore shortly after the peak winds subside. Any modelling of storm scenarios should include this wind-setup relaxation effect – failing to do so could underestimate peak water levels post-front. In the Gippsland Lakes, the wind setup and seiche cycle can contribute significantly to peak water levels during windstorms (Walpole et al 2011).

Wave action and erosion: While W and SW winds are offshore for the study area, the shoreline’s orientation means parts of it could still feel wave impacts. The north-west-facing half of the study area is still exposed to a Westerly wind, allowing a limited local fetch of approximately 1km across Eagle Point Bay to generate some wave setup under strong gale force wind conditions. Erosion risk will however be lower from such wave action than for onshore winds. Instead, the concern would be if the wind shifts rapidly (e.g. SW to south or SE as weather systems move) – then new waves could arrive from another direction while water levels are adjusting. Also, if water level rebounds quickly after a setdown, it can erode freshly exposed lakebed and foreshore sediments when it rushes back. The returning water might carry

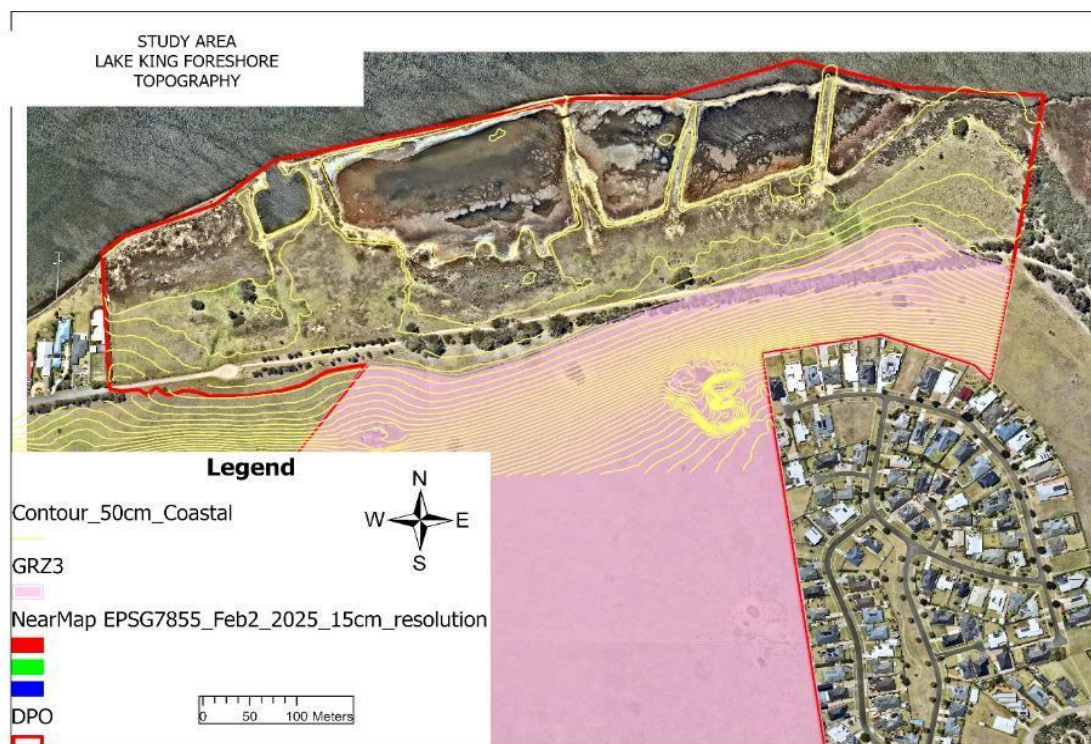
debris or cause scour at any low points along the foreshore, potentially enlarging eroding breaches.

In summary, SW and W winds associated with frontal passages tend to stress the system in the opposite direction to E/NE winds. They temporarily relieve pressure on the western shore (wind setdown) but can lead to a later surge and oscillating water levels once winds ease. The Point Fullarton foreshore might avoid peak flooding during the height of a westerly gale, only to experience a rapid water rise and flood wave as the wind-driven setup equilibrates. Erosion from these events would likely come from any brief wave attack during the rebound or from strong currents if water flows back from the east side of the lake. Notably, East Sale's data underscores how frequent and strong such westerlies can be – it records west-quarter winds more than any other direction. Thus, cold front scenarios with gale-force W/SW winds must be included in hazard assessments, albeit with the understanding that the timing of flooding at the study area may lag the wind peak.

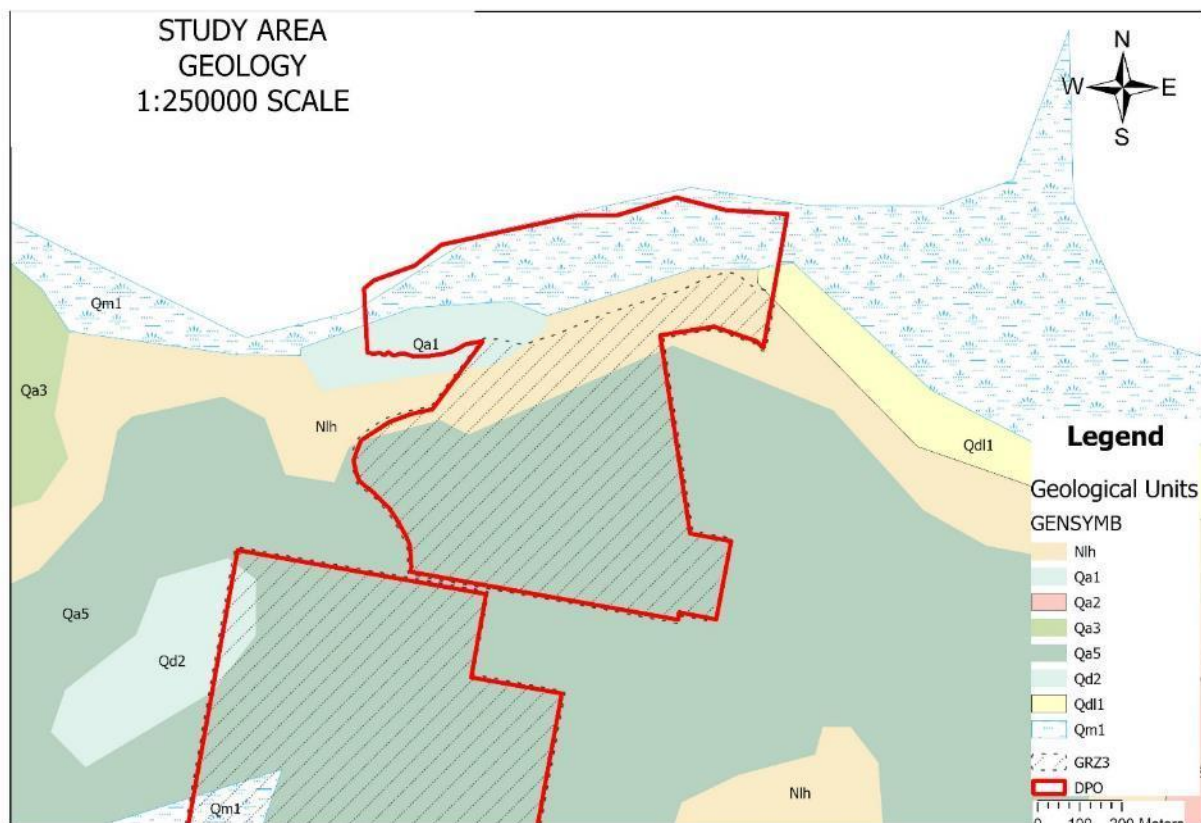
Topographic and geological vulnerability of the study area

The physical setting of the site exacerbates its vulnerability to the wind-driven water level changes described above. Key topographic features and their influence on hazard include:

Low Relief and Flat Topography: The study area's foreshore has very little elevation gain – it remains largely flat up to ~200 m inland in sections, with coastal lagoons/wetlands directly landward of the beach. This means even a modest inundation will spread far inland, covering a broad area of the foreshore zone. The lack of slope slows drainage, so floodwaters from a surge or setup event can linger. The map of the study area (shown below) with 50cm contours shows clearly the flat topography of foreshore zone.



Unstable Geology:



Shoreline substrate type is clearly the major influence on shoreline susceptibility to erosion (Feagin et al. 2009; Cowart et al. 2011; Bezerra et al. 2011). The foreshore area's substrate is predominantly composed of Quaternary marine (Qm1) and alluvial (Qa1) deposits overlain by sodsol soils, which typically exhibit limited structural cohesion and stability when exposed to wave attack and inundation. These soil and sediment types are particularly vulnerable to erosion due to their susceptibility to saturation, dispersion, and subsequent loss of structural integrity during high-energy wave events and storm surges. Under conditions of rising sea levels, the frequency and intensity of wave-driven erosion processes is expected to increase, progressively undermining shoreline stability. The inherently weak sodsol soils exacerbate erosion risk, potentially leading to accelerated shoreline retreat and increased inland inundation, especially under storm conditions and elevated sea levels. Given the composition of the foreshore materials, comprehensive coastal hazard assessments should explicitly account for heightened erosion susceptibility and incorporate adaptive management measures to mitigate risks associated with projected sea-level rise.

Marginal Bluff as a Barrier: The only significant rise is a marginal bluff or escarpment (approx. 0.75m-1m AHD) along the eastern foreshore of the study area. Under normal conditions this bluff separates the lake from the interior flats. However, 1 m AHD of elevation is a very narrow margin in the context of sea level rise and increasingly intense and frequent projected storm tides. A wind setup of 0.25 m plus a moderate storm surge/tide (~0.3 m) would overtop the landform with just 0.5 m of SLR. Moreover, once overtopped, the bluff's presence may impede return flow, meaning flooded areas could stay inundated longer (water trapped behind the berm). Conversely, if the bluff is breached (via erosion or a low point), it could concentrate flow

and potentially widen the breach via erosion, permanently lowering the barrier height at that spot. Each extreme event thus has the potential to reshape the shoreline – for example, cutting a new channel between lake and lagoon – increasing vulnerability to the next event.

Importantly, as shown by the geological map (see page 33), much of the foreshore, including the bluff, is comprised of relatively soft Quaternary marine (Qm1) deposits, which would suggest the bluff is not a particularly solid landform, and therefore erodible. Without a geotechnical investigation of the underlying geology of the bluff and surrounding foreshore areas, any assumption that the bluff will provide a barrier to future shoreline erosion is not supported by the available geological data.

Shallow Nearshore Waters and Wave Dynamics: The coastal profile of the study area is characterized by shallow nearshore waters extending outward from the shoreline into Lake King, a common feature of lagoon environments. Typically, this shallow platform limits wave height near the shore, as waves tend to break offshore before reaching the shoreline bluff. During moderate onshore wind conditions and when water levels are low, this shallow area effectively dissipates wave energy, significantly reducing wave impact on the bluff. However, elevated water levels, caused by wind-driven setup or storm surge, can submerge the shallow platform, allowing larger, more energetic waves to approach and directly impact the bluff. As water levels rise above the fringing flats, the effective wave energy reaching the bluff increases substantially, accelerating erosion.

Recent aerial imagery from Nearmap (15 cm resolution), captured approximately two years apart, indicates that the low berm separating the eastern lagoon from Lake King has already been breached. Such breaches are significant, as they not only enable direct inland flooding under elevated lake conditions but also remove natural wave protection, leaving the shoreline more exposed to erosion. Projected sea-level rise will exacerbate this vulnerability, progressively undermining the berm and marginal bluff's capacity to function as protective barriers during storm events. Consequently, the risk of aggressive shoreline erosion and inland flooding will escalate as future water levels continue to rise.





Given these factors, the erosion and flooding risk along this foreshore is tightly linked to wind-driven water level changes. During E/NE wind events (onshore winds), the risk is immediate and dual-natured – water level rise threatens to inundate land and waves attack the shoreline directly, causing erosion and further failure of the lagoon berm. During W/SW events (offshore winds), the risk is more delayed and subtle – initial water retreat could even dry out the lagoons, but the subsequent return flow might catch the area by surprise, and any structural weakness in the lagoon berm or bluff could be exploited by the oscillating water. Over time, repeated events from both directions can lower the resilience of the foreshore: onshore storms eat away at the bluff from the front, offshore-driven seiches can undermine it from behind if water overtops and flows out.

Practically, this means that the study area foreshore is highly susceptible to coastal hazards, and increasingly so as sea levels rise -a fact which is acknowledged in the LCHA. Even moderate wind setup (tens of centimetres) could flood the foreshore wetlands and fringing lagoon vegetation, and severe events will inundate further inland. Erosion of the lagoons and bluff will gradually move the shoreline landward, unless defensive measures are undertaken.

Representativeness of Wind Stations for Hazard Modelling

Accurate prediction of wind-driven hazards of the study area depends on using wind data that truly represents the site's conditions. The three stations offer different perspectives, each with its own biases relative to the foreshore:

Eastern Breakwater (Lakes Entrance): This station, being right at the coast, is most representative of the strong onshore winds that drive storm surge and direct wind setup in the lakes. It captures the full force of SE and E gales coming from Bass Strait with very little land interference. As noted, winds recorded here are stronger (less friction) and more indicative of over-water conditions. For modelling extreme E/SE/NE events (like ECLs), Eastern Breakwater data is invaluable – it won't under-estimate the wind stress on Lake King's surface. However, one should note that Lakes Entrance is ~23 km east of Point Fullarton and slightly different in orientation; local terrain could mean that, for example, a due-east wind at the Entrance becomes an ESE wind on Lake King, etc. Minor directional offsets aside, this station provides an excellent measure of coastal wind forcing. The study area's foreshore is somewhat tucked

behind the Raymond Island and the Boole Poole Peninsula – during certain Southerly wind conditions, the site will therefore experience less Southerly (and Westerly wind conditions) than the open entrance does. Nonetheless, for hazard scenarios it is prudent to err on the side of the higher wind speed input (from this station) to ensure the model captures worst-case wind setup.

Bairnsdale Airport: Located ~12 km from the study area, on the Gippsland plains, this station provides a good local wind climate reference. It sees the same large-scale winds as the subject area but with some land dampening. For instance, an afternoon sea breeze that might blow 20 kn (10 m/s) at Lakes Entrance could register a few m/s lower at Bairnsdale. Likewise, a westerly gale funnels through Bairnsdale with slightly reduced intensity due to surface roughness. Directional biases at Bairnsdale are minimal – the terrain around is fairly open, though there are some low hills toward the south, west and east.

By and large, Bairnsdale Airport data should capture the timing and general direction of winds affecting the study area reliably. It might underestimate peak wind speeds that occur over Lake King, especially for onshore winds, as the Gippsland Ports analysis suggests (Port & Coastal Solutions, 2023). Therefore, using Bairnsdale alone in a model is likely to under-predict the magnitude of wind setup (since wind stress would be slightly underestimated). Conversely, Bairnsdale might better reflect winds from the northwest or west that have traversed inland – these could be more turbulent or gusty at Lakes Entrance, whereas Bairnsdale gives a steadier average. In summary, Bairnsdale’s data is representative for multi-directional moderate winds, but peak hazard-driving winds (especially from SE/E) should be cross-checked with Eastern Breakwater to avoid missing the extreme tail of wind speeds.

East Sale Airport: This station is quite distant (~55 km west) and is most representative of broad-scale frontal winds. Its strong bias toward westerlies means it will not accurately reflect the frequency of E/SE/N winds at Lake King – many coastal storms that batter the study area with easterlies would barely register at Sale (or arrive there much weakened). If one were to rely on East Sale data alone for wind input, hazards from East Coast Lows could be severely under-predicted.

On the other hand, East Sale’s robust recording of westerly gales is useful for quantifying the upper-end of frontal wind speeds. It is likely to capture the peak gust potential of winter cold fronts better than Bairnsdale (which might miss some of the strongest gusts if storms are stronger toward central Gippsland). That said, East Sale’s environment (open plains) could even overshoot the local intensity of a west wind at Point Fullarton if there are any shielding effects at the lake (for example, the rise of land west of the Mitchell River might break the full force). In general, East Sale data should be used with caution: it’s excellent for understanding the duration and power of westerlies in the region, but it under-represents the easterly sea breeze and north easterly component. Any model using East Sale must be supplemented with the other stations to ensure balanced wind forcing.

Directional and Speed Biases:

To summarize biases – Eastern Breakwater tends to record higher wind speeds for onshore (SE-S) winds (less friction, open exposure), so it might bias a model high on wind stress given the site is partially sheltered from these directions. Bairnsdale might bias a model low on wind stress (due to land friction) but gets the directions right; it might also slightly over-emphasize NW/W winds relative to SE, since some sea breezes weaken before reaching that far inland. East Sale will bias the wind climate heavily toward W/SW and largely ignore true coastal

easterlies – a model that weighted Sale too much would potentially underestimate surge from an east wind event but could overestimate how frequently strong westerlies occur at the lake (since at Sale even moderate fronts register as continuous westerlies, whereas at Lake King some of those times might actually be calm or easterly due to local sea breeze circulation).

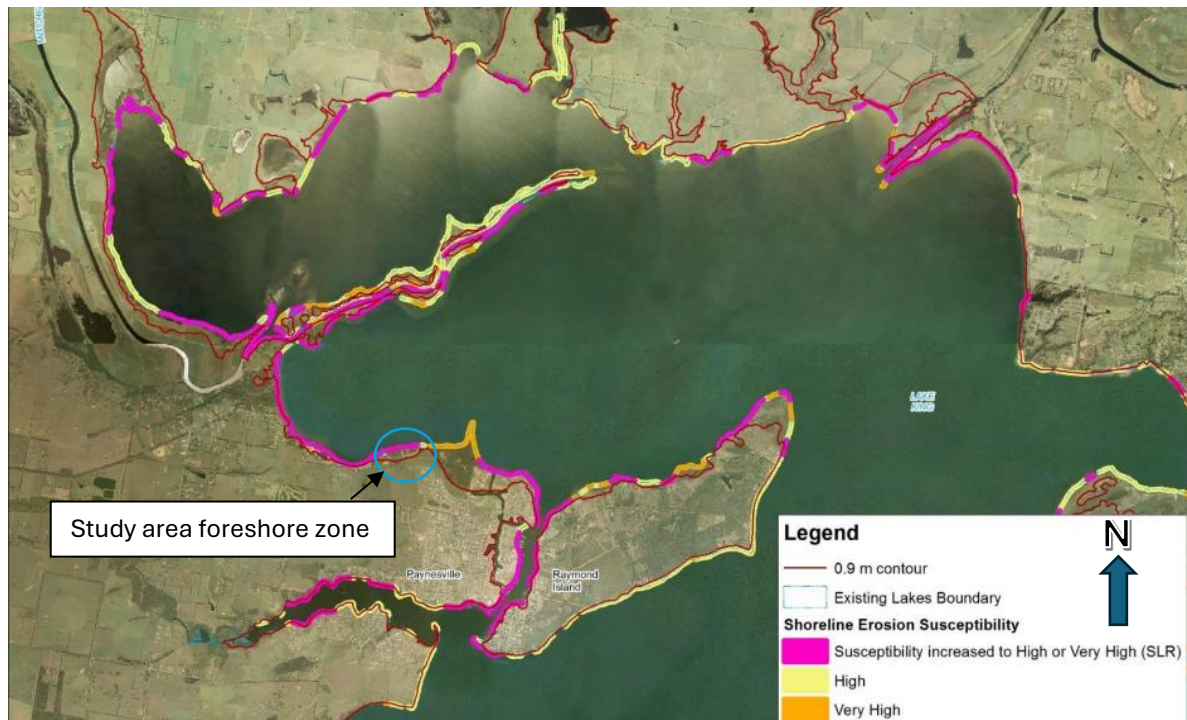
Multiple wind data sources: For the most accurate hazard modelling, a blend of data ought to be used: use Eastern Breakwater for E/SE storm winds and peak gust magnitudes, Bairnsdale for local validation and multi-directional baseline winds, and East Sale for additional perspective on westerly extremes. Model calibration should ensure wind over water is not underestimated – the Gippsland Ports study explicitly notes Eastern Breakwater’s winds are “more representative of over-water winds”. This implies that when simulating wind setup on Lake King, using Eastern Breakwater wind speeds (or adjusting Bairnsdale winds upward by a factor) would give more realistic water level responses. Conversely, for directions like due west where Eastern Breakwater might be partially sheltered by land, Bairnsdale/Sale data would fill the gap. Recognizing these nuances will improve the reliability of predictions for wind-driven surge, flooding and erosion of the study area.

Shoreline Erosion Hazard Modelling

Introduction

Shoreline erosion along the Lake King frontage of the study area is influenced by multiple interacting factors, including physical morphology, wave and current dynamics, sea level rise, geological substrate, vegetation communities, and land use. To comprehensively assess these influences, the LCHA developed a weighted, score-based spatial framework, integrating quantitative parameters (waves and currents) with qualitative factors (geology and vegetation), and validated against historical erosion events.

Under current conditions, much of the shoreline near the study area is classified as having "high" susceptibility to erosion, indicating potential vulnerability to erosion impacts even without sea-level rise. The LCHA found that projected sea-level rise of approximately 0.8 m by 2100, significantly increases erosion susceptibility. The shoreline from Paynesville to the Nicholson River—which includes the study area —was identified as particularly vulnerable. An indicative erosion hazard zone, closely corresponding to the 0.9 m AHD contour, highlights the expected extent of shoreline retreat and realignment.



Outline of the Erosion Hazard Modelling Methodology

The framework developed for assessing shoreline erosion hazards in the Gippsland Lakes system involved creating a spatial data model with 5m grid resolution (with results averaged out to 50m grid resolution). This model integrated quantitative and qualitative information about critical physical, environmental, and biological attributes of the Gippsland Lakes. For each component, a susceptibility score was assigned to sections of the Lakes shoreline. A weighting was then applied to the three individual component scores and these values were then combined to form an overall shoreline erosion susceptibility rating (see summary below):

Component	Erosion Susceptibility Score (a)	Weighting (b)	Overall Shoreline Erosion Susceptibility Rating
Physical	1-5	1	Sum(a x b)
Environmental	1-5	0.5	
Biological	1-5	0.25	

The scores and weightings for each component were developed through an iterative benchmarking process. An overall shoreline Erosion Susceptibility Rating was then derived by combining the three different contributing component scores. The resultant scores ranged from 2 to 8.75, and any rating above 5.5 (the 50th percentile) were identified as indicating potential susceptibility to erosion. Those areas of shoreline with an ESR above 5.5 were further categorised into shorelines with either High or Very High erosion susceptibility, depending on their overall ESR.

Shorelines with a Very High ESR were considered areas of shoreline with active erosion, and erosion rate of 0.2-0.5m / per annum was uniformly applied to these areas. Shorelines with a High ESR were uniformly deemed to have an erosion rate of 0.1-0.2m / per annum. These erosion rates are low to moderate, reflecting gradual change – and the authors cautioned that they are multi-decade averages that “do not reflect short term” fluctuations. The potential erosion extent was then delineated by multiplying the erosion rate with the number of years to 2100 and then comparing it to the 0.9m AHD contour (considered indicative of the likely future shoreline location under 0.8 m SLR). Whichever line was greater, was deemed to be shoreline hazard zone in 2100. Notably, the authors acknowledged that the 0.9m contour is a rough approximation of future shoreline extent as it “does not take account of any sediment [erosion] or vegetation response to increased mean water levels” (LCHA 2014; Report 1; p.vi).

Foreshore zone: Study Area



Photograph 2: Aquatic habitat – habitat zones U & X comprising mudflats dominated by low saltmarsh shrubs and rushes.

The foreshore area of the study site is dominated by aquatic habitat zones—labelled U & X on the map above (shown as yellow cross-hatching). These zones consist primarily of highly erodible mudflats vegetated by saltmarsh shrubs and rushes, as illustrated in Photograph 2. The LCHA (2014, R4, p. 36) explicitly acknowledges this vegetation type provides minimal or no resistance to erosion from wind or wave action, assigning it the highest Biological Erosion Susceptibility Score among native vegetation communities examined in that study.

Although saltmarsh habitats generally occur in areas sheltered from open-ocean swell waves, they remain vulnerable to wind-driven waves generated along the limited fetches within

sheltered tidal embayments. Such wind waves are a significant driver of shoreline erosion within saltmarsh habitats, particularly under conditions of rising sea levels (Pralad, 2014). However, the simplified fixed-contour method employed by the LCHA neglects this crucial geomorphic principle, specifically that sea-level rise typically results in shoreline recession through erosion where shorelines consist of easily eroded materials (Zhang et al., 2004; Stive et al., 2009). Given the foreshore area's composition—saltmarsh vegetation rooted in highly erodible Quaternary marine sediments (Qm1) and sodsol soils—it clearly aligns with this well-established principle. Consequently, the LCHA's static contour approach likely underestimates the true magnitude and extent of shoreline recession anticipated under projected sea-level rise scenarios.

In summary, while the regional-scale erosion modelling and mapping provided by the LCHA can broadly highlight areas at risk, they are not sufficiently detailed nor methodologically robust enough for local coastal hazard vulnerability assessments, as further discussed in the following section.

Critique of Shoreline Erosion Hazard Modelling Methodology

Limitations of the Weighted Scoring Framework

The Gippsland Lakes Local Coastal Hazard Assessment (LCHA) evaluated shoreline erosion susceptibility using a multi-factor, weighted scoring system. Each shoreline segment was classified based on combined physical, environmental, and biological characteristics, integrated through assigned scores and expert-derived weights (Water Technology, 2014).

Oversimplification and subjectivity

While considering multiple erosion factors is scientifically sound, the transparency and robustness of the weighting scheme raise concerns. The absence of detailed, objective rationale for assigned weights introduces significant subjectivity, as expert judgement strongly influences scores (Sharples et al., 2009). For example, different experts might assign varying importance to fetch length versus vegetation type, yet planning authorities must trust these expert-derived scores without clear, quantitative calibration. Thresholds for susceptibility categories ("High" vs. "Very High") were arbitrarily determined by cut-offs (e.g., the 50th percentile), lacking an empirical basis and thus relying heavily on subjective expert assessments. The resulting high proportion of shorelines categorised as high or very high indicates limited discriminatory power between varying erosion risks. Without quantitative error analysis or empirical validation, the accuracy of these ratings compared to actual erosion outcomes remains uncertain.

Additionally, much of the underlying data is predominantly qualitative, interpolated from various sources of varying resolution and quality, and derived from short-term, site-specific studies rather than consistent long-term empirical observations. A technical review of Gippsland Lakes shoreline studies found that information on shoreline stability was “almost entirely qualitative” and drawn from site-specific investigations, not a consistent long-term dataset and with no empirical validation to ensure these ratings reflect actual erosion potential.

Low resolution model inputs

Though the raster modelling analysis was undertaken at a 5m grid resolution, analysis results were generalised to represent features at least 50 m in length (comprising of a minimum of ten 5m grid units). The downscaling of the analysis was necessary because including features of

less than 50 m was beyond the scale of resolution of many of the input data sets, which ranged from 1:25,000 to 1:250,000 for EVC and geology layers. This means local nuances – such as pockets of localised erosion on a lagoon berm or unstable sediments and soils – could be masked by the broader segment score. Indeed, the LCHA itself emphasized that its erosion hazard analysis focused on broad “*lake-scale trends of shoreline change rather than small-scale*” variations (LCHA 2014; Report 4, p.2).

In other words, the weighted score method provides a coarse regional overview but was never designed to capture site-specific instabilities or small, resilient landform features. This coarse resolution is understandable for a strategic assessment, but it can lead to misclassification in particular locations if local factors deviate from the dominant underlying feature set (McPherson et al., 2015; Thom et al., 2018). For local coastal vulnerability assessments, site-specific geotechnical and vegetation assessments are necessary to more confidently assess site erosion risks.

Limited empirical evidence-base

This underscores a key limitation: the weighted scoring, while systematic in appearance, was built on limited empirical evidence. The LCHA’s own metadata advises readers to consult the detailed project reports to understand the assumptions and limitations behind the susceptibility data. In a formal hazard assessment report, it would be appropriate to acknowledge that this scoring framework involves considerable expert judgement and considerable simplification. The differential weighting of environmental, physical and biological factors therefore does not appear evidence-based (e.g. derived from robust, empirical, peer-reviewed studies or sensitivity analysis) but rather generally reflects untested assumptions.

In sum, while the weighted multi-criteria approach in the LCHA is a reasonable starting point for ranking erosion susceptibility at a regional scale, it is not very transparent or rigorously validated, and lacks the resolution to detect site-specific differences and coastal process interactions. These methodological weaknesses mean the resulting “susceptibility” map should be used with caution – it provides a broad indication of relative risk at the regional scale, but it is not a precise prediction of erosion outcomes at the local scale. Awareness of these methodological limitations is crucial for planning authorities relying on these assessments for coastal management and planning decisions (Sharples et al., 2009).

Limitations of Uniform Erosion Rates and Static Shoreline Assumptions

Uniform rates of shoreline erosion are not justified

The second major methodological issue is the way the LCHA translated those susceptibility rankings into actual projected shoreline change. Rather than dynamically modelling coastal processes, the assessment applied uniform, fixed erosion rates to high-risk categories and used a static contour as a proxy for the future shoreline. Specifically, shore segments deemed “Very High” susceptibility were assumed to erode in the order of 0.2–0.5 m per year, while “High” susceptibility segments were assigned 0.1–0.2 m per year. These values were not derived from site-specific modelling of future conditions, but are based primarily on limited historical observations from the *Gippsland Lakes Shore Erosion & Revegetation Strategy* (Sjerp et al, 2002).

This erosion report, though an important and significant study for the time, was again largely a qualitative assessment relying heavily on un-orthorectified photo interpretation and basic field

inspections; falling well short of a rigorous, empirical analysis (see Appendix B: Analysis of the Sjerp et al (2002) *Gippsland Lakes Shore Erosion & Revegetation Strategy* for more detail).

Rapid onset erosion hazard not modelled

While using past erosion ranges as an approximate guide is a common practice, the assumption of a constant linear erosion rate over multiple decades is scientifically fraught. Shoreline erosion typically does not occur at a steady, unchanging pace year after year. Shoreline erosion tends to be episodic, associated with extreme weather events (storms, surge and flooding) that are capable of rapidly eroding shorelines in a short period of time. This form of ‘rapid-onset erosion hazard’ typically occurs very quickly over a period of days or weeks, and can accelerate over time as conditions evolve. A fixed multi-decade rate ignores the likelihood of non-linear change. Due to data limitations however, short term erosion response (storm bite) was not assessed. With 1% AEP extreme weather events projected to become far more frequent and intense in the Gippsland Lakes, relying solely on estimated long-term average erosion rates constitutes a major methodological limitation of the Local Coastal Hazard Assessment (LCHA).

Ignoring climate change induced erosion risk

Critically, the assumption of consistent erosion rates over decades neglects the likely acceleration of coastal erosion due to sea-level rise and potentially increased storm intensity (Clarke et al., 2019; Sharples et al., 2009). The LCHA used the 0.9 m AHD contour as a proxy for the 2100 shoreline (assuming ~0.8 m of sea-level rise by 2100). In practical terms, this means the assessment drew the expected year-2100 shoreline at the present-day 0.9 m elevation line on the topographic map, effectively using a “bathtub” inundation model to locate the future water’s edge.

This approach entirely bypasses any dynamic coastal morphology adjustments – it presumes that the lake’s water level will be ~0.8 m higher, and wherever that higher water intersects the current land elevation will be the new shoreline. While this yields a rough indication of the landward shift of the coastline, it ignores sediment transport, erosion/accretion feedbacks, vegetation loss and shoreline profile response (Kinsela et al., 2022; Hanslow et al., 2019). As noted in the LCHA (R4. p.34), loss of fringing vegetation from SLR, salinity die-back and drought often results in greater exposure of the shoreline to increased wave and current action, which in turn contributes to accelerated erosion and shoreline retreat (Boon, et al 2014).

Stochastic versus deterministic modelling of coastal hazard risk

Moreover, the emerging best practice in erosion mapping is to display erosion extents by planning horizon (sea level rise scenario) and by storm event likelihood (AEP) using Monte Carlo modelling. This probabilistic hazard risk modelling accords with *the Victoria's Resilient Coast – Adapting for 2100+* statewide approach to coastal adaptation which requires a detailed understanding of the likely coastal hazard threats spatially. Stochastic modelling considers variability and uncertainty explicitly by simulating a wide range of possible conditions, assigning probabilities to different erosion extents or flood levels. An example of probabilistic erosion assessment (95th percentile) for a backshore wetland from the Port Phillip Bay LCHA, illustrating erosion extents for the 1% AEP event across different planning horizons (sea-level rise scenarios – including 1.4m by 2100) is reproduced below:



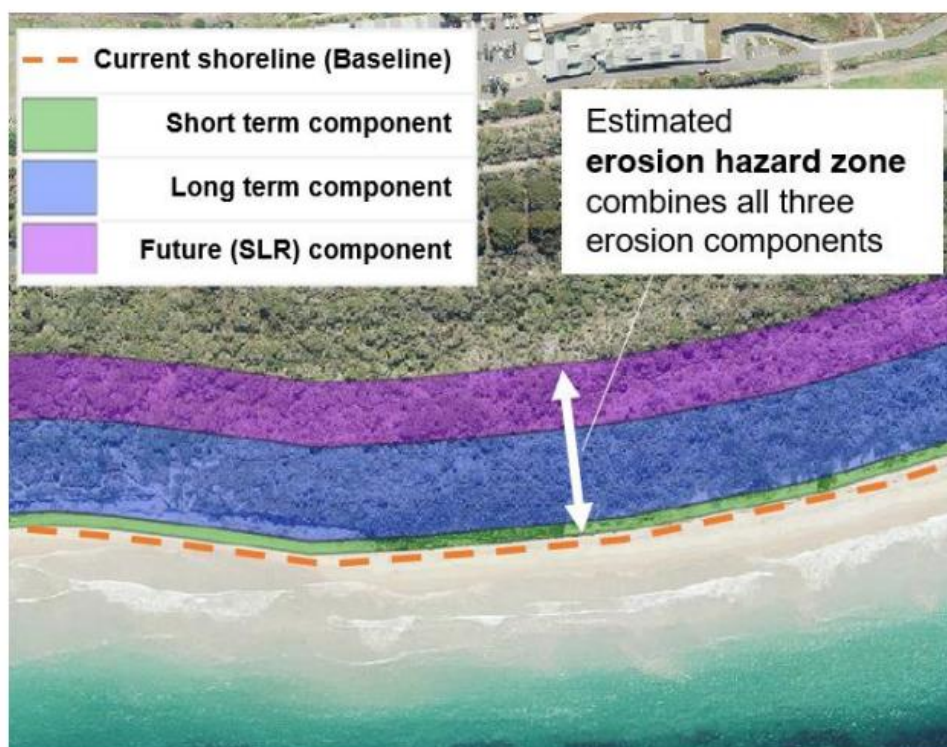
Figure 5-9 Backshore Wetlands Example from 95th Percentile 1% AEP

Limitations of the 0.9m contour line

The hazard report itself acknowledges that simply using the 0.9 m AHD contour “*does not take account of any sediment or vegetation response to increased mean water levels*” (LCHA 2014; R1, p.vi). In other words, it neglects the fact that as the water rises, shores may actively erode back (or in some cases, build up if sediment is deposited), so the actual 2100 shoreline could end up landward of the 0.9 m contour in erosion-prone areas (or potentially seaward if there’s significant sedimentation or managed beach nourishment). The static-contour method assumes no change in shoreline shape or sediment volume – it’s a passive flooding model, not a geomorphic model – and does not account for short term, long term and future sea level impacts on the shoreline. This is a significant methodological limitation: coastal science has long recognized that a given rise in mean water level can induce a disproportionate horizontal retreat of the shoreline through profile translation (as captured in Bruun rule concepts and subsequent modifications). This static single contour line is not consistent with coastal hazard best practice, which maps the Erosion Hazard Zone by combining all three erosion components (see extract from the Port Phillip LCHA, 2023 below).

Moreover, recent studies indicate that integrating SLR, storms, and coastal change into dynamic models can yield 3 to 7 times greater flood exposure than SLR alone with a static coast; highlighting the potential underestimation risk of static ‘bathtub’ models (Barnard, et al.

Erosion hazard zone	= Short Term	+ Long Term	+ Long Term
	storm event change	historic change	future change due to sea level rise



2019). By not modelling these coastal processes and adopting a static contour line approach to SLR, the LCHA likely underestimates the erosion hazard extent in highly erosion prone locations

like the Lake King frontage of the study area. Moreover, recent advances in reduced-complexity/hybrid models, have led to scalable, data-assimilated, probabilistic shoreline-change models (CoSMoS-COAST) that can achieve realistic simulations of long-term coastal change and uncertainty across large coastal regions (Vitousek et al. 2024). Applying historical, satellite-derived observations of shoreline position combined with daily hindcasted and projected wave and sea-level conditions, CoSMoS-COAST can estimate long-term coastal change by 2100.

No integrated wave or storm modelling of shoreline erosion

Using a fixed contour and uniform erosion buffers also fails to incorporate future changes in wave climate or storm frequency. The LCHA's susceptibility scoring did consider wave exposure under current conditions, and notably for the sea-level rise scenario they recomputed wave exposure with higher water levels and even removed existing protective structures (assuming those may not be present or effective by 2100). However, beyond adjusting the susceptibility category, there was no subsequent *process* simulation of how the shoreline would migrate – it was still handled via the static 0.9 m line and linear retreat amounts. This disconnect means the methodology cannot account for dynamic interplay (e.g. a breached barrier could alter wave penetration drastically, or loss of vegetation could further accelerate erosion). It treats each factor independently in the scoring phase, but once it comes to mapping future shoreline, it resorts to a highly simplified translation.

In simpler terms, failing to account for the erosion caused by rising sea levels, wind, waves, and tides on the exposed foreshore area is not consistent with current best-practice modelling standards. For example, the 2022 Port Phillip Bay Coastal Erosion Hazard Assessment used a specialised coastal erosion model (known as "SBEACH") to simulate how beaches respond to powerful storms. This model used data on extreme water levels and wave conditions derived from probabilistic methods (developed by CSIRO), helping planners predict short-term erosion rates under different storm intensities, including rare but severe events - such as 1%, 2%, and 5% annual exceedance probability storms (Water Technology, 2023a). Incorporating these processes and tools ensures that coastal planning accurately reflects the real-world risk of shoreline erosion, ultimately helping to protect infrastructure and ecosystems into the future.

The 2022 Port Phillip Bay Coastal Erosion Hazard Assessment also included a long-term shoreline erosion modelling component, which estimated how coastlines would retreat progressively under rising sea levels and changing wave climates over many decades. This long-term modelling combined historical shoreline change data with projections of future sea-level rise, sediment availability, and changing storm conditions to predict likely shoreline positions in 2050, 2070, and 2100 (Water Technology, 2023a). By explicitly incorporating uncertainties and probabilistic scenarios, this approach provided planners with robust, science-based guidance on where and how far shorelines could recede, enabling informed decision-making about future coastal infrastructure placement and ecosystem management.

Lack of sensitivity analysis and alternative scenario modelling

In a formal coastal hazard report, these simplifications warrant a frank critique. The scientific validity of assuming constant erosion rates over ~80 years is low – it doesn't reflect the non-linear nature of coastal change or the likelihood of accelerating erosion under rising seas. Likewise, using a static 0.9 m AHD contour as the 2100 shoreline is a blunt-tool approach that provides a first-order guess but misses the complexity of shoreline morphology changes.

A more robust approach would involve iterative or modelled shoreline response (for example, using a morphological model or at least a rule-based system that includes profile recession with SLR). At minimum, a sensitivity analysis could have been done: e.g. what if erosion rates increase by 50% after 2050, or if more frequent storms cause rapid-onset erosion and shoreline retreat – how would that change the erosion hazard zone? Without such analysis, the current method cannot confidently predict extreme shoreline retreat outcomes. The LCHA’s broad-brush results are useful for regional planning, but the methodological flaws mean that on-the-ground management decisions (like setback distances or asset relocations) should not rely solely on these figures.

The Port Phillip Bay CEHA 2022 utilised coupled hydrodynamic and wave models (SCHISM-WWMIll), to assess storm tide and wave action for 5, 2 and 1% AEPs events in its stochastic inundation and erosion assessments for recent decades and under SLR scenarios of 0.2, 0.5, 0.8, 1.1 and 1.4 m (sensitivity testing). The following map (reproduced from the Port Phillip 2022 hazard assessment) highlights the Total Erosion Setback taken from the 95th percentile of the 2100 (0.8m SLR) scenario with a 1% AEP storm event. Note how the greatest setbacks (+170m of foreshore erosion) are locations with low-lying backshore wetland areas, which is a similar landform to the study area.



Figure 4-1 Total Erosion Setback Example (2100 0.8m SLR, 95th Percentile)

The map overleaf (reproduced from the Port Phillip 2022 hazard assessment) highlights the use of probabilistic (Monte Carlo) modelling to show varying potential rates of shoreline erosion (retreat) for the 1% AEP 2100 (0.8m SLR) scenario. Put plainly, the mapping shows the likely extent of shoreline erosion by 2100, based on advanced computer simulations. The simulations were run a million times to explore many different possible erosion scenarios. The results focus on the "95th percentile," meaning the erosion shown is greater than or equal to what happens in 95% of these scenarios, and only 5% of the scenarios showed more extreme erosion.

In simpler terms, there's a 95% chance that the actual future shoreline will be within this mapped erosion area—so it's intentionally cautious, representing a conservative, risk-averse approach. This approach ensures planners can consider the worst realistic erosion outcomes to keep communities, environmental assets and infrastructure safe. Significantly, the 95th

percentile value was agreed with DEECA on the basis that it takes a conservative (risk-averse) approach (Water Technology 2023; p.75).



Figure 5-1 Different Percentile Outputs Comparison. 1% AEP 2100 (0.8m SLR) for TCSC 76

In contrast, the uniform erosion rates and static-contour assumptions of the Gippsland Lakes LCHA make the shoreline erosion hazard modelling simplistic and optimistic. The method estimates a general “worst-case” erosion envelope by 2100, but it does so by linear extrapolation and ignoring geomorphic processes; consequently, it may not fully capture the actual hazard risk, especially under a scenario of accelerating sea-level rise, increased wind intensity and variability, unstable geology and more energetic storm events. These limitations should be clearly acknowledged in the hazard assessment, and if possible, future assessments should incorporate dynamic probabilistic modelling akin to the Port Phillip LCHA, or at least scenario-based adjustments to improve the realism of shoreline change projections.

Overall, the Gippsland Lakes LCHA’s shoreline erosion modelling is a useful high-level tool, but its methodology is now dated and has notable flaws. The weighted scoring system, while comprehensive in scope, suffers from subjectivity and potential oversimplification. The use of fixed erosion rates and a static 0.9 m AHD contour for the 2100 shoreline further simplifies a complex reality, potentially misrepresenting the timing and extent of future erosion. These methodological issues suggest that the results should be applied with caution and supplemented by more detailed, process-based modelling and investigations for specific high-risk localities. Each of these critiques highlights an area where the modelling could be improved to increase confidence in the hazard predictions – for example, by making the scoring more data-driven and transparent, and by replacing the static retreat assumptions with a more dynamic coastal evolution model that accounts for the interplay of rising sea level, sediment transport, vegetation change and changing wave climates on the Gippsland Lakes shoreline.

It is strongly advisable to adopt a more conservative risk management approach, which uses 95th percentile erosion hazard zones to give planners a greater initial understanding of potential erosion hazard impacts. However, even best-practice regional scale hazard assessments such as the Port Phillip LCHA generally lack the resolution for property level assessments. A local scale (site-based) stochastic analysis of coastal hazard risk is warranted given that:

- the existing LCHA is inadequate,
- local conditions have not been assessed in detail (e.g. geotechnical assessment of the foreshore area – esp. the marginal bluffs’ underlying sediments and soils)
- long-term regional trends are highly variable
- key environmental values (and potentially assets) are located within erosion hazard zones.

Moreover, it’s best practice to obtain additional site-specific/ high resolution data and undertake localised analysis for precise impact assessments at the individual property level (O’Grady et al. 2024). This is also consistent with the coastal risk assessment requirements of Clause 13.01-2S.

Conclusion

The comprehensive review of the 2014 Gippsland Lakes LCHA has identified critical methodological and analytical shortcomings that significantly constrain its effectiveness as a decision-support tool for coastal hazard management. While the study provides foundational insights, the limitations in scenario scope, hydrodynamic modelling, data calibration, sensitivity analyses, storm surge assessment, wind and wave climate considerations, and vegetation dynamics indicate substantial potential for underestimation of risks. Addressing these gaps through enhanced scenario analysis, advanced hydrodynamic modelling, updated data calibration, robust sensitivity and uncertainty assessments, detailed storm surge and extreme event modelling, integration of vegetation and sediment dynamics, and adaptive benchmarks is imperative. Implementing these improvements will lead to a more accurate and scientifically robust coastal hazard assessment, ultimately ensuring effective, long-term coastal management and adaptation planning in the Gippsland Lakes region.

Until these recommendations are implemented, the 2014 LHCA should not be relied upon to inform coastal hazard understanding and planning across the Gippsland Lakes region.

Recommendations

To address the identified methodological and data limitations of the 2014 LCHA and enhance the robustness and reliability of future coastal hazard assessments, the following recommendations are proposed:

1. Comprehensive Scenario Analysis:

- Expand SLR scenarios to include higher-end projections (e.g., up to 1.1 m or greater by 2100).
- Conduct scenario analyses beyond 2100 to capture long-term coastal hazard dynamics.
- Integrate modelling of compound events, specifically simultaneous occurrences of major floods, extreme storm surges, and significant wind setups, to accurately represent realistic "perfect storm" conditions.

2. Advanced Hydrodynamic Modelling:

- Adopt three-dimensional hydrodynamic models capable of accurately simulating salinity stratification, circulation patterns, and ecological responses within Lakes Victoria and King.
- Enhance model resolution to capture localised flooding and erosion dynamics more accurately, thereby improving spatial precision in hazard mapping.

3. Updated Calibration and Data Integration:

- Recalibrate hydrodynamic models using recent extreme flood and storm events post-2012 to reflect contemporary climatic conditions.
- Regularly update input datasets, including wind, wave, and hydrological data, to incorporate evolving climatic trends and recent scientific findings.

4. Robust Sensitivity and Uncertainty Analyses:

- Conduct comprehensive sensitivity analyses using extreme storm scenarios rather than moderate conditions alone, ensuring more realistic representation of future climatic extremes.
- Implement probabilistic approaches to quantify uncertainties explicitly, providing clearer guidance for risk-informed decision-making.

5. Detailed Storm Surge and Extreme Event Modelling:

- Explicitly model projected increases in storm intensity and frequency, incorporating these factors into future coastal hazard assessments.
- Develop compound flooding scenarios integrating catchment floods, oceanic storm surges, and wind-driven wave action, aligned with best-practice guidelines such as Australian Rainfall and Runoff (ARR) recommendations.

6. Vegetation and Sediment Dynamics:

- Integrate vegetation survey data and response modelling under projected SLR and salinity scenarios, accounting for vegetation loss, distribution changes, and implications for shoreline stability.
- Employ geotechnical assessments to collect localised, high-resolution data for sediment transport and geomorphic modelling. Best practice probabilistic modelling can more accurately predict shoreline profile adjustments dynamically, providing realistic projections of erosion and accretion processes.

7. Adaptive Planning Benchmarks:

- Move from static benchmarks to adaptive management frameworks that incorporate ongoing monitoring and periodic updates based on the latest scientific projections and observed changes.
- Regularly review and adjust planning benchmarks in response to emerging climate data and research, ensuring ongoing resilience and preparedness.

Adopting these recommendations will ensure future coastal hazard assessments for the Gippsland Lakes region are accurate, scientifically robust, and capable of effectively informing long-term adaptive planning and management strategies.

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APPENDIX B: Analysis of Gippsland Lakes Shore Erosion & Revegetation Strategy

Erosion model component	Primary data sources	Methodology	Limitations	Discussion
Erosion rates 0.1-0.2m/yr = High 0.2-0.5m = Very High These rates are low to moderate, reflecting gradual change – and the authors cautioned that they are multi-decade averages that “do not reflect short term” fluctuations.	Sjerp et al (2002) <i>Gippsland Lakes Shore Erosion & Revegetation Strategy</i>: Gippsland Coastal Board, Vic.	Lit review, Aerial photo interpretation, - comparison of available aerial photography covering the period 1935-40 to 1997, - comparison of historic photos with new land and boat-based digital photographs of the same location; Field inspections: -determine erosional state of shoreline (e.g. eroding / stable / accreting) - take photos -access condition of	Aerial photography sets held by NRE were often incomplete or absent, presenting a considerable limitation on data availability Low resolution aerial photography, particularly from older sets, does not allow minor shoreline change to be detected. The limit of accuracy is generally in the order of ± 5 metres Inability to identify fixed reference features also hampers accurate comparisons. Assessment of shoreline change is further limited by short term and seasonal variability	Analytical limitations: Specific erosion rates were not applied to each individual section of shoreline along the lakes. The approach relied on a generalised ‘long term average’ derived from very limited data using rudimentary measurement techniques (discussed below). Shoreline erosion tends to be episodic, associated with extreme weather events (storms, surge and flooding) that are capable of rapidly eroding shorelines in a short period of time. This form of ‘rapid-onset erosion hazard’ typically occurs very quickly over a period of days or weeks. Due to data limitations however, short term erosion response (storm bite) was not assessed. With 1% AEP extreme weather events projected to become far more frequent and intense in the Gippsland Lakes, relying solely on estimated long-term average erosion rates constitutes a critical methodological

		infrastructure if present	in shoreline position, particularly sandy shores, and by the difficulty in interpreting shoreline position during times of high-water level and minor floods. Data from earlier shoreline measurements and comparisons by Dr. Eric Bird could not be retrieved from departmental archives. Hence, re-survey of former shoreline transects was not possible	limitation of the Local Coastal Hazard Assessment (LCHA). Moreover, the strategy lacked rigorous statistical treatment of shoreline movement. It did not calculate error margins for each measured change (beyond a general ± 5 m accuracy limit noted for photo interpretation) nor performed trend analyses across multiple dates. Valuable historical transect data was lost prohibiting resurveys and more precise erosion measurements. The analytical approach was therefore rudimentary by modern standards – relying on expert interpretation and basic arithmetic rather than repeatable, geospatial computations. While understandable given the data available, this limits the scientific rigor: results may be subject to interpreter bias, and subtle changes could be overlooked if they did not exceed the discernible threshold on photos. In summary, the strategy's methodology was grounded in sound basic practices for its time – field validation and historical photo comparison – but falls short of a fully rigorous, quantitative analysis. It provided a broad-brush assessment of erosion patterns, suitable for a strategic overview, but with inherent uncertainties that were
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				only partly acknowledged in the report's limitations. Historical Aerial Photographs (1935–40 to 1997): These provided the backbone for quantifying shoreline change. The strategy encountered significant data gaps and quality issues in this record. - Historical aerial images were low resolution (oblique aerial shots), - lacked fixed ground control points - no consistent scale or precise location data available - images were not orthorectified, therefore yielded only coarse information unsuitable for accurate measurement of shoreline change over time. - no use of high-precision GPS surveying, no laser scanning, and no computer-automated shoreline extraction. The aerial photos were simply interpreted visually rather than by using image processing software to delineate shorelines. While adequate for a qualitative strategy, the lack of more advanced tools means the methodology had very limited accuracy and not reliable estimates at the property level. The LCHA acknowledges (Report 4; p.69) many of the above limitations by noting “the erosion hazard zones defined in [LCHA] study are therefore based on the available erosion rate data” and recommended “site specific
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				monitoring data” to refine the hazard zones further.
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Appendix C: Response to Expert Witness Statement of Warwick Bishop – Hydrology and Flooding (Amendment C172egip, 2025)

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1. Introduction

This document provides a detailed review of the Expert Witness Statement authored by Warwick Bishop (Water Technology, 2025) regarding Amendment C172egip for the Paynesville Growth Area Structure Plan (PGASP). The review evaluates the report’s methodological robustness, the appropriateness of the 2.8 m Australian Height Datum (AHD) contour adopted for flood and coastal hazard planning, and the suitability of recommendations regarding

infrastructure placement below this level. Ecological risks, especially concerning the adjacent Ramsar-listed Gippsland Lakes wetlands, and climate adaptation implications are further critically assessed.

Specifically, it scrutinises the scope and foundational assumptions underpinning the evidence, notably its reliance on outdated data sources—principally Grayson et al. (2004) and the Gippsland Lakes Local Coastal Hazard Assessment (LCHA) reports (Water Technology, 2014). The evaluation also benchmarks the expert’s methodology against contemporary best-practice standards demonstrated by recent comprehensive assessments such as the Port Phillip Bay Coastal Hazard Assessment (PPCHA, 2022) and national coastal hazard assessment principles outlined in the National Climate Change Adaptation Research Facility (NCCARF) guidelines.

2. Executive Summary

This review identifies significant methodological and scope limitations in the Expert Witness Statement for Amendment C172egip. Key findings are as follows:

- **Limited Scope and Confirmation Bias:** The scope of the expert’s engagement explicitly required him to validate the predetermined 2.8 m AHD contour, which may have inadvertently limited the breadth of the analysis, leading more towards a justification-based review rather than a fully independent and comprehensive evaluation. This narrow scope prevented exploration of alternative benchmarks or advanced dynamic and probabilistic modelling techniques, which are increasingly recommended in coastal hazard assessments.
- **Reliance on Outdated and Deterministic Modelling:** The primary basis for the adopted 2.8 m AHD contour is derived by simply adding 0.8 m of projected sea-level rise to the Grayson et al. (2004) flood level, which lacks climate change considerations⁷⁴. Moreover, the 2014 LCHA inundation and erosion hazard assessments, foundational to the expert’s conclusions, employed static scenarios, limited event simulations, and did not effectively account for compound hazards, stratification processes, or higher-end sea-level rise scenarios. This deterministic and simplistic approach could potentially underestimate future risks by a significant margin, and fails to align with contemporary risk-assessment methodologies and best practice.
- **Infrastructure Risk Assessment Gaps:** Recommendations to site drainage and recreational infrastructure below 2.8 m AHD were based on qualitative reasoning without comprehensive, quantitative lifecycle or vulnerability analyses. No rigorous assessment of long-term operational risks, ecological impacts, or cost-benefit evaluations was conducted, raising significant uncertainty about the resilience and sustainability of proposed infrastructure.
- **Ecological and Ramsar Wetland Implications:** The evidence inadequately considered ecological impacts, notably the potential disruption of wetland migration and habitat degradation associated with increased inundation frequency and severity. This

⁷⁴ Refer to Appendix D: Review of Gippsland Lakes Flood Level Modelling Project – Final Report (Grayson et al., 2004) for further analysis on the limitations of this key flood study.

oversight neglects obligations under Ramsar Convention principles and risks future environmental degradation.

- **Benchmarking Against Best Practice:** Compared to the PPCHA (2022) and the Victorian Coastal Hazards Extended Guideline (2022), the methodology appears outdated and insufficiently precautionary. Modern assessments emphasise dynamic, probabilistic, and integrated hazard modelling, which are absent in this evidence, leaving critical uncertainties unaddressed.

In summary, the expert report, while complying nominally with existing policy minimums, falls significantly short of best practice. Given the nationally significant environmental values, the need for long-term infrastructure resilience, and significant climate uncertainties associated with the Gippsland Lakes and wider catchments, it is recommended that the planning panel:

- Seek supplementary analysis by applying the CSIRO (2024) Coastal Inundation Local Government Area Assessment for East Gippsland (CILGAA-EG) probabilistic inundation layers to determine more conservative foreshore setbacks.
- Impose rigorous adaptive management and monitoring conditions to address the shortcomings identified herein.

3. Constrained Scope of Engagement

Narrow Terms of Reference: The expert's role was explicitly framed to **validate and justify** a pre-selected flood hazard contour (2.8 m AHD) rather than to independently evaluate the most appropriate method for coastal hazard assessment. His own statement of instructions shows he was engaged to "*provide validation, justification and appropriateness*" for using the 2.8 m AHD contour, to review hazards only as they pertain to that line, and to justify placing infrastructure below the 2.8m line. This constrained brief inherently limited the expert's analysis. Rather than assessing alternative benchmarks or applying contemporary risk assessment methodologies, the expert's analysis was narrowly constrained to supporting the pre-selected 2.8 m AHD contour. Such a narrow scope precludes a best-practice evaluation of coastal hazard risk – the expert was not asked to question whether 2.8 m AHD is truly the optimal or most precautionary benchmark, nor to compare it with modern methodologies and best practice coastal risk assessments.

This approach may unintentionally give rise to concerns regarding confirmation bias, as the analysis appears primarily oriented towards supporting the Council's predetermined contour, rather than objectively evaluating it against contemporary best-practice standards.

Contemporary coastal hazard assessments generally involve exploring multiple scenarios of hazard extents and probabilities, whereas the scope of this expert's engagement was narrowly defined to affirm an historical and unsatisfactory planning benchmark. This limitation may inadvertently undermine the independence of the analysis, as it precludes the consideration of important alternative approaches (e.g. probabilistic modelling, adaptive risk scenarios), which were not examined at all.

Implications: The 2.8 m AHD line is derived by combining results from an earlier flood modelling study—currently subject to peer review—with the state's minimum policy allowance for Sea Level Rise (SLR) - discussed further below. Crucially, however, the expert's terms of reference did not extend to examining the ongoing validity of this simplistic approach to coastal risk mitigation. There was no mandate to ask, for example, "Is there a more up-to-date or higher

flood level we should use? Would a different mitigation method yield a safer outcome for 2100 and beyond?”

In effect, the expert’s role was confined to justifying an existing out-dated planning control. This is a fundamental methodological limitation: instead of a comprehensive hazard study adopting best practice, we essentially received a **justification report**. As a result, the evidence lacks the breadth expected of a contemporary coastal risk assessment – it does not venture beyond the 2.8 m contour or critically evaluate its adequacy relative to evolving climate risks and current scientific best practice.

4. Static Hazard Benchmark – the 2.8 m Contour Line

The expert’s analysis did not incorporate dynamic simulations of flooding in the way current guidance recommends, such as time-step hydrodynamic modelling of storm tides in conjunction with compound flood events (Water Technology, 2022). Instead, the expert treats the 2.8 m AHD line as a fixed boundary between “safe” and “unsafe” land for a limited planning horizon period (2100). This oversimplifies reality – coastal flooding is a dynamic *process*, not just a bathtub level. The expert report acknowledges dynamic processes like catchment stream flows, wind set up and coastal surges can cause flooding, with stream flows being the main driver of peak flood levels in the Lakes. He further notes the 2.0 m peak flood level was derived from the Grayson et (2004) flood study which did not account for Sea Level Rise (SLR). The expert’s evidence focused exclusively on the adoption of the 2.8 m AHD contour as the “conservative” flood-risk boundary, justified primarily on the assumption that Sea Level Rise (SLR) would likely increase the Gippsland Lakes substantial storage capacity during flood events. This reasoning draws specifically on findings from the 2014 Local Coastal Hazard Assessment (LCHA), which modelled a 10% Annual Exceedance Probability (AEP) flood scenario with a +0.8 m SLR. Under this scenario, the LCHA modelled a peak flood level increase of approximately 53.6 cm, corresponding to an SLR response factor of 0.67. This indicates that flood peaks in the Gippsland Lakes do not increase proportionally (1:1) with the full magnitude of sea-level rise, due to the significant water storage effect within the lakes.

However, the LCHA did not explicitly model the critical 1% AEP Flood scenario for the higher (+0.4 m and +0.8 m) SLR scenarios. Recognising this limitation, the expert chose not to apply a SLR response factor. Instead, he adopted the full 0.8 m SLR addition to the existing 2.0 m peak flood level, resulting in the proposed 2.8 m AHD contour, which he described as an “appropriately conservative” benchmark to guide planning and development decisions up to 2100.

We consider this analysis subjective, based on limited modelling and insufficient data points, and thus question its suitability as a genuinely conservative benchmark. Specifically, our concerns relate to the following points:

5. Absence of Modelled 1% AEP +0.8 m SLR Scenario

The 2014 Local Coastal Hazard Assessment (LCHA) did not include explicit modelling of the crucial 1% Annual Exceedance Probability (AEP) flood scenario under a +0.8 m sea-level rise (SLR). This represents a substantial knowledge gap because the 1% AEP flood is the widely adopted standard for land-use planning, infrastructure design, and assessing flood risk to communities. Without this critical scenario explicitly modelled, planners and decision-makers lack accurate data on how severe flooding might realistically manifest under high-end future

sea-level conditions. This uncertainty is not adequately addressed by merely assuming that increased lake storage volume from sea-level rise will sufficiently attenuate peak flood levels.

6. Likely Higher SLR Response Factor at Greater SLR Levels

Analysis of the 10% Annual Exceedance Probability (AEP) flood modelling at Paynesville reveals that the Sea-Level Rise (SLR) response factor increased by approximately 15.52% between the +0.2 m and +0.8 m SLR scenarios. If a similar relationship holds for the critical 1% AEP flood scenario, it is likely the response factor under a +0.8 m SLR would exceed the previously calculated factor of 0.65 (derived from the +0.2 m SLR scenario). In practical terms, this indicates that the actual increase in peak flood levels under a +0.8 m SLR scenario could significantly surpass the 52 cm implied by the lower response factor of 0.65, potentially reducing the purported "conservative buffer" by at least 10 cm or more. Without explicit modelling the 1% AEP flood at higher SLR scenarios, the expert's claim of conservatism rests on speculative assumptions rather than robust evidence. Thus, the assertion of a conservative benchmark at the 2.8 m AHD level must be approached with caution, as it may underestimate true future flood and shoreline erosion risks.

7. Unmodelled Baseline and Future Design Storm levels

The LCHA also never explicitly modelled the 1% AEP Design Storm event under existing mean sea level (MSL) conditions or future SLR scenarios. The absence of baseline and future SLR scenario modelling for 1% AEP Design storm events in the Gippsland Lakes introduces further uncertainty. The duration of storm surge events can range from 2 to 11 days, with longer events having greater potential for more extensive inland inundation (McInnes et al. 2009). Failing to consider the impact of future design storms in conjunction with SLR on flood levels further undermines confidence in the robustness and accuracy of the proposed 2.8 m benchmark.

8. Increased Frequency and Severity of Future Extreme Storm Events

The fixed +0.8 m component does not adequately consider recent climate projections for East Gippsland that indicate 1 in 100-year high water level events could occur much more frequently (10 to 100 times annually) by 2100 under varying emissions scenarios (Kirono et al. 2022). Furthermore, increases in mean and extreme sea levels associated with climate change are likely to result in significant changes to the Lake King shoreline in the future (McInnes et al. 2009). These increasingly frequent and severe storm events will substantially influence coastal processes; including the interaction between wind-wave action, soft sediments and accelerating shoreline recession (Pralad et al. 2009). The LCHA's failure to consider such extreme weather projections or explicitly model future wind wave fetch exposure to Lake King's western shores, further weakens confidence in the selected 2.8 m AHD contour as a conservative and reliable safeguard against future coastal hazards

9. Discrepancies in Wind Setup Estimates

The expert report indicates wind setup can cause fluctuations in lake water levels of around 30 cm. However, this figure is notably lower than the wind setup values presented in the Local Coastal Hazard Assessment (LCHA), which explicitly states that "wind setup can elevate water levels over periods of several hours to a day by up to approximately 0.5 m" (LCHA 2014; Report 2, p. 5). Despite acknowledging the potential impact of wind-induced water-level variations, the adoption of the 0.8 m sea-level rise benchmark includes no additional allowance or freeboard to account for future increases in wind setup magnitude or frequency. Providing a freeboard for wind setup is becoming a standard practice for probabilistic 'bathtub' assessments to help account for uncertainties, such as increased rainfall intensity and sedimentation, in addition to

wave setup effects (O’Grady, 2024). Consequently, the expert’s selected peak flood water level lacks any explicit allowance for increased wind setup effects anticipated under future climate scenarios, potentially resulting in an underestimation of future peak water levels and associated flood risks.

10. Astronomical Tide Component Not Considered

The expert acknowledges in his report that the tidal range at Paynesville is approximately 0.1 m, yet he excludes this tidal component from his ‘conservative’ +0.8 m SLR benchmark. By contrast, the 2014 Local Coastal Hazard Assessment (LCHA) explicitly incorporates tidal influences into its shoreline erosion analysis, adopting a +0.9 m AHD contour. The LCHA notes that “the present mean water level in the lakes is approximately 0.1 m AHD due to tidal pumping (resulting from increased resistance through the entrance during ebb tides compared to flood tides) and river inflows. Thus, a mean lake level of 0.9 m AHD under +0.8 m sea-level rise conditions is appropriate” (Water Technology, 2014).

This raises an important question: why was a similar approach not taken in setting the flood-risk benchmark for Paynesville’s growth area? It is entirely reasonable to expect that astronomical tides will continue to influence lake water levels into the future—indeed, recent research strongly suggests this influence could become more pronounced with sea-level rise (SLR). Hauge et al. (2023) conducted an in-depth tidal study at Lakes Entrance, confirming that tidal ranges have significantly increased in recent years due to rising mean sea level and morphological changes at the inlet. Rising sea levels reduce bottom friction by deepening the estuary entrance, enabling greater water volumes to flow during both ebb and flood tides. This friction reduction increases the tidal prism (the total volume of water moving into and out of the lakes each tidal cycle), ultimately leading to higher mean high water (MHW) and mean higher high water (MHHW) levels. Hauge et al. (2023) found that for the Gippsland Lakes, future increases in tidal range due to sea-level rise will likely have a more substantial impact on flooding than equivalent changes from weather and ocean conditions alone. Therefore, excluding the tidal component from the SLR benchmark reduces the effectiveness and conservatism of the 2.8 m AHD flood level. Given that tidal amplification due to future SLR is well documented and significant, it is critical that adaptation planning explicitly accounts for this factor.

11. Deterministic Modelling and Limitations in Hazard Scenario Analysis

The analysis adopted a deterministic method, simply adding a fixed 0.8 m sea-level rise (SLR) to an existing 1% AEP flood level of 2.0 m, resulting in the 2.8 m AHD benchmark. Although this aligns with older Victorian policy guidelines, it represents an overly simplistic ‘bathtub’ inundation scenario, neglecting event probabilities, unexpected factors, and dynamic flood processes. Current international and Victorian guidelines advocate a more sophisticated, risk-based approach, incorporating probabilistic modelling and higher-end SLR scenarios (IPCC AR6, 2021; Victorian Resilient Coast Extended Guideline, 2022). Consequently, the 0.8 m SLR and the associated 2.8 m AHD contour are now increasingly viewed as insufficiently conservative.

Significantly, the evidence did not examine flood frequency or timing—critical questions such as how often or under what conditions the 2.8 m threshold might be exceeded by 2100. Additionally, it did not consider compound events (e.g., simultaneous lake flooding and extreme coastal storm surge events). Modern best-practice coastal hazard assessments now routinely employ joint-probability and time-domain modelling approaches—such as Monte

Carlo simulations—to robustly quantify uncertainties and probabilities (O’Grady et al., 2024; McInnes et al., 2024). These probabilistic methods capture the range of plausible outcomes, thus allowing planners to understand and manage uncertainties effectively.

Regrettably, no such comprehensive analysis was conducted. Instead, the expert relied solely on outdated deterministic modelling from the 2014 hazard study—which itself lacked probabilistic or compound event scenarios (see detailed analysis in Appendix A). Had the expert analysis incorporated the latest CSIRO probabilistic modelling data for East Gippsland (O’Grady et al., 2024a), these essential questions and uncertainties could have been clearly addressed, better informing the Panel and ensuring genuinely conservative flood planning outcomes.

12. Lack of Dynamic Flood Simulation and Consideration of Temporal Flood Characteristics

By using probabilistic tools or at least planning to a “likely upper bound” (e.g. 95th percentile outcomes), planners can better account for uncertainty. This reduces the chance of potentially catastrophic impacts to coastal values and infrastructure if sea-level rise follows a higher trajectory. For example, the Port Phillip Coastal Hazard Assessment (2022) aligns closely with the DEECA Coastal Hazards Extended Guideline (2022), employing best-practice coastal modelling techniques to simulate inundation and shoreline erosion under multiple probabilistic scenarios that account for varying storm conditions and projected sea-level rise. It assessed both event-based storm-tide flooding (temporary inundation caused by extreme storm events) and permanent inundation resulting from projected sea-level rise across various probability levels and emissions scenarios, thereby offering a significantly more comprehensive and detailed perspective on coastal hazard extents.

By contrast, the expert’s evidence did not explore the temporal aspects of flooding (e.g. flood duration, wave overtopping, multi-day flood peaks) – critical factors for infrastructure resilience and ecological impact in estuarine environments. Additionally, no freeboard allowance was applied to account for these flood factors. Moreover, the absence of probabilistic analysis was surprising, particularly given the availability of the recent CSIRO Probabilistic Coastal Inundation Layer for East Gippsland LGA (O’Grady et al., 2024a). In light of CSIRO’s latest probabilistic modelling tailored specifically to the East Gippsland Local Government Area, the claim that the 2014 LCHA represents “the most recent modelling” is increasingly untenable.

Notably, Gippsland Lakes flooding can involve compound dynamics (catchment flows and storm surge) and long flood durations due to the restricted lake outflow; none of these scenarios were explicitly examined by the expert report. The expert simply referenced the Grayson (2002) modelled peak water level with an additional 0.8m allowance for SLR, and assumed keeping some development above that line suffices. This approach misses the probabilistic nature of coastal hazards. As climate change progresses, there is inherent uncertainty in how often and how severely floods will occur, and how far the shoreline will erode and retreat.

Best practice would evaluate a range of SLR sensitivity scenarios and storm probabilities, rather than a single ‘design event’ (Water Technology, 2022; McInnes et al. 2022). Here, the 2.8 m AHD line was treated almost as an absolute threshold – a method now considered outdated and inadequately conservative given more recent climate projections and modelling (McInnes et al., 2022; O’Grady et al 2024a). In summary, the focus on a static contour without probabilistic or dynamic analysis is a significant methodological shortcoming when judged

against modern coastal risk assessment standards - which call for embracing uncertainty, conducting scenario analyses, and using risk-based metrics rather than fixed lines on a map (Water Technology, 2022).

13. Utility and Suitability of Probabilistic ‘Bathtub’ Modelling for Gippsland Lakes Context

The CSIRO probabilistic inundation layer for East Gippsland provides estimates of the likely range (uncertainty) of how high future design storms will reach using numerical simulations of historic extreme water levels with future mean sea level projections from the sixth IPCC assessment report (AR6). Although based on a probabilistic ‘bathtub’ rather than a dynamic inundation model, the dataset does incorporate a freeboard allowance for wave setup. Moreover, augmented bathtub modelling using relatively high-resolution data may provide an acceptable low-cost alternative approach to dynamic flood modelling in young lake-like estuarine systems such as the Gippsland Lakes (Kumbier, et al. 2019). Recent research comparing the accuracy of dynamic and static bathtub modelling, found that estuaries with relatively cleared and flat foreshore landscapes with sandy and shallow nearshore bathymetry (such as the study area) had lower terrain roughness and bottom friction, allowing storm surge and flood waters to travel further inland more easily and quickly, mimicking uniform bathtub-like flooding patterns (Kumbier et al. 2019; Williams & Lück-Vogel, 2020). The conservation of water mass and flow dynamics in low-relief environments—where channels and depressions are minimal—the attenuation is low, leading to a more uniform spread pattern resulting in extensive inundation similar to bathtub-model predictions (Didier et al. 2018; Hong et al. 2024). Finally, estuaries characterised by limited sediment infill and relatively narrow, shallow foreshores akin to our study area, are likely to experience reduced attenuation of flood waters, enhancing inundation extents (Kumbier et al., 2019).

Additionally, the CSIRO enhanced ‘bathtub’ modelling provides probabilistic flood-zone maps that clearly differentiate areas of low-lying land according to their likelihood of inundation for specific future years, global greenhouse gas Shared Socioeconomic Pathways (SSPs), and design storm events defined by Average Recurrence Intervals (ARIs) (O’Grady et al., 2024a). Incorporating this dataset would have further strengthened the robustness and comprehensiveness of the risk assessment, as well as ensuring closer alignment with the DEECA hazard assessment guidelines (2022) —interestingly, developed by Water Technology itself.

14. No Consideration of Compound or Cascading Hazards

A related limitation is the absence of compound hazard analysis. Coastal flooding risk in the Paynesville area is not only a function of lake water level, as the expert rightly acknowledged, but can be exacerbated by concurrent factors – e.g. heavy rainfall runoff coinciding with high lake levels, or strong wind set-up and wave action on top of an elevated lake. The 2014 Gippsland Lakes Local Coastal Hazard Assessment (LCHA), which the expert relies on, itself did not effectively model the probabilistic occurrence of compound extreme events. The expert report carried this limitation forward; there is no evidence he introduced any joint-probability analysis - such as assessing the combined probability of a 1% catchment flood and a 1% design storm occurring together. Failing to analyse compound events significantly underestimates risk, as real-world extreme flooding in estuarine environments often involves multiple drivers acting together (Kumbier et al. 2018). For example, a moderate lake flood coincident with a storm surge might achieve a similar water level to the nominal “1% AEP flood” alone – but the

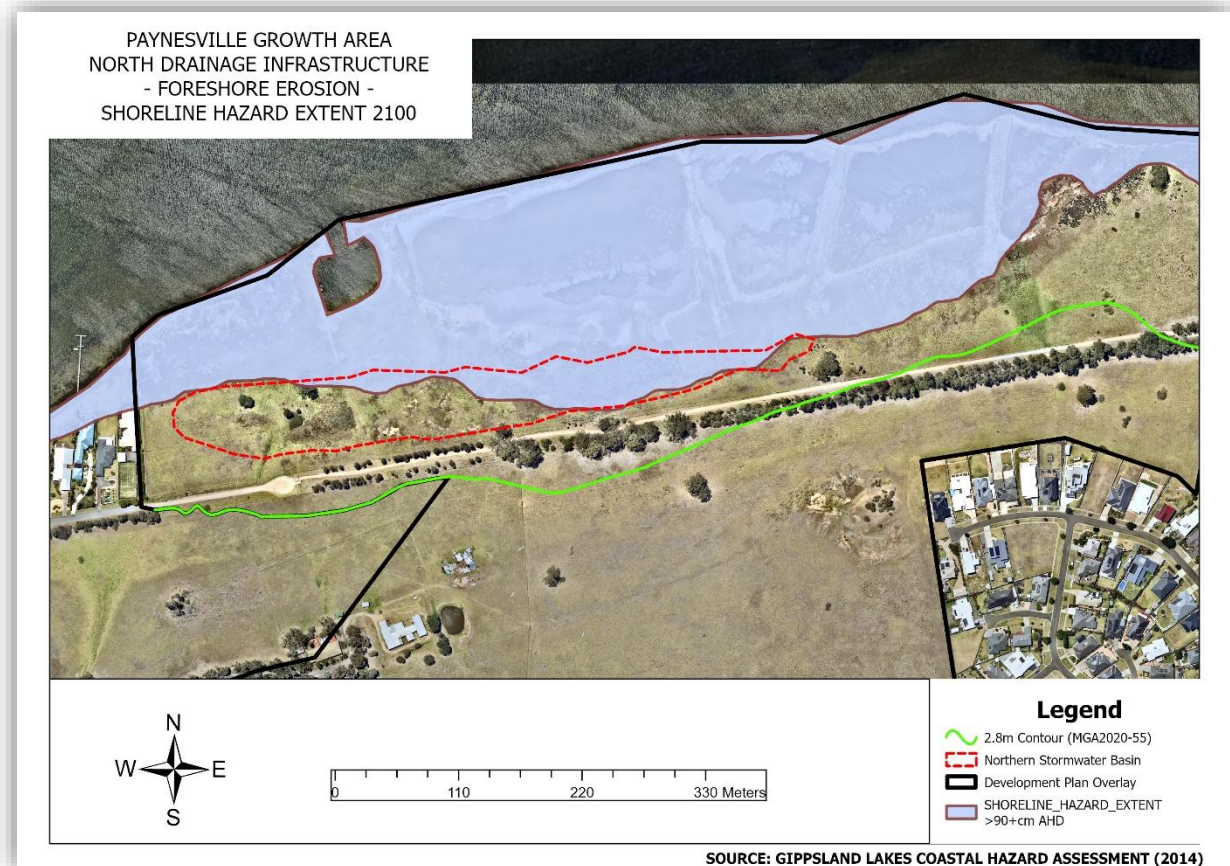
expert's approach, framed by the 2.8 m single scenario, cannot capture such variability and uncertainty.

Similarly, the evidence does not address storm sequencing or duration (e.g. back-to-back east coast lows), which could keep water levels high for prolonged periods. Contemporary best practice hazard assessments, including the PPBCHA (McInnes et al. 2022) explicitly consider compound and cascading hazards, because these represent plausible worst cases for which communities should plan. The omission of this analysis in the expert report is a noteworthy gap – it implies a false sense of precision and safety by focusing only on an isolated scenario. In reality, a small change in assumptions (e.g. slightly more intense rainfall, or an ocean storm surge coinciding with peak flows) could render the 2.8 m AHD threshold non-conservative. Yet the expert did not evaluate such combinations, nor quantify the margin of safety that 2.8 m provides (if any) under compound conditions.

This underscores the perception that the engagement was about back-validating a 2.8m AHD line rather than truly stochastically interrogating risk from all angles. In summary, the identified gaps—particularly the absence of explicit modelling for critical scenarios, reliance on limited and extrapolated data, and omission of contemporary climate science projections—represent significant shortcomings in the hazard assessment underpinning the Amendment. These limitations collectively raise substantial uncertainty, undermining the comprehensiveness and adequacy of the Amendment's approach to managing coastal flooding risks in the context of climate change. The next section of this review will expand on the infrastructure risk assessment.

15. Deterministic Infrastructure Recommendations (Lack of Full Risk Assessment)

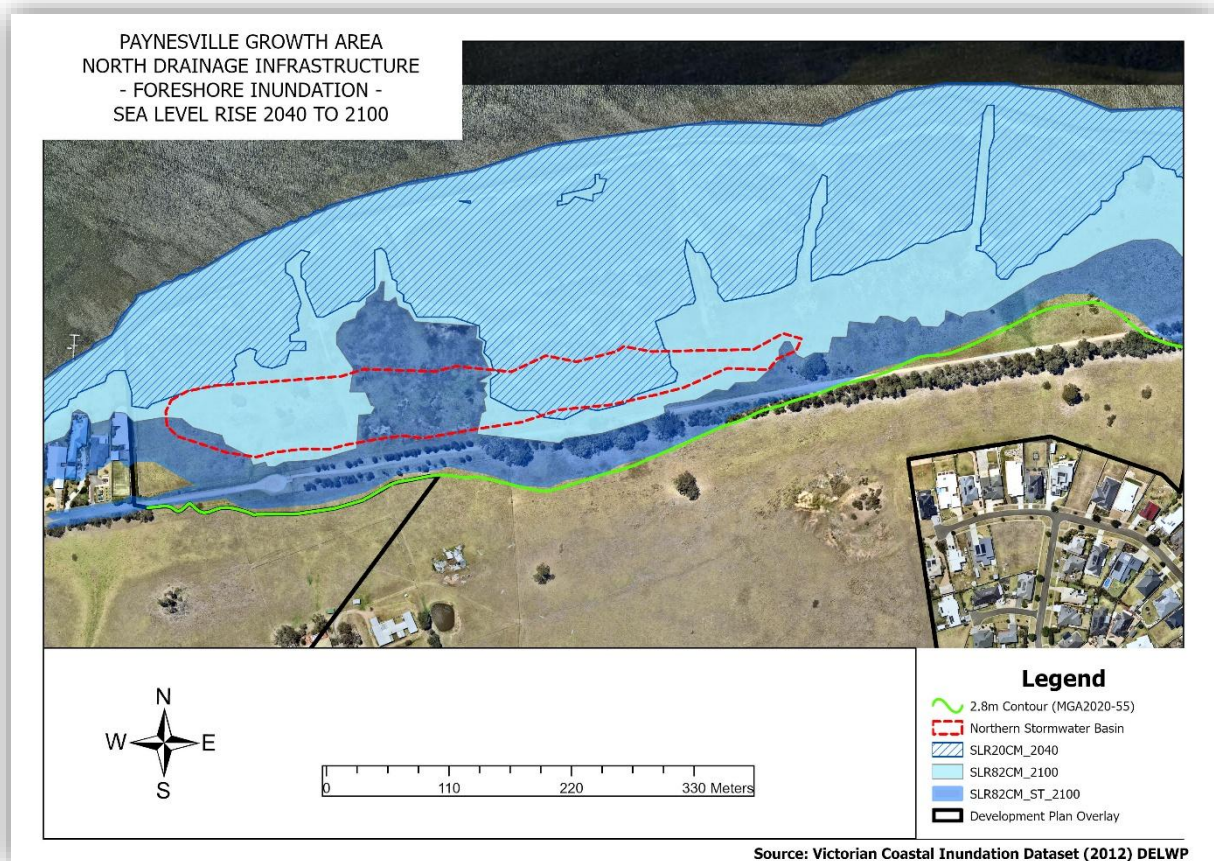
The map (shown below) of projected shoreline erosion extent was derived from the Gippsland Lakes LCHA Shoreline Erosion Study (2014), and suggests that around 1 ha or approximately



37% of the 2.7ha drainage basin (red dashed polygon) is projected to be lost to shoreline erosion and inundation by 2100, unless mitigation measures are taken. The map above provides context the expert's assertion that "by 2100, under 0.8 m SLR conditions, the mean water level in the Gippsland Lakes around Lake King is expected to sit at approximately 0.9 m AHD. Therefore, drainage infrastructure built at or below this level may be ineffective by this time." He concludes however, that it is "*appropriate*" to install drainage infrastructure below the 2.8 m AHD line, on the proviso that it is designed with future water levels in mind. This rationale is deterministic and limited in scope: he argues that during a rare large flood, local stormwater assets are of minor consequence (since the entire area would be inundated by lake flooding) and that such events are infrequent.

A robust risk assessment would instead begin by mapping projected shoreline hazard and inundation extents under a range of sea level rise scenarios, and then clearly identifying infrastructure locations relative to these hazards. In this instance, even an initial assessment indicates that the proposed infrastructure site faces significant exposure to permanent inundation by as early as 2040, with coastal inundation and erosion risks worsening by 2100.

A preliminary analysis of sea-level rise (SLR) and extreme weather impacts on the proposed foreshore drainage basin (marked by the red dashed polygon) using the 2012 Victorian Coastal



Inundation dataset layers reveals that:

- **By 2040**, a projected SLR of approximately 20cm is expected to permanently inundate around **0.66 ha (approximately 24.4%)** of the proposed ~2.7-hectare drainage basin
- **By 2100**, permanent inundation due to an anticipated sea-level rise of 82 cm would affect approximately **1.95 hectares (around 72.2%)** of the basin, assuming no protective measures are implemented to hold back lake waters.
- Furthermore, extreme coastal inundation events (1 in 100-year high sea level events such as storms and tidal surges) – represented by the shaded dark blue (SLR82cm_ST_2100) layer, are projected to completely inundate remaining unsubmerged portions of the drainage basin between **10 to 100 times per year** by 2100, depending on emission scenarios (Kirono et al., 2022, pp. 62,63).

Under such circumstances, the principles embedded in Victoria's planning and coastal management frameworks would clearly support relocating the infrastructure to a site with a substantially lower risk profile, rather than attempting to engineer resilience into a

fundamentally vulnerable location. Indeed, the Victorian Marine and Coastal Policy (DELWP, 2020) and Planning Practice Note 53 (DELWP, 2023) explicitly advocate for the adoption of hazard avoidance as the primary response to coastal risks. They stipulate that infrastructure should not be sited in areas demonstrably subject to future coastal erosion or inundation hazards unless no feasible alternatives exist. By contrast, the expert's approach—focusing exclusively on design-based mitigation—neglects the well-established hierarchy of coastal risk management principles, which prioritise avoidance before adaptation or mitigation.

Consequently, the more appropriate planning response would be to thoroughly investigate and prioritise relocating the drainage infrastructure to a less vulnerable site. Only if no suitable alternatives are identified should design-based solutions be explored to mitigate future hazards. Even then, such solutions must incorporate probabilistic rather than deterministic hazard assessments to ensure long-term resilience and alignment with contemporary best-practice coastal planning principles.

Specifically, planners should embed probabilistic coastal hazard analyses into strategic planning—potentially utilising the recently released CSIRO (2024) Probabilistic Coastal Assessment layers for the East Gippsland LGA. These assessments should critically evaluate key zoning decisions for resilience at multiple stages across the planning horizon, considering a range of emissions pathways and design storm events.

Key questions to address include:

- **Frequency and Duration:** How frequently, and for what duration, will public infrastructure such as proposed roads and stormwater assets become inundated or rendered ineffective due to rising sea levels and increased intensity of extreme weather events?
- **Asset Performance:** What is the probability of asset failure or reduced performance arising from saline intrusion during smaller, yet increasingly frequent events, as rising baseline water levels shift the inter-tidal zone progressively inland?
- **Environmental and Economic Consequences:** What would be the environmental and economic repercussions if the infrastructure were to fail—for example, through contamination of adjacent Ramsar wetlands or the impost on emergency services?

The magnitude and seriousness of these potential impacts were inadequately addressed in the expert report. Moreover, his evidence lacks clarity regarding the long-term adaptation strategy for the infrastructure (i.e., whether it will eventually be raised, abandoned, or protected through engineered measures). Instead, the expert's analysis defers rigorous examination, suggesting merely that "an assessment on the tolerable frequency of ineffective drainage" should be conducted if outlet pipes are positioned near projected future mean sea levels. This statement clearly implies that no comprehensive vulnerability or lifecycle cost-benefit analysis has yet been undertaken. Moreover, the exceptionally low elevations of the proposed drainage basin mean the constructed wetland's outfall pipe would, from the outset, be dangerously close to the existing mean water level, significantly increasing the likelihood—indeed, almost



ensuring—that saline ingress will adversely impact stormwater infrastructure performance early in its operational life.

In summary, the recommendation to permit drainage infrastructure within an identified hazard zone with high conservation values was based primarily on deterministic assumptions rather than on detailed, analytically-driven risk and vulnerability assessments. Given the low elevations of the proposed drainage basin, this approach introduces considerable uncertainty and risk, undermining alignment with robust coastal risk management and contemporary planning standards.

“Tolerable” but Unquantified Risk

The expert further suggests that certain infrastructure, such as recreational trails and park amenities, can be located below the 2.8 m AHD contour provided these facilities are designed to withstand occasional flooding and are easily repairable. Although this aligns broadly with the principle of allocating lower-value uses to higher-risk areas, the expert does not substantiate this position with a detailed, documented risk analysis or probabilistic hazard mapping.

A preliminary evaluation using the 2012 Victorian Coastal Inundation dataset (see figure overleaf) reveals significant vulnerability:

- By **2040**, a projected sea-level rise (SLR) of approximately 20 cm is expected to permanently inundate around **11.63 hectares (51.05%)** of the approximately 22.79 ha area situated below 2.8 m AHD.
- By **2100**, a further projected sea-level rise of approximately 82 cm could permanently inundate over **17 hectares (74.76%)** of the area below 2.8 m AHD, assuming no protective measures are implemented.
- Additionally, approximately **22 hectares (97%)** of the proposed conservation reserve below 2.8 m AHD will experience severe impacts from the projected 82 cm SLR, combined with increasingly frequent storm and tidal surge events by the end of the century.

Critically, key risk factors such as the anticipated flooding frequency of these assets by 2100, potential erosion impacts on foreshore trails, and cumulative maintenance costs over the asset lifecycle were not quantitatively assessed. Instead, the expert provides only qualitative criteria—such as infrastructure that is "not critical for access or evacuation" and "relatively cheap to repair"—as justification for placing these assets below the inundation contour. This deterministic reasoning presumes flooding events will be both rare and short-lived, leading to impacts considered tolerable. However, in the absence of quantitative evidence, the Panel is required to accept these assumptions without verification.

Moreover, the analysis lacks a clear lifecycle vulnerability assessment or a defined adaptation strategy. Best-practice climate adaptation requires explicit consideration of how assets will be managed as coastal conditions deteriorate—for example, clarifying whether foreshore pathways would be relocated inland as erosion advances, or whether protective engineering measures might be pursued (potentially causing environmental harm to adjacent wetlands). The provided evidence is notably silent on these critical long-term considerations.

Consequently, the recommendation appears ad hoc, implying: 'It is acceptable to situate certain infrastructure in flood-prone areas, as long as occasional flooding is accepted.' While such an approach might be reasonable in the short term, it glosses over how these assets will endure over decades of progressively worsening shoreline erosion, flooding and rising sea levels. By failing to undertake a rigorous, quantitative risk assessment—including evaluating likelihoods, consequences, and adaptation triggers—the expert's advice does not meet the comprehensive risk management standards outlined in recognized frameworks such as 5334:2013 (*Climate Change Adaptation – Risk-Based Approach*) or the best-practice methodologies set forth in the DEECA *Coastal Hazards Extended Guideline* (2022).

In summary, the reliance on deterministic assumptions rather than robust quantitative risk analyses constitutes a significant methodological deficiency when planning infrastructure in an area projected to face escalating coastal hazards.

Key Data Sources: Limitations and Outdated Assumptions

The expert's opinions rely heavily on three key technical sources, each of which has significant limitations that propagate into his conclusions:

(i) [Grayson et al. \(2004\)](#) – Gippsland Lakes Flood Level Modelling: This landmark study is the origin of the 1% AEP flood level of 2.0 m AHD at Paynesville which underpins the entire 2.8 m contour selection. However, the Grayson et al. (2004) modelling is now over 20 years old and was conducted before the era of climate-change-inclusive flood modelling. Crucially, as the report makes clear, *“the modelled peak flood level of 2.8m AHD...does not take into account for the impacts climate change.”* This means that the base flood estimate is likely understated for future conditions – as climate science indicates, extreme rainfall events are expected to increase in intensity, which the expert explicitly notes *“potentially resulting in increased flood levels in the Gippsland Lakes.”* The expert’s solution to this was essentially to apply a “level of conservatism” by simply adding 0.8 m SLR. But no additional margin was added to reflect higher catchment flows; in other words, no quantitative update of the 2.0 m figure was done. The reliance on an outdated 2004 model is a vulnerability: any errors or limitations in that study carry through to today, which is why all nine existing flood studies are currently being peer reviewed – with results expected to be released later this year (Chester, pers coms June 2025).

Notably, hydrological records in the region post-2004 include significant flood events (e.g. 2007, 2011/12, 2016, 2021) and updated Intensity-Frequency-Duration (IFD) rainfall data, which could inform a new design flood level. None of this newer data appears to have been incorporated. Best practice would demand either a re-calibration or at least a sensitivity test to see if 2.0 m AHD is still valid today. Instead, the expert treated 2.0 m as a given, only updating it by adding SLR. This is a clear limitation: the flood model is “pre-climate change” in its inputs, and the expert’s use of it does not account for potential increases in flood magnitude due to climate trends in rainfall or unanticipated shoreline erosion rates in response to more intense and frequent extreme future weather events. Please refer to Appendix D for a more detailed review of the Grayson et al. (2004) flood study.

Essentially, the analysis assumed stationary hydrological conditions (aside from changes in lake levels). However, current Victorian coastal risk assessment guidelines (Water Technology, 2022) explicitly recommend employing probabilistic models to robustly ‘stress test’ infrastructure against a broader array of emissions scenarios and extreme storm events. Alternatively, if relying on simpler static ‘bathtub’ models, these guidelines at minimum recommend incorporating an additional freeboard allowance to account for uncertainty. Neither of these best-practice approaches was applied in this case.

Please refer to Appendix D for more in-depth analysis of the limitations of the Grayson et al. (2004) study.

(ii) [Water Technology \(2014\)](#) – Local Coastal Hazard Assessment (Inundation): The expert cites Water Technology’s 2014 Gippsland Lakes/90 Mile Beach LCHA as the “most recent modelling” for flood levels and uses it to support the contention that the 2.8 m line is, if anything, slightly conservative. As noted previously, more recent probabilistic modelling of the East Gippsland LGA was released by the CSIRO last year, and while the 2014 LCHA was a valuable study, it too has **notable constraints** that limit its adequacy for effective coastal risk planning.

Please refer to Appendix A for more detailed review of the LCHA, highlighting its key limitations.

(iii) **Water Technology (2014) – Local Coastal Hazard Assessment (Erosion):** The expert also drew on the LCHA’s coastal erosion hazard assessment (e.g. to identify erosion susceptibility of the foreshore). The LCHA’s erosion component used a semi-qualitative “weighted scoring” method to rank shoreline segments by erosion risk under future sea level. This approach is inherently subjective – it involved expert judgment to weight factors like geomorphology, wave exposure, and vegetation, due to limited site-specific data. The methodology did not incorporate dynamic coastal process modelling, such as detailed sediment transport or morpho-dynamic simulations of shoreline retreat. Instead, it relied on assigning risk levels using simplified assumptions about future shoreline movements. Specifically, the LCHA projected a uniform shoreline recession rate (either 0.1–0.2 m/year or 0.2–0.5 m/year) relative to a fixed contour (0.9 m AHD) under a single sea-level rise scenario (0.8m by 2100 +0.1m for tidal range at Paynesville). This approach essentially applied a static and uniform recession estimate, then translated the existing shoreline position inland, without dynamically accounting for coastal processes or site-specific variability.

Comparison to Best Practice Standards (PPCHA 2022 & Victorian Guidelines)

When measured against the *Port Phillip Bay Coastal Hazard Assessment (2022)* and prevailing *Victorian Coastal Hazard Extended Guideline*, the methods and conclusions in the evidence report fall short of best practice hazard assessment in several key respects. The PPBCHA 2022 is widely regarded as a best-practice benchmark for regional coastal hazard studies in Australia – it combined the latest science, monitoring and technical assessments, and used sophisticated modelling to capture complex coastal processes. Key features of the PPCHA (and similar modern studies) include:

Multiple Climate Scenarios: PPCHA examined hazards across short, medium, and long-term planning horizons with various sea-level rise increments, rather than anchoring to a single end-century value. This allows planners to see impacts at (for example) 2030, 2070, 2100, and beyond, including higher-end SLR sensitivity scenarios. By contrast, the Paynesville Amendment relies on one scenario (0.8 m by 2100). Current national guidance (e.g. from IPCC AR6 or Australian State policies) often suggests considering upper-bound SLR projections for critical infrastructure or vulnerable areas.

The expert’s analysis did not incorporate any sensitivity scenario higher than 0.8 m, nor any post-2100 consideration (despite the fact that development built now will exist after 2100). This is a divergence from best practice, where adaptive planning would consider the possibility of greater SLRs (for instance, Victorian policy recognizes 0.8 m by 2100 **as a minimum**, not a cap, and notes sea levels will continue rising beyond 2100). Indeed, the *Marine and Coastal Policy* notes that the current 0.8 m by 2100 benchmark is under active review and “will be revised... considering the most recent sea-level rise projections... to provide locally relevant and accurate information” (*Marine & Coastal Policy*, 2020).

This acknowledges that a static benchmark must be updated or replaced with a more nuanced, time-phased strategy as science advances. Finally, treating a 2.8 m AHD line as an eternal cutoff fails to address high-consequence, low-probability outcomes and the inevitable post-2100 sea-level rise. By contrast, emerging guidance urges precautionary and adaptive planning: use higher-end probabilistic scenarios for important assets, incorporate safety margins, and design adaptation pathways that are flexible and promote resilience. In practice, this might mean requiring relocatable designs, or preserving wide buffer zones that allow the shoreline to migrate over time.

In summary, Australian and international experts now view a fixed 0.8 m/2100 SLR benchmark as an outdated minimum. Modern policy stresses risk-based, adaptive approaches: use up-to-date projections (e.g. IPCC AR6's higher ranges), plan for uncertainty with probabilistic methods or "worst-case" sensitivity tests, and implement adaptive pathways so that coastal development can adjust over coming decades. This ensures coastal planning is conservative enough to handle evolving climate risks, rather than anchored to a now-undersized 2.8 m AHD line from earlier projections.

Probabilistic and Risk-Based Methodology: The PPCHA employed a probabilistic approach to coastal inundation, involving a range of design storm events and likelihoods rather than a single "1% flood" line. It looked at events like 10%, 5%, 2%, and 1% AEP, under different sea levels, giving a more comprehensive picture of risk (for example, mapping zones of frequent flooding vs very rare flooding). This aligns with national risk assessment frameworks (ISO 31000-based) and the Victorian guidelines which call for evaluating likelihood and consequence across scenarios. In the expert's evidence, there is no probabilistic risk map or gradation – in fact there's no inundation mapping supporting his analysis at all – which is unusual for such a report to overlook.

The land is either "below 2.8 m (flood-prone)" or "above 2.8 m (developable)". Such a binary approach does not reflect the continuum of risk. It ignores, for instance, the fact that land above 2.8 m might still flood in a 1% AEP compound event, or in higher sensitivity scenarios involving +1.1m or +1.4m SLR by 2100 (corresponding to a very high emissions scenario to stress-test system response) to provide additional insight into more extreme futures or a margin of safety. Best practice would have involved either a risk matrix or at least acknowledgment of uncertainty bands (e.g. "we choose 2.8 m but there's a X% chance a flood could exceed that by 2100"). The absence of any quantitative risk metrics (like expected annual damage, probabilities of exceedance, etc.) is notable. Essentially, the evidence provides a single deterministic safety margin, whereas best **practice provides a spectrum of risk**.

Dynamic Coastal Processes and Compound Hazards: The PPCHA took into account not just static water levels but also dynamic processes: storm tide hydrographs, wave action, coastal erosion during storms, and even groundwater intrusion as sea levels rise. It explicitly separated storm-driven inundation from permanent tidal inundation, and analysed short-term erosion (storm bite) versus long-term shoreline recession. Additionally, it considered interactions (e.g. how erosion might exacerbate flood pathways, how rising groundwater could affect drainage). In comparison, the expert report was relatively siloed: inundation was considered in a static sense, and erosion only through outdated mapping, with little discussion of interaction between the two (for instance, how an eroding shoreline could allow floods to reach further inland).

There was also no mention of groundwater, which in low-lying coastal areas can lead to waterlogging or saline intrusion well before surface flooding occurs – an issue PPCHA highlighted for some areas. National principles of coastal hazard assessment (such as those by Engineers Australia or state coastal guidelines) emphasize a holistic view of coastal risks – considering all factors (waves, water levels, erosion, sediment supply, etc.) together. The expert's evidence, constrained by a narrowly defined brief focusing predominantly on a single elevation contour, did not incorporate these broader dimensions. While understandable given the expert's specific remit in hydrology and flooding, this limitation means the advice provided

lacks the comprehensive analysis that could have been achieved had his brief permitted him to fully leverage his extensive expertise.

According to best-practice standards, an integrated coastal hazard assessment would typically be undertaken (or at least clearly referenced) to ensure, for example, that allowing infrastructure below the 2.8 m contour would not inadvertently create unintended consequences, such as necessitating erosion protection measures that significantly alter natural coastal processes.

Adaptive Management and Uncertainty: Modern coastal planning encourages strategies that are adaptive, acknowledging that predictions come with uncertainty. For example, Victoria's draft Resilient Coast – Adapting for 2100+ framework (2022) promotes identifying trigger points and developing pathways (e.g. build now with ability to relocate later if risk becomes unacceptable). The PPCHA's role was partly to inform such adaptive plans by providing a range of hazard extents.

In the Paynesville context, however, the amendment is justified solely by the use of a fixed/static control (2.8 m contour) with no clear adaptive mechanism beyond that. There is no discussion in his statement of adaptive responses to new data and evidence (e.g. the outcomes from the current flood mapping review for instance) shows 2.8 m is too low – can the line be revised? Will additional protections be required or is there a workable plan for managed retreat? The Marine and Coastal Policy (2020) itself, which requires planning for **at least** +0.8 m SLR, also urges regular updates to hazard assessments and a precautionary approach.

The expert's report did not mention any need for updating the hazard line over time or monitoring changes, which is out of step with the "monitoring and review" component of risk management. Additionally, from a national policy perspective (e.g. Australian Disaster Resilience or Victorian hazard planning guidance), planning should account for deep uncertainty by building in buffers or flexible responses. Here, the buffer is minimal (the chosen policy allowance) and flexibility is not built into the planning control (it is a hard zoning boundary). As a result, the approach may lack resilience if future conditions diverge from the expectation.

In summary, when compared to the PPCHA 2022 and national best-practice principles, the expert's methodology appears out-of-date and narrowly focused. The PPCHA represents the current gold standard – using multiple scenarios, probabilistic analysis, and integrated process modelling – whereas the Amendment C172egip evidence relies on an older deterministic model, a single scenario, and isolated considerations. Best practice would demand a **broader risk assessment** to ensure no critical factors (like compound flooding or higher SLR risk) are overlooked.

Unfortunately, these critical factors were largely omitted from the expert report's analysis due to the restrictive terms of reference and reliance on legacy datasets. In many respects, the overly constrained 'justify and validate' remit represented a missed opportunity, limiting the expert's ability to fully leverage his expert knowledge and analytical expertise. This methodological constraint has practical implications, potentially resulting in decisions under Amendment C172egip that are less robust and inadequately prepared to manage future climate uncertainties.

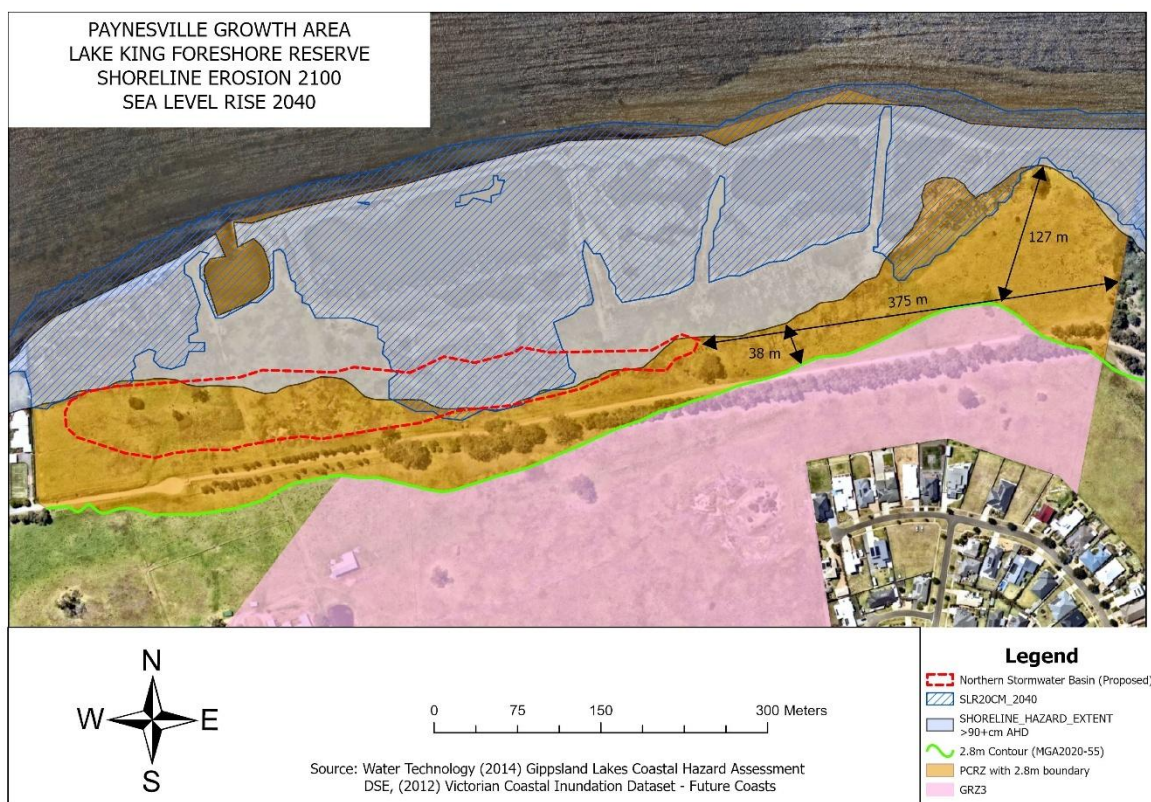
Implications for Climate Adaptation and Ramsar Wetland Protection

The limitations identified above carry significant implications for long-term climate adaptation in the Paynesville Growth Area and the protection of the adjacent Ramsar-listed wetlands. The Gippsland Lakes system, including the growth area foreshore on Lake King, is an internationally recognized wetland ecosystem (Ramsar site) with high ecological value, particularly for EPBC-listed migratory bird species and wetlands. Planning decisions here must balance development with the resilience of natural systems under climate change. By using a simplified hazard line approach, the amendment risks a form of “**maladaptation**” – i.e., implementing controls that seem sufficient now but prove inadequate later.

Adaptive Capacity of Wetlands: The Structure Plan wisely stipulates that “*Areas of foreshore land below 2.8 m AHD shall not be developed for urban purposes and should be transferred to public ownership and managed to maintain and enhance ecological values.*” This indicates a clear intent to allow the low-lying areas to function as natural buffer and habitat rather than be filled or built upon. The expert’s evidence supports leaving that land as open space, which is appropriate. However, his recommendations to permit certain infrastructure (drainage assets, paths, recreation areas) within this foreshore zone could inadvertently compromise the site’s ecological function if not very carefully managed. The expert did not address critical issues such as how infrastructure like shared paths or large constructed drainage wetlands might influence local wetland hydrology or the capacity for natural wetland migration in response to rising sea levels.

Healthy wetlands naturally adapt by shifting inland (a process known as “habitat migration” or “transgression”) when the adjacent shoreline remains undeveloped. The introduction of fixed infrastructure near the shoreline—even relatively minor facilities—poses a significant risk of impeding this natural migration process, resulting in “coastal squeeze.” Furthermore, it can necessitate protective measures for infrastructure that disrupt natural hydrological processes, potentially exacerbating habitat loss as sea levels rise. Given that the expert’s analysis, understandably, did not encompass a detailed ecological impact assessment, these essential ecological considerations were not evaluated.

Many submitters to the Panel highlighted the importance of “*maintaining the natural appeal of the foreshore*” and the need for “protection of the Ramsar wetlands.” These are critical concerns because any future scenario that leads to erosion or inundation of the wetland could trigger legal and environmental obligations to respond. If the hazard planning underestimates the risk, the wetland might degrade more quickly than anticipated – for instance, greater freshwater runoff and/or higher flood frequency could alter the salinity balance or erode the shoreline, reducing the extent and quality of the saltmarsh / swamp scrub vegetation. The expert’s reliance on a static flood benchmark (2.8 m) and erosion mapping that may under-predict future climate change impacts means there is uncertainty whether the wetland will remain viable in the long term. Best-practice adaptation would involve identifying whether the



wetland has room to migrate and whether additional buffers are needed if 0.8 m SLR is exceeded. The evidence did not delve into these questions, meaning the Panel has little information on the *real* margin of safety for the wetland’s adaptation.

Moreover, even when applying the most optimistic shoreline erosion projections from the 2014 LCHA to the coastal zone, it is clear that the proposed adaptation buffers remain inadequate to effectively protect high-conservation coastal habitats (as per the map below). At its widest point the PCRZ in 2100 is 127 m from the 2.8 m AHD line, and just 38 m from GRZ boundary at its closest point. Given the length of the proposed drainage basin, by 2100 only around 39% (385 m of the 985 m long) foreshore reserve is not projected to be impacted by coastal squeeze. Interestingly, the Victorian Coastal Inundation _Future Coasts layer showing the projected extent of a 20cm Sea Level Rise (SLR) by 2040 in blue crosshatch protruding past the LCHA 2100 projected shoreline over on the eastern bluff. The different inundation extents resulting from the two projects highlights the complexities and uncertainty inherent in SLR modelling, given both the LCHA (2014) and Vic Inundation datasets (2012) used the same 1m Coastal DEM with a vertical accuracy of +/- 10 cm.

For the best results, a site specific TV540 LiDAR survey for instance, would provide a far high resolution 10 cm Digital Elevation Model with a vertical accuracy of +/- 3 cm enabling much more accurate inundation modelling. The results of this desktop inundation analysis should be treated with caution however, given the considerable uncertainties that exist with both the datasets. Moreover, geotechnical assessments and bespoke inundation modelling using advanced aerial LiDAR data would be required for more accurate inundation mapping at the property level. All existing inundation studies are for considered accurate enough for regional-level strategic planning except for the LCHA (2014) which was never designed as a full flood study, lacking 1% AEP flood layers for a planning horizon past 2040.

Infrastructure vs. Ecology Trade-offs: By recommending that “tolerable” infrastructure can be placed below 2.8 m, the expert essentially suggests using the fringe of the wetland/open space for human amenities (e.g. trails, drainage basins, playgrounds). While these uses are not as damaging as buildings, they still entail disturbance and ongoing maintenance. Without a full risk and environmental analysis, it is unclear if such installations might, for example, concentrate foot traffic in sensitive areas, require periodic repair that brings machinery into the wetland, or if damaged drainage assets could release pollutants or alter water levels in wetland areas. Additionally, if erosion accelerates, a foreshore path could become threatened, and the pressure may arise to armour the shoreline to protect it – which would be detrimental to natural coastal processes. The expert’s report did not mention any geomorphic monitoring or thresholds for intervention, whereas a contemporary adaptation plan likely would (e.g. “if shoreline erodes within X meters of asset, relocate or remove path”). This is a gap in ensuring wetland protection – it leaves open the question of how to respond if climate impacts are greater than anticipated.

Resilient Communities: From a broader adaptation standpoint, adopting the 2.8 m AHD line based on older methods potentially underestimates risk to the community itself. If, for instance, sea levels reach 1.0 m by 2100 (a plausible high-end outcome) or an extreme flood occurs that overtops 2.8 m, the newly developed area could face flooding despite the current planning control. Homes close to 2.8 m AHD might experience inundation, and critical infrastructure like access roads or utilities could be compromised. This would demand either emergency responses or retrofitted defences, which are far more costly than avoiding risk areas from the onset. In effect, insufficient precautionary planning now could reduce the community’s climate resilience later.

Both the Victorian Marine and Coastal Strategy and the State Planning Policy Framework (Clause 13.01-2S) call for using best available science and a precautionary approach in coastal hazard planning. By adhering to the (now-dated) 0.8 m SLR policy without examining whether a more cautious line is warranted, the expert’s advice might meet the minimum requirement today but not the spirit of evolving climate adaptation policy nor applies best practice. State policy and guidance emphasize protecting not just physical assets but the environmental values as part of adaptation (recognizing ecosystems like wetlands provide natural defence and community benefit). The tension between placing infrastructure for human use and maintaining ecological integrity was not resolved by the evidence – it simply assumed both can co-exist if designed appropriately, without substantiation.

Conclusion – Need for Enhanced Risk Assessment

In conclusion, the expert statement, while addressing the immediate questions posed to him, exhibits significant methodological limitations when viewed through the lens of best-practice coastal hazard management. The constrained terms of reference resulted in a tendentious justification of a static 2.8 m AHD benchmark, rather than a critical evaluation of it. The reliance on legacy studies (2004 and 2014) – without referring to contemporary climate science or employing modern probabilistic techniques – means the Amendment’s technical underpinnings may well significantly **underestimate future risks**.

The recommendations on infrastructure, lacking a full risk or lifecycle analysis, leave uncertainties about how those facilities will be managed under worsening conditions. And importantly, the approach, as presented, may not fully safeguard the adaptive needs of the Ramsar-listed wetlands or the long-term resilience of the development itself. By contrast, the 2022 PPBCHA and CSIRO Coastal Inundation Local Government Area Assessment for East Gippsland (CILGAA-EG) provide examples for more rigorous, dynamic, and precautionary assessment methods. Applying the East Gippsland CILGAA-EG (2024) probabilistic inundation layers for instance, might suggest a higher planning contour is needed to accommodate all *plausible* high water-level scenarios (comprising tides, storm surges, sea-level rise projections across multiple SSPs), thereby providing a more robust and precautionary basis for long-term flood risk and foreshore erosion management critical to long-term coastal adaptation planning.

The review highlights that climate adaptation must be understood as an ongoing, iterative process; merely setting a fixed line on an elevation map is insufficient unless it is embedded within a flexible, adaptive and preferably probabilistic framework that can evolve as knowledge and circumstances change. Regrettably, the expert evidence presented does not demonstrate such an adaptive ‘best practice’ precautionary framework.

It is recommended that the Panel approach the 2.8 m AHD contour and its associated infrastructure allowances with caution. As a minimum precautionary measure, planning decisions and infrastructure siting should utilise the CSIRO Probabilistic Coastal Inundation Assessment layers as a decision support tool, and adopt the 95th percentile (Zone 4) inundation extent for the 1% AEP event scenario, ensuring a more robust and conservative approach to managing future coastal inundation risks. We strongly encourage the Panel to consider implementing additional requirements or conditions—such as mandating the preparation of a Foreshore Hazard Management Plan as an integral component of the Foreshore Improvement and Management Plan, and establishing periodic reviews of flood levels. These measures would align Amendment C172egip with contemporary best-practice coastal risk management standards, safeguarding critical coastal wetlands and habitats for future generations.

Only by implementing these rigorous and adaptive measures can East Gippsland Shire Council genuinely assure the community that development within the Paynesville Growth Area is sustainable, ecologically responsible, and resilient in the face of climate change.

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Appendix D: Review of Gippsland Lakes Flood Level Modelling Project – Final Report (Grayson et al., 2004)

Introduction

The Gippsland Lakes Flood Level Modelling Project (GLFMP), conducted by Grayson et al. (2004), established flood levels (1% Annual Exceedance Probability or AEP) for the Gippsland Lakes region using a joint-probability approach combining river inflows, ocean tides, and wind storm surge effects. Although pioneering at the time, the study now falls short due to advancements in flood modelling methodologies, data availability and computational capabilities, and evolving climate risk understanding.

This review examines the GLFMP Final Report through a contemporary lens, focusing on: (1) the absence of future climate change considerations; (2) the modelling approach used compared to current best practices in coastal flood modelling; (3) data gaps, assumptions, and limitations evident in the study; (4) how the report's findings (especially 1% AEP flood levels) compare with results from more recent studies like the Gippsland Lakes Local Coastal Hazard Assessment 2014, Port Phillip Bay Coastal Hazard Assessment 2022; and the latest CSIRO 2024 Probabilistic Coastal Inundation LGA Assessments; (5) the appropriateness of the 2004 report's outputs for guiding today's coastal planning and flood management decisions.

Overview: Grayson et al. (2004) developed a flood level modelling methodology for the Gippsland Lakes that was innovative for its time, combining hydrologic, hydrodynamic, and statistical components to derive design flood levels. The study's key output was new estimated water levels for the 5%, 2%, and 1% AEP events at various locations around the lakes (e.g. a 1% AEP flood level of ~2 m Australian Height Datum Paynesville). While scientifically robust by early-2000s standards, the report has notable shortcomings and dated elements when viewed against current best practice.

Lack of Climate Change Consideration: The GLFMP explicitly did not account for future climate change impacts on flood levels. Sea level rise, changes in storm intensity, and altered hydrology were outside its scope. This omission is critical because even modest sea level rise can significantly raise extreme water levels in an estuary. For example, Current standards, including Victoria's Planning Practice Note 53, mandate considering *at least* 0.8m SLR by 2100 (DELWP, 2023), highlighting the study's outdated baseline. Similarly, the potential increases in extreme rainfall intensity or shifts in river flow regimes were not examined. The 2004 report did recommend that its methodology, which links rainfall, river flows, ocean levels and wind, *could* be used to assess climate change scenarios in future work. Nonetheless, the absence of any such scenarios in the GLFMP means its findings are now unsuitable for current climate-aware planning.

Modelling Approach vs. Current Best Practice: The GLFMP used a one-dimensional hydrodynamic model (SOBEK), inadequate for capturing lateral flood spread and dynamic coastal interactions. Modern standards employ two-dimensional (2D) or three-dimensional (3D) models (e.g., Delft3D, MIKE21) which more accurately simulate inundation dynamics (McInnes et al., 2022). While the 1D model was well-calibrated (peak levels during historic floods were reproduced within ~0.1–0.14 m), a 1D approach cannot capture the full two-dimensional flow patterns and inundation extents on floodplains. Current best practice for coastal flood modelling is to use two-dimensional (2D) or even three-dimensional models for

greater spatial fidelity, especially in open water bodies, highly stratified estuaries and complex shorelines (Wu et al., 2011). Modern 2D models (e.g. Delft3D, MIKE21, TUFLOW) can simulate the spread of floodwaters across landscapes, interactions of waves, and localised effects more realistically than a channelised 1D model.

Additionally, Grayson et al. relied on a joint-probability Monte Carlo simulation approach – randomly generating long synthetic sequences of weather, tide and river flow inputs to drive the model. In recent years, this concept of compound flooding has been widely adopted as standard practice. New assessments, however, often leverage greater computing power to simulate large ensembles of events in 2D, yielding probabilistic flood maps. For instance, the 2022 Port Phillip Bay Coastal Hazard Assessment ran bay-wide models of storm tides and waves over multiple decades and scenario conditions. It produced probabilistic inundation layers (mapping the 5th, 50th, and 95th percentile extents for a given AEP and SLR scenario) rather than a single deterministic outline. Notably, the CSIRO probabilistic coastal inundation assessments produced similar stochastic flood layers, though with less sophisticated modelling than the PPBCHA. In comparison, the GLFMP’s approach – while advanced in 2004 – now appears relatively coarse, lacking the multi-dimensional detail and explicit uncertainty quantification expected in current coastal flood studies.

Data Gaps, Assumptions, and Limitations: The reliability of the GLFMP results is inherently tied to the data available and assumptions made in 2004. Several limitations are evident:

- **Short instrumental record:** Continuous water level monitoring within the Gippsland Lakes had only been in place since ~1998. The model was calibrated and tested against ~25 years of historic forcing data (1976–2000), a period that happened to be relatively dry with few large floods. The report acknowledges that using just the last 25 years would underestimate long-term flood levels, prompting the use of stochastic data generation to extend beyond the sparse record. Even so, the lack of any major recorded flood (e.g. the benchmark 1952 flood) for direct calibration means there is uncertainty in how well the model would perform for truly extreme events.
- **Entrance dynamics:** The Gippsland Lakes’ connection to the ocean (Lakes Entrance) is a dredged channel prone to morphological change during floods. The GLFMP had to assume a fixed entrance geometry – selecting a single set of model parameters that gave the best overall fit to observed water levels on average. In reality, deeper dredging and large floods alter the entrance bathymetry and tidal prism, potentially increasing the tidal range (Hauge et al 2024; also, Kumbier et al, 2018). The Grayson study noted the Boxing Day 1998 storm caused an apparent temporary change in entrance conditions, making that event harder to simulate, with peak flood levels out by 0.14 m (Grayson, et al 2004).
- **Assumed dominance of river floods:** The joint-probabilistic approach in GLFMP made an assumption that extreme lake levels are primarily driven by river flooding rather than coastal surge. The method stratified events into “western rivers dominant” vs “eastern rivers dominant,” reflecting an assumption that one major river system will control the peak in each case. While reasonable, this is likely to underplay compound scenarios

where moderate floods coincide with extreme storm/tide surge events. The dependency functions used to link ocean tide, pressure, and wind setup to the dominant river flow were assumed stationary and reliable – an approach that is not supported by the latest climate science, which project far less stable and more extreme weather patterns for the East Gippsland region (Pepler et al. 2016; McInnes, 2024)

- **Other data constraints:** Only one long-term ocean tide gauge near Lakes Entrance was available (at Bullock Island) and it provided limited offshore water level data. The team had to reconstruct offshore coastal water level series indirectly by combining local tide measurements and atmospheric pressure/wind data. This reconstruction carries uncertainty, especially for representing extreme coastal storm surges that were not directly observed. Moreover, bathymetric and topographic data (DEM) in 2004, was of far lower resolution than what LiDAR surveys provide now, affecting flood mapping precision. In summary, the GLFMP had several known data gaps which necessitated clever workarounds (stochastic generation, empirical correlations) but also introduced uncertainty and potential bias in the final flood level estimates. These limitations underscore that the results have inherent uncertainty and should be used with caution, especially as local and regional conditions change further.

Findings vs. More Recent Modelling (LCHA 2014, PPCHA 2022, and CSIRO 2024):

Later studies have revisited coastal flood hazards in the Gippsland Lakes and other Victorian coasts with improved methods and climate change considerations. The Gippsland Lakes/90 Mile Beach Local Coastal Hazard Assessment (LCHA, 2014) essentially built upon the GLFMP by incorporating sea-level rise scenarios and two-dimensional inundation mapping of a limited range of scenarios for planning purposes. The LCHA found the *present-day* 1% AEP flood level around Paynesville at approximately 1.7 m AHD (lower than the GLFMP), and a 1.83m AHD peak flood level with a sea level rise of +0.2 m. Importantly, the LCHA did not model +0.4 m, and +0.8 m SLR scenarios – making the LCHA an inadequate substitute for a full flood study (refer to appendices A and C for more detailed analysis of the LCHA).

Meanwhile, the Port Phillip Bay Coastal Hazard Assessment (PPBCHA, 2022) showcases current best-practice techniques on a larger scale. That project combined multi-decade 2D hydrodynamic simulations of storm tides (including wind and pressure effects) and wave modelling to capture coastal flooding in Port Phillip Bay. It integrated rainfall-runoff for catchment flooding in some scenarios and considered a range of SLR increments up to +1.1 m and +1.4 m (sensitivity scenarios for plausible but low confidence high emissions scenario). The outputs are probabilistic flood maps for each scenario – for example, digital layers delineating the 1% AEP inundation extent for median conditions and for conservative worst-case (95th percentile) conditions. In comparison, the GLFMP produced a single set of water levels (no probabilities of exceedance other than the AEP itself) and static maps for current climate only.

Additionally, the PPBCHA incorporated related hazards like coastal erosion and even groundwater intrusion, reflecting a holistic coastal hazard approach. By contrast, GLFMP did not address erosion of lake shorelines or other compounding factors that could worsen flood impacts. Similarly, the most recent 2024 CSIRO Coastal Inundation Local Government Area

Assessments (CILGAA) incorporated extensive probabilistic scenario analysis with simplified wave parameterisation and recognition of post-2100 high-end scenarios. However, the PPBCHA's approach is significantly more sophisticated in terms of hydrodynamic realism, explicitly modelling coastal dynamics, waves, and combined flooding processes, resulting in higher accuracy and detail at the local level than the CSIRO modelling.

In sum, the more recent studies confirm the general magnitude of flood levels estimated by GLFMP for the historical climate, but they provide a far more detailed and comprehensive overview of inundation hazard when factoring in climate change and advanced modelling. The GLFMP's findings are essentially a *subset* (present-climate, water-level only) of what is now available. Unsurprisingly, modern analyses such as the CSIRO CILGAA (2024) tend to produce higher peak flood levels for future planning and emphasize mapping of flood extents under various scenarios, which the 2004 report could not fully deliver.

Use of GLFMP Outputs in Current Planning: Current guidance (e.g. Planning Practice Note 53) explicitly directs decision-makers to use the best available information on coastal hazards. Therefore, while the GLFMP was a foundational study and its methodology remains sound for assessing joint flood probability, its specific results and data should be updated before being applied to any new planning controls. The lack of climate change considerations alone makes its direct use in determining long-term development levels inappropriate today. In practice, agencies should use GLFMP in combination with, or superseded by, the latest CSIRO findings and any subsequent updates (e.g. new flood studies or consideration of the currently under peer review or updated climate data). In summary, the 2004 outputs are no longer sufficient on their own for informed coastal planning or flood management decisions in the Gippsland Lakes – they need augmentation with contemporary hazard assessment data that include climate change and finer-resolution modelling.

In conclusion, the GLFMP final report's outputs are not fully adequate for current coastal planning or flood overlay delineation without augmentation. At minimum, planners should adjust the 1% AEP levels upwards for projected sea level rise and use the probabilistic spatial inundation layers from the CSIRO CILGAA. Ideally, new modelling (or an extension of GLFMP's model with updated data) should be undertaken to refine flood levels under present and future conditions. The trend in Victoria is clearly toward using the newer hazard assessments. It remains an important technical reference, but decision-makers should rely on the **more up-to-date studies** that build on its foundation for any practical applications.

Recommendations

Based on this review, the following recommendations are made:

- **Incorporate Climate Change in Flood Modelling:** Update or redo the Gippsland Lakes flood level modelling to explicitly include future climate scenarios. In particular, perform simulations for mid-century and end-century sea level rise (e.g. +0.4 m, +0.8 m, +1.1 m, +1.4 m) and, if possible, adjusted rainfall/runoff projections and probabilistic compound event analysis. This will produce more conservative and climate resilient design flood levels that are more relevant for future planning, addressing the key gaps in the 2004 and 2014 LCHA studies.
- **Adopt Modern 2D Hydrodynamic Models:** For any new modelling of the Gippsland Lakes flooding, utilize a two-dimensional hydrodynamic model (or for better accuracy in

stratified estuary environments - a 3D model) to capture floodplain inundation and spatial variations in water levels. A 2D approach will improve the accuracy of inundation extents and allow stochastic modelling of scenarios like levee overtopping or breakout flows that a 1D model cannot handle. It will also facilitate coupling with wave models if needed. This aligns with current best practices demonstrated in recent hazard assessments (e.g. PPBCHA's bay-wide 2D modelling).

- **Use Probabilistic Hazard Mapping:** Build on the joint-probabilistic approach of GLFMP by presenting results in terms of probabilistic inundation maps (i.e., PPCHA 2022 and CILGAA 2024). For example, produce GIS layers for the 1% AEP flood extent under present conditions and future SLR scenarios, including confidence bounds (e.g. show a range of more likely vs. worst-case extents).
- **Address Data Limitations in Future Studies:** When conducting new analyses, attempt to fill the data gaps identified in 2004 and 2014. This includes maintaining and expanding the water level gauging network (the 2004 team recommended an extra gauge offshore of Lakes Entrance – if not already in place, this should be pursued). Continuous long-term records of ocean tides, storm surge, and lake levels will improve model calibration and trend detection.. If feasible, couple the hydrodynamic model with a simple morphological module or scenario-based adjustments to represent how a big flood might change the entrance conveyance or how shoreline retreat will impact future shoreline hazard extent.
- **Periodic Recalibration and Verification:** Treat the flood model as a living tool – whenever significant new flood events occur, use them to verify and recalibrate the model. For instance, the June 2007 flood (peak ~1.4 m AHD) and the floods of 2012 or any recent events can be simulated with the model to check that it still reproduces reality well. This ongoing validation will build confidence in the model's predictive ability for larger, less frequent events. It will also highlight if any assumptions (e.g. hydrology or correlation) are no longer holding true under current climate variability.
- **Integrate Findings into Planning Frameworks:** Ensure that updated flood levels and hazard maps (from CILGAA or newer studies) are formally incorporated into planning controls. The relevant Planning Scheme overlays (Floodway Overlay, Land Subject to Inundation Overlay, etc.) is outdated, incomplete and inaccurate; and needs to be urgently revised to reflect the best available 1% AEP extents for current climate and to consider sea level rise allowances as mandated by state policy. Planners need to use a climate-adjusted 1% AEP (or a higher standard for critical infrastructure) for planning and design, rather than the historical 1% level with an overly simplified +0.8 m addition to account for climate risk. Essentially, move away from using the 1952 or 2004 levels with static SLR increments, and adopt a probabilistic, risk-based approach.

Implementing these recommendations would ensure that the spirit of the GLFMP – to provide a rigorous, defensible basis for flood planning – is upheld, using modern science and data in accordance with the planning and policy framework. It would transition the region's flood risk management from a retrospective view to a more **proactive, climate-resilient stance**.

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