Latham Snipe – Point Fullarton 2024 photo by Varo Dharmarajah

SHEARWATER-PAYNESVILLE RESIDENTIAL DEVELOPMENT EPBC ACT

REVIEW OF PRELIMINARY DOCUMENTATION
EPBC 2023/09592

FOGL
FRIENDS OF THE GIPPSLAND LAKES
PARKS AND RESERVES

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1. Introduction

This submission is made in formal opposition to the proposed Shearwater–Paynesville Residential Development, which has been referred under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) due to its likely significant impacts on Matters of National Environmental Significance (MNES). Chief among these MNES are the adjacent Gippsland Lakes Ramsar wetland and the habitat for the EPBC-listed migratory bird Latham's Snipe (*Gallinago hardwickii*). Both are of high conservation value and protected under the EPBC Act. The proposed development seeks to employ a non-standard, **experimental stormwater and habitat creation strategy** to mitigate impacts, attempting to simultaneously fulfill stormwater treatment requirements and provide on-site habitat offsets within a constrained coastal landscape.

Despite the proponent's assertions, our analysis indicates that the strategy is **incomplete, unproven,** and **poses significant residual risks** to the Ramsar wetland's ecological character and the local Latham's Snipe population. In line with the EPBC Act's precautionary principle and environmental protection objectives, we present a technical assessment of the proposal. We integrate evidence from previous submissions and current scientific literature to demonstrate that the project, as designed, **fails to adequately avoid, mitigate, or offset** its impacts on MNES. We respectfully urge the Commonwealth to give due weight to these findings in its assessment.

1.1 Overview of Key Development Challenges

The high conservation value and sensitive coastal setting of the project area present complex challenges. In response, the proponent has proposed an unconventional Stormwater Management Strategy (SWMS) aiming to achieve four interrelated objectives:

- **Enhance habitat** for the listed migratory Latham's Snipe (a species listed under international migratory bird agreements and as a marine migratory species under the EPBC Act).
- **Meet stormwater treatment targets** consistent with Best Practice Environmental Management Guidelines (BPEMG) for water quality.
- **Buffer and protect the adjacent Ramsar wetland**, maintaining its ecological integrity.
- **Address coastal hazard vulnerabilities** (sea-level rise, inundation, erosion) affecting the site.

These goals are laudable in principle but exceedingly difficult to realize concurrently. The following sections assess each issue in detail against EPBC Act requirements, scientific evidence, and relevant guidelines. Particular attention is given to whether the **integrated drainage-and-habitat design** can genuinely offset the development's impacts without causing new adverse effects.

2. Latham's Snipe Habitat Impacts and Mitigation Measures

2.1 Significance of the Habitat: The project site and its immediate vicinity provide important habitat for Latham's Snipe, a migratory shorebird. The site is one of only ~28 known regular Snipe sites in East Gippsland, with surveys recording up to 40 individual Snipe on the property at one time (average counts around 18). Such numbers constitute a significant proportion of the species' population in this region, meeting the EPBC significance criteria for important migratory species habitat (i.e. supporting ≥0.1% of the population). The adjacent Gippsland Lakes Ramsar reserve at Point Fullarton, and nearby wetlands such as McLeod's Morass, also support Latham's Snipe; together these sites form a **network of habitat** patches in the eastern Gippsland region. Individual Snipe return to the same sites annually, but also shift between local wetlands depending on conditions, underscoring that **each site is part of a larger interconnected habitat mosaic** for the species. This regional context means the loss or degradation of the project site would contribute to a cumulative reduction in available habitat and could not be compensated by remaining sites alone.

2.2 Underestimation of Habitat Extent: We have serious concerns that the proponent's mapping and assessment underestimate the area and quality of Snipe habitat on the site. The ecological reports provided rely heavily on direct observation data to delineate "habitat," an approach that is inherently unreliable for cryptic, intermittently present species. As noted in the Gippsland Environment Group 2023 submission and again in Appendix A1.5, the absence of observed birds in a given patch during limited surveys **does not imply absence of habitat value**. Seasonal and weather variability, as well as recent land management (e.g. slashing or grazing), strongly influence whether Snipe are detected at any one time.

> Thus, **observational data** should not form the principal basis for the mapping of important habitat.

In this case, extensive areas of suitable vegetation were **excluded from the proponent's Snipe habitat map**, contrary to ecological evidence. Patches of sedges and damp grass on muddy soil – identified by the consultants themselves as preferred foraging habitat – were left out of the mapped habitat extent. Likewise, large portions of the north-eastern floodplain and the central depression, which often support soft, damp ground with tall grasses and sedges, were omitted.

Notably, the proponent's own flora and fauna study (Biosis 2022) stated that these grassy areas on the slopes and in the central depression "provide refuge and resting sites for Latham's Snipe" and **"may provide habitat"** for the species in general. It even recognized that Snipe and other waterbirds forage in the adjacent wetlands, making the on-site habitat part of a broader foraging landscape. Yet, despite this, most of the **northern slopes and low-lying eastern area were excluded** from the final habitat map produced by Nature Advisory.

Crucially, the inconsistency in habitat mapping significantly downplays the development's impact, and greatly overstates the net gain attributed to the project's compensatory measures (see Appendix A1.5 for technical details).

In reality, nearly the entire project area, particularly the moist grass-sedge areas and fringes near the Ramsar boundary, should be considered important Snipe roosting habitat (and to a lesser extent as suitable night foraging habitat). The proposal would remove or alter much of this habitat.

Any claim that only a small portion of the site is "utilized" by Snipe is not supported by the evidence – rather, habitat availability is broad, and usage varies with conditions.

2.3 Disturbance, Predation and Management Issues:

The project's design attempts to mitigate impacts on Snipe by setting aside an on-site "Snipe habitat reserve" (an ephemeral stormwater basin with surrounding vegetation), along with measures like fencing, pet controls, and vegetative screening. While these measures are well-intended, their effectiveness is highly questionable in both the short and long term. A dog-proof perimeter fence and an 8–10 m wide dense but low shrub screen are proposed to physically separate the residential area from the Snipe offset habitat. However, **such barriers will not stop the most problematic disturbances**.

Feral and domestic cats, foxes, and avian predators (hawks, owls) can easily penetrate or bypass fences and vegetation screens. Cats, in particular, climb over fences and move through dense undergrowth readily; foxes can dig under fences if they are not constantly maintained.

Thus, predation pressure on roosting Snipe is expected to increase once houses are established, even if dogs are kept out. Similarly, artificial light from the new homes is likely to spill into the reserve – especially since any vegetation screen tall enough to block light may conflict with planned view-sharing requirements (the developers have indicated a restriction on vegetation height to preserve lake views).

The proposed baffles on street lighting will not reduce light pollution from homes and vehicles using the road. Night lighting is a documented threat to shorebirds and may deter Snipe from using otherwise suitable habitat

Noise and general human activity adjacent to the fence could also cause chronic disturbance. It is well recognized that disturbance which renders habitat unusable is functionally equivalent to habitat loss (Gill et al. 2001; Frid & Dill, 2002; Reid et al. 2018).

Another concern is the **intensive management and enforcement required** to maintain the created habitat in a suitable state. The offset area will need ongoing weed control, predator control, and possibly water level management. The proponent's plan includes a Construction and Environmental Management Plan with biosecurity measures (weed hygiene, etc.), and an Offset Management Plan detailing weed control and monitoring over 20 years. However, invasive weeds are likely to establish given soil disturbance and nutrient inputs, and keeping the habitat in an optimal condition will require regular intervention. For example, if tall reeds or mat-forming weeds colonize the wetland, heavy machinery or herbicides might be needed to remove them – activities that would temporarily disturb or exclude Snipe.

Weed invasion can substantially reduce habitat value and will necessitate "ongoing and costly" control efforts, which themselves introduce further disruption to any remnant habitat. This cycle could undermine the habitat's value over time.

The long-term maintenance burden also raises questions of resourcing and responsibility. It is understood that the offset reserve would be handed to the local Council for management around two years after establishment. Given the ***present state of nearby Council-managed reserves*** (which suffer weed infestations, lack predator control, and poor fence maintenance), there is legitimate concern that the Snipe reserve could degrade without sustained, specialized management and active enforcement of native vegetation removal and exclusion of people and pets from the reserve.

In short, the proposed mitigations (fencing, screens, street lighting baffles and management plans) are unlikely to fully prevent increased disturbance and predation, especially beyond the initial years of the project.

Any small, enclosed patch of habitat immediately next to an urban area will inherently have higher predation risk and human influence. These indirect impacts mean that even if some habitat is retained on-site, its usage by Snipe may decline markedly.

2.4 Buffer Distance and Adjacent Land-Use: It is also important to consider the **lack of adequate buffer** between the development and the habitat/Ramsar wetland. The current layout appears to confine wildlife habitat within a narrow reserve directly abutting residential lots. Recent research on Latham's Snipe has quantified how far the birds should be buffered from human activity to avoid disturbance. Hansen et al. (2025) found that **minimum vegetated buffer widths of 75–110 meters** are needed to prevent 80–95% of disturbance (vigilance or flushing) responses in Snipe. In practice, this means that if human presence (houses, walkers, lights) is closer than ~75 m, a significant portion of Snipe will be on alert or displaced; a 110 m buffer is needed to virtually eliminate disturbance for almost all birds. The proposed 8-10m wide densely planted, low shrub vegetated screen, falls far short of these buffer distances. Moreover, given their significantly larger size—103 hectares and 158 hectares respectively—the Edithvale and Seaford Wetlands are not analogous to the 3.1 ha Offset Habitat Area.

> The use of Edithvale and Seaford Wetlands as reference examples of vegetated buffer effectiveness is therefore **methodologically flawed.**

In some locations, backyards and roads would lie only tens of meters from the designated habitat, separated merely by a fence or low shrub line. This is a fraction of the recommended setback. Such a small buffer implies a high risk that Snipe will perceive threats and avoid using the habitat near the development. Although the adjacent Ramsar reserve to the north provides some separation in that direction, on the development side the **offset area is effectively hemmed in by housing**. The outcome could be that Snipe retreat further into the Ramsar wetland or abandon the area entirely, thereby seriously disrupting their local distribution. This is precisely the kind of impact (disturbance leading to site abandonment) that EPBC Significant Impact Guidelines aim to prevent for migratory species.

> In summary, the project is likely to **fragment and isolate** an area of important Snipe habitat, reduce its usage through disturbance, and increase mortality risk – all constituting a significant impact on the species' lifecycle in this locality.

2.5 Conclusion for Snipe: On the evidence available, the proposed action would result in a **net loss of functional habitat for Latham's Snipe**. It would directly remove core roosting habitat and indirectly render the remaining areas less suitable through disturbance and edge effects. The on-site offset plan is experimental and unproven as a like-for-like replacement for the existing habitat. Given the species' reliance on a network of sites, eliminating or degrading one of the region's key sites will contribute to cumulative population pressures. It is our assessment that the development **would substantially modify, destroy or isolate an area of important habitat** for Latham's

Snipe, and *"could seriously disrupt the lifecycle (feeding, resting) of an ecologically significant proportion of the population"* – thus meeting multiple **Significant Impact Criteria for migratory species** (per EPBC Act guidelines).

It's important to note the strong reluctance of Council and (to a lesser extent) other land managers to implement fox baiting control measures and apply vegetation clearing enforcement measures near residential areas. Many landowners disapprove of baiting, fearing accidental pet poisoning. Similarly, the fencing off and protection of Ramsar habitats on nearby Raymond Island has proven very challenging, with long-standing illegal clearing by residents of protected native vegetation for enhanced water views an ongoing and unresolved issue. In sum, the mitigation measures proposed do not adequately counter these impacts in either scope or surety.

3. Stormwater Management Strategy and Proposed Habitat Creation

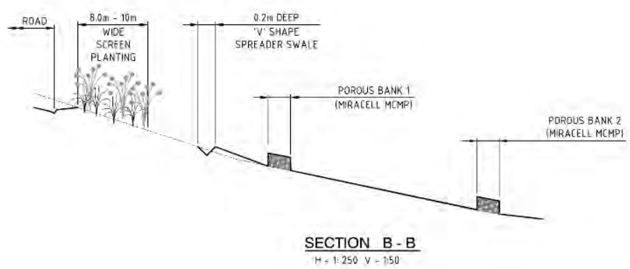
The SWMS lies at the heart of the proponent's impact mitigation and offset strategy. In concept, it involves a novel **hybrid drainage design** that replaces a conventional stormwater basin with a shallow, vegetated ephemeral wetland spread across approximately 1.3 hectares of the site. This area is intended to serve dual purposes: treat stormwater runoff from the development (and even external catchments) to required water quality standards, and simultaneously function as **compensatory habitat** for Latham's Snipe (providing ~2.6 ha of foraging habitat and ~0.55 ha of roosting habitat, as claimed). Achieving these two goals together is ambitious, and as our analysis shows, the current plan falls short of demonstrating that it can be done reliably.

3.1 Design Evolution and Uncertainties: Initially, a more traditional stormwater treatment train was considered – including a large constructed wetland, bioretention basins, sediment ponds, and an outlet swale – typical for a 22+ hectare catchment. That standard design was predictably able to meet pollutant reduction targets in modelling. However, recognizing the high ecological values (i.e. the Snipe observations) on parts of the land, the designers drastically modified the drainage concept to avoid a permanent water body and instead create a "diffuse" flow wetland habitat. Key changes included removal of the large wetland basin, multiple dispersed pipe outlets along the road, and introduction of two long porous gravel filter banks and a broad, shallow spreader swale to distribute flows over the land.

These custom elements are novel – essentially a **bespoke swale and porous bioretention system** integrated into the landscape. The primary objective is clearly the habitat outcome, with stormwater treatment described by the proponent's engineer as "a byproduct" of works designed for Snipe habitat.

While innovative, this design is **largely untested**. Many critical functional details remain undefined or unproven at the current stage (Preliminary Documentation).

The two parallel porous banks consist of a proprietary HDPE product (Miracell) filled with gravel and placed on top of the in-situ soil (as shown in cross section B-B). Porous filter banks used in this manner are not standard MUSIC (Model for Urban Stormwater Improvement Conceptualisation) nodes, and modelling them requires assumptions or the use of proxies, which in this instance, appears to be the use of swale nodes.



Due to the paucity of detailed data on proxy node parameter input values, it is unclear how this Swale design can provide any of the functions claimed, i.e. stormwater treatment, retain water or provide habitat.

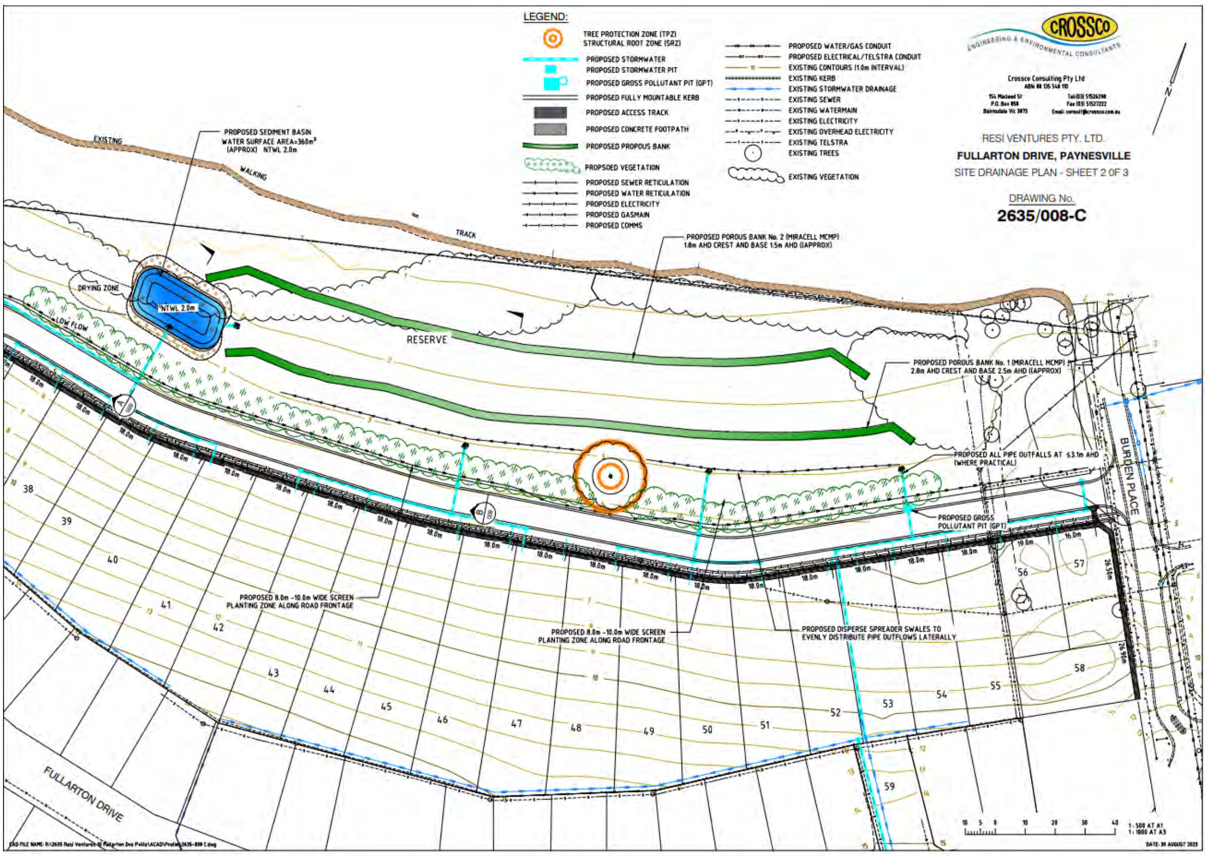


Figure 3.1: Drainage plans (eastern stormwater assets)

The porous filter banks (shown as two thick green lines in Figure 3.1) are referred to as a bioretention system in the Table A.5.3 (p.203) yet appear to be modelled as swales (see MUSIC schematic overleaf – swales circled in blue).

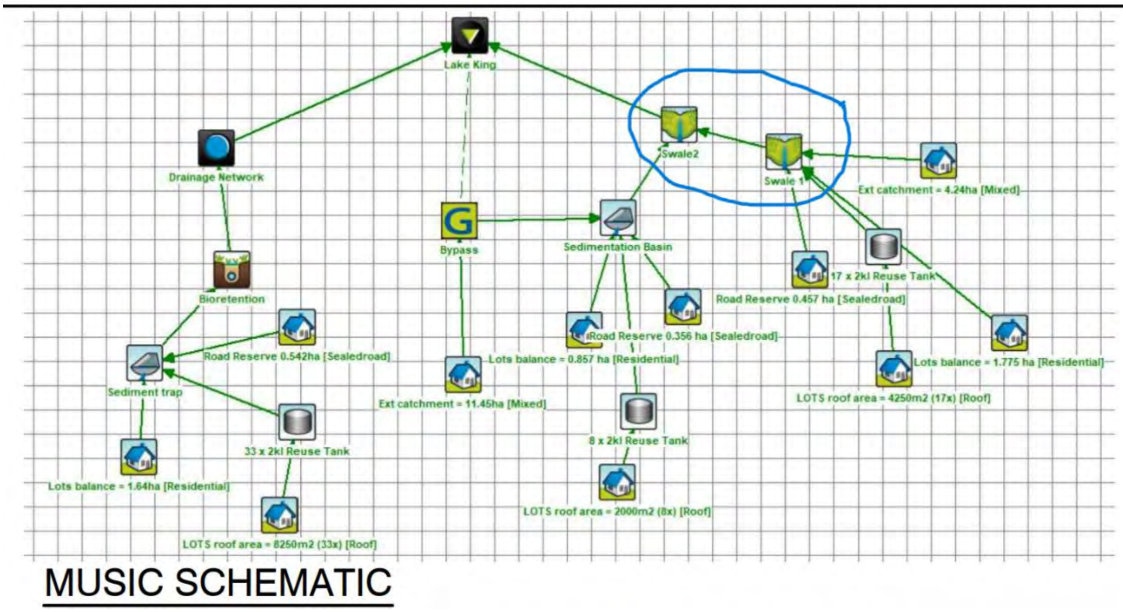


Figure 3.1(a): MUSIC Schematic – the treatment train (Swale nodes circled in blue)

Both swales and bioretention systems differ significantly in their designs and are completely different to the porous bank design shown on the plans and described in the Neil Craigie report.

For example, the exact specifications of the porous filter media, the planting regime for the wetland (species, density, micro-topography), the long-term water level management strategy, and how the system will be maintained/adapted over time are not fully resolved. The proponent's documentation and *EPBC Onsite Offset Management Plan* assert that detailed design work and an independent expert review have confirmed the concept's feasibility. However, upon examination of the provided materials, there is **minimal evidence of such detailed functional design**. There are no engineering drawings of final grades or cross-sections showing how water will flow and pond, no hydrogeological analysis of soil infiltration capacity, and no concrete plans for managing extreme events beyond referencing an open overflow to the lake.

The **hydrological modelling** underpinning the design is also high-level or conceptual. A MUSIC model was used to estimate pollutant load reductions, but it relies on generic assumptions and "nodes" not intended for this kind of habitat-oriented system.

The porous gravel filter banks were modelled as standard swale nodes due to the limitations of MUSIC in representing non-standard treatment elements, necessitating the use of surrogate node types to approximate hydrological and treatment functionality

Such approximations introduce uncertainty. The model has not been calibrated or subjected to sensitivity and uncertainty analysis for this specific application, meaning its predictions of nutrient and sediment removal are not rigorously validated.

The model output **lacks transparency**, as it aggregates all sub-catchments and treatment nodes, thereby obscuring the individual performance of specific system components—including the western and eastern treatment assets and their respective outfalls.

WATER QUALITY TREATMENT PERFORMANCE TABLE

WETLAND, BIORETENTION & SWALE		Sources	Residual Load	% Reduction	% Best Practice
LOTS 34-59 & EXTERNAL CATCHMENT	Flow (ML/yr)	43	38.8	9.8	
	Total Suspended Solids (kg/yr)	6.99E+03	1.34E+03	80.8	≥80
	Total Phosphorus (kg/yr)	1.50E+01	6.41E+00	57.4	≥45
	Total Nitrogen (kg/yr)	112	60.9	45.5	≥45
	Gross Pollutants (kg/yr)	1.60E+03	4.25E+01	97.3	≥70
SEDIMENT BASIN & BIORETENTION		Sources	Residual Load	% Reduction	% Best Practice
LOTS 1-33	Flow (ML/yr)	8.47	6.73	20.5	
	Total Suspended Solids (kg/yr)	1.07E+03	1.34E+02	87.5	≥80
	Total Phosphorus (kg/yr)	2.28E+00	1.32E+00	41.9	≥45
	Total Nitrogen (kg/yr)	18.2	9.31	49	≥45
	Gross Pollutants (kg/yr)	3.00E+02	0.00E+00	100	≥70
OVERALL		Sources	Residual Load	% Reduction	% Best Practice
LOTS 1-59 & EXTERNAL CATCHMENT A & B	Flow (ML/yr)	51.5	45.5	11.6	
	Total Suspended Solids (kg/yr)	8.06E+03	1.48E+03	81.7	≥80
	Total Phosphorus (kg/yr)	1.73E+01	7.74E+00	55.3	≥45
	Total Nitrogen (kg/yr)	130	70.2	46	≥45
	Gross Pollutants (kg/yr)	1.90E+03	4.25E+01	97.8	≥70

MUSIC OUTPUT RESULTS

a) Output for differentiated catchments / treatments and outfalls

TABLE 1 MUSIC Model results- Total System Resi Ventures P/L, Fullarton Drive

Location	Parameter (kg/yr)	Total catchment source loads	Resi Ventures Source loads	Residual loads to Lake King	Load removed	% Removal of Resi Ventures source loads	% Removal Total System source loads
Lake King outfalls	Flow (ML/yr)	51.5	18.4	44.6	6.9	38	13
	TSS	8,160	2,520	886	7,274	288	89
	TP	17.3	5.2	6.6	10.7	205	62
	TN	131	39	70	61	156	47
	Gross Pollutants	1,900	656	43	1,857	283	98

MUSIC OUTPUT RESULTS

b) Output aggregated by combining catchments / treatments to single outfall

Figure 3.1(b) : MUSIC Output Results tables – split and lumped

We submit that without a proper independent audit of the MUSIC model and a functional design report (including full design calculations), the claimed performance of the SWMS cannot be verified and therefore relied on for the crucial Offsets Assessment.

To avoid any perceived conflict of interest, it's imperative that the model reviewer not be involved in the design of the project, nor have previously acted as an expert witness in legal proceedings on behalf of the land owners/proponents.

3.2 Hydrological Risks to Wetland Performance:

A fundamental question is whether the constructed ephemeral wetland will indeed provide suitable hydrology for Snipe habitat *and* treat stormwater as intended. These goals can be in conflict. Latham's Snipe prefer shallow, intermittently wet conditions – typically <10 cm water depth with ample muddy edges. The design aims to spread water thinly across the site to emulate this. However, in heavy rainfall events, even with dispersion, significant volumes of runoff will inundate the area. If water pools too deeply or for too long, it could promote dense reed growth (diminishing the open structure Snipe require) or simply render the habitat unusable until drawdown.

Conversely, in dry periods the area might remain dry for extended times, reducing foraging opportunities. The documentation acknowledges that Snipe site use varies with rainfall – *“too little and too much water within a site”* both reduce usage. Balancing these extremes in an engineered system is challenging. There is a risk that the habitat will be either too wet (immediately after storms, potentially scouring out vegetation or creating deep pools) or too dry (between rain events or in drought summers), neither of which yields the consistently suitable conditions the species needs.

In essence, the hydrological regime of the offset habitat may not reliably mimic a natural wetland’s variability – especially as it must also function to detain and filter runoff.

Further, the water quality treatment efficacy of the system is uncertain under real-world conditions. The reliance on vegetated swales and filters presumes fresh, low-salinity runoff feeding the wetland plants. But given the site’s coastal context (bordering an estuarine lake), intrusion of saline water is likely in extreme high-water events (see *Coastal Hazard Risks* below. Periodic inundation of the swales by brackish lake water or exposure to salt spray may stress or lead to die-off of the freshwater biofiltration plant species, thereby compromising the system’s pollutant removal efficiency and long-term treatment performance. This could leave the system treating runoff with a degraded plant community, reducing its effectiveness. At the same time, if the vegetation shifts (e.g. salt-tolerant species colonize or weeds take over bare areas), the habitat value for Snipe is likely to decline.

These interdependencies highlight that the stormwater-habitat system is fragile – success requires a narrow band of conditions and careful upkeep.

3.3 Long-Term Viability under Climate Change:

The SWMS has not been demonstrated to be robust under future climate and sea-level conditions. The proponent did not model performance or fate beyond a 10 year (historically low rainfall) time period, yet the project is meant to be enduring. By around 2040, moderate sea-level rise (~0.2 m) combined with more frequent extreme storm surges could inundate around a third of the stormwater swale/wetland area with saline floodwaters. Indeed, the proponent’s own consultants acknowledge that by 2070, high tides and storms will push saltwater into areas of the site where critical drainage infrastructure is planned. CSIRO climate projections (2022) likewise warn of far more frequent intense weather events around the Gippsland Lakes due to climate change.

As a result, sections of the drainage system are likely to be periodically submerged in brackish water in coming decades. As noted, this would render the freshwater treatment wetland less effective – contributing to vegetation die-off, stunted growth and reduced nutrient uptake, and eventual failure of pollution uptake processes are likely unless mitigation measures are implemented. The proponent's own engineering reviewer, Mr. Neil Craigie, acknowledged that if predicted sea-level rise occurs, the layout offers an "opportunity" to relocate the existing recreational trail onto the northern filter bank (which is higher). However, such a relocation would mean turning the supposed Snipe refuge into a public path in the future, directly contradicting the intention to fence it off as a dedicated sanctuary.

This exemplifies the looming incompatibility between sustaining a relatively peaceful wildlife habitat and accommodating inevitable coastal changes. In summary, by 2070 the stormwater infrastructure – and with it the integrity of the on-site habitat – is at high risk of compromise. A failure of the system (whether gradual or sudden) would likely result in loss or significant degradation of the offset habitat and untreated or polluted runoff discharging to the Ramsar wetland. Thus, the SWMS as proposed cannot be considered sustainable in the long term without significant adaptive interventions that have not been planned or costed.

3.4 Regulatory Implications

: Under the EPBC Act, the onus is on the proponent to **demonstrate that impacts will be avoided or mitigated** to acceptable levels and that any offset will meet strict standards. Here, the stormwater-habitat strategy is the linchpin of both impact mitigation (protecting water quality in the Ramsar site) and offsetting (compensating for Snipe habitat loss). The analysis above raises substantial doubt that the current strategy can deliver on these fronts. The design remains **untested and incomplete**, which is inconsistent with the EPBC Act requirement for a high degree of certainty in impact management.

The Commonwealth's Environmental Offsets Policy (2012) explicitly requires that offsets *"effectively account for and manage the risk of the offset not succeeding"*. In this case, the risk of not succeeding is high, yet no alternative or contingency offset is offered if the stormwater approach fails to perform as habitat. The policy also requires that an offset *"improve or maintain the viability"* of the protected matter (here, Snipe and Ramsar values) – a standard that this project's offset cannot meet if it in fact degrades over time as expected under climate change. We elaborate on these policy issues in Appendix 3.

It is evident that the functional design stage is incomplete and basic parameters (like bioretention and swale geometries, soil properties, vegetation characteristics and maintenance plans) are not well-defined. The ability of MUSIC to produce accurate pollution reduction outputs becomes limited without detailed parameter inputs. At the concept stage, MUSIC simply applies empirical pollutant removal equations (k-C*), which don't reflect detailed variations in treatment performance due to temperature, flow path, vegetation, or clogging. Similarly, the accuracy of MUSIC outputs during the concept stage is questionable due to lacking many of these critical parameter inputs.

Given the lack of detailed site-specific inputs and functional system design verification, the pollutant reduction outcomes presented in the model are highly uncertain and should be treated as indicative only, rather than as a reliable basis for regulatory assessment.

3.5 Stormwater Management Standards and Implications for Offset Viability

The receiving environment for the proposed development – immediately adjoining Lake King, a Ramsar-listed wetland in the Gippsland Lakes – is of exceptionally high ecological value. Under EPA Victoria's Urban Stormwater Management Guidance (Publication 1739.1, 2021), areas draining to such sensitive waterways (including estuaries and Ramsar wetlands) are intended to be treated as **"priority areas"** for enhanced stormwater management.

While priority areas in regional Victoria have not yet been formally mapped or designated, the guidance explicitly notes that a transparent process is needed to identify them, reflecting the expectation that ecologically significant locations like Lake King warrant more stringent controls. In these de facto priority areas, higher performance targets apply – notably, the guidance calls for a **50–90% reduction in mean annual runoff volume** (via on-site retention through infiltration, harvesting, and evapotranspiration) as opposed to the ~25% volume reduction target in non-priority areas. This means that development design must maximise stormwater infiltration, retention and reuse, and maintain baseflows, in addition to achieving enhanced pollutant load reductions.

Adopting the EPA's stricter priority area targets (i.e. requiring substantial stormwater harvesting and infiltration beyond the normal BPEM objectives) is recognized to create more resilient outcomes for high-value waterways. Given the immediate proximity of the Ramsar wetland, applying the highest level of stormwater control is not just best practice but a regulatory imperative: under the EPBC Act Environmental Offsets Policy, any mitigation or offset must "**improve or maintain**" the viability of the protected matter (Principle 1). Failure to enforce the enhanced flow and water quality targets designed for priority areas could result in greater stormwater volumes and pollutants entering Lake King than the sensitive ecosystem can tolerate, thereby risking a decline in the wetland's ecological character.

In short, treating the site as a **de facto priority area** – with the corresponding elevated stormwater retention and treatment requirements – is essential to fully protect the

Ramsar values of Lake King and to ensure compliance with the EPBC Act's fundamental principle of maintaining (or improving) the viability of this protected wetland.

3.6 Conclusion for Stormwater Management Strategy

In sum, the SWMS in its current form does not inspire confidence as a robust mitigation or offset; rather, it represents a **significant unresolved experimental aspect** of the proposal. We strongly recommend that, at minimum, the Commonwealth require the proponent to **provide a full functional design and independent audit** of the stormwater and habitat system before any approval is considered. This should include the MUSIC model files, detailed design drawings, modelling of climate scenarios, and a comprehensive risk assessment (sensitivity analyses, etc.). Without such information, approving the project would amount to sanctioning a trial-and-error approach in regionally important Latham Snipe habitat and an internationally significant wetland area – which is inconsistent with the precautionary principle. Furthermore, the site's immediate proximity to Lake King and its Ramsar-listed wetlands reinforces the regulatory expectation that enhanced stormwater controls—consistent with EPA Victoria's priority area targets—must be applied to ensure compliance with EPBC Act objectives and avoid unacceptable impacts on protected ecological values.

*(Detailed technical analysis of the stormwater design's limitations and requirements for further work is provided in **Appendix 1** and **Appendix 2** to this submission.)*

4. Protecting the Ramsar Wetland – Likely Impacts on Gippsland Lakes Ramsar Site

The project area directly adjoins the **Gippsland Lakes Ramsar Site**, specifically the Point Fullarton (Jones Bay) wetland reserve which forms part of the Ramsar-listed complex. The Gippsland Lakes is Australia's largest estuarine lagoon system and is recognized as a Wetland of International Importance under the Ramsar Convention (listed 1982). The Ramsar site's **ecological character** includes a mosaic of wetland types – intertidal marshes, freshwater marshes, lakes and lagoons – supporting high biodiversity. Notably, the adjacent reserve protects several **EPBC-listed ecological communities**: Coastal Saltmarsh, Estuarine Swamp Scrub, and Gippsland Red Gum Grassy Woodland, among others.

It is an important area for waterbirds (including migratory shorebirds and waterfowl) and provides breeding and feeding habitat for numerous aquatic species. The Ramsar site currently meets 6 of the 9 Ramsar listing criteria, underlining its significance for biota, including Criterion 4 (supporting species at critical life stages) and Criterion 5 (supporting ≥20,000 waterbirds). Protecting the ecological character of this wetland –

i.e. maintaining its biological and physical attributes – is an obligation of both the State and Commonwealth governments under the Ramsar Convention and EPBC Act.

4.1 Hydrological Connectivity and Water Quality: One of the most critical impact pathways to the Ramsar wetland is via **water flows and water quality**. The project area is hydrologically connected to the Ramsar wetland – it lies upslope, and presently, rain that falls on the site either soaks in or trickles through the paddock toward the wetland and Lake King. This overland diffuse flow and infiltration effectively provide a level of natural filtration (grasses and soil removing some nutrients) even though it is not engineered – meaning runoff reaching the wetland from the undeveloped site today is comparatively low in pollutants. The development, however, will introduce extensive hard surfaces (roads, roofs) and concentrated drainage infrastructure and a substantially greater volume of stormwater runoff than at present must be managed. If the stormwater treatment system functions perfectly, water quality might be maintained; but as discussed, there are risks it will not.

Failure or under-performance of the stormwater system would result in more intense pulses of freshwater runoff, carrying increased loads of nutrients, sediment, and other contaminants, being discharged into the Ramsar wetland.

This could cause a *"substantial and measurable change in the water quality of the wetland"*, breaching a key Ramsar impact threshold. Even under normal operation, the development seeks to channel runoff from an additional ~15.7 ha of external catchment through the site into the wetland. Thus, the volume of freshwater entering the wetland from this locality will significantly increase post-development. The proponent's own impact assessment acknowledges this, but downplays it by aiming to treat the water. We highlight that an influx of stormwater into what is a largely brackish/saline marsh system can itself be harmful, reducing soil salinity, and increasing nutrient levels that favour exotic invasive species (Geedicke, 2018).

Ramsar Significant Impact Guidelines note that actions likely to cause a *"substantial change in the hydrological regime"* of a wetland (such as altering the timing or volume of inflows) may have significant impact. Here, routing stormwater that was once diffused across a broad front into more focused discharge points could alter inundation patterns in the saltmarsh. If large freshwater pulses repeatedly flood the saltmarsh, the soil salinity and plant community could shift.

Coastal saltmarsh by nature is salt-adapted; an increase in freshwater inundation could allow less salt-tolerant (and possibly invasive) plants to invade or could disrupt the growth cycles of the saltmarsh flora (Geedicke, 2018). We note the concern that the project will lead to ***a substantial increase in the volume of freshwater entering the wetlands,*** which is indeed likely given the planned drainage. The ecological repercussions of freshening a portion of the marsh have not been assessed, but they could include reduced health of saltmarsh vegetation (which needs some salinity) and changes in invertebrate communities that form the food base for waterbirds.

Moreover, should the stormwater system fail (e.g. swales clogged, vegetation dying or growth rates stunted, etc.), untreated runoff would carry more urban pollutants into the lake, such as hydrocarbons from roads, nutrients from gardens, and sediments from erosion than currently occurs at present.

This would contribute to eutrophication risk (algal blooms) and other water quality issues that directly threaten the Ramsar site's values. Recall that after bushfires, pulses of nutrients and sediments caused significant ecological impacts in the Gippsland Lakes. A chronic smaller source of pollutants from urban stormwater is also detrimental, just more insidious.

The proponent is effectively asking that we trust an untested stormwater scheme to safeguard the wetland's water quality **in perpetuity**. Without absolute confidence in that system, the default position must be that water quality will likely be degraded – an unacceptable outcome under EPBC standards.

4.2 Habitat and Species Disturbance:

In addition to hydrological impacts, the proximity of the development raises concerns about **disturbance to wildlife within the Ramsar reserve**. Latham's Snipe, as discussed, move between the site and the Ramsar wetland for foraging. If displaced from the site, more birds may concentrate in the Ramsar wetland, potentially leading to greater competition or stressing resources there. More directly, the new residents may inadvertently or deliberately enter the Ramsar reserve (e.g. for recreation).

While the plan includes fencing along the boundary, there will be access points (for maintenance, etc.) and it cannot be assumed residents or their cats will never get into the wetland. Increased human presence adjacent to a wetland often results in **trampling of vegetation, noise, light, and introduction of pests** (weeds, pets) in the protected area (Gil et al, 2001; Frid & Gil, 2002). We highlighted the risk of cats and foxes – they will not recognize a fence line and could prey on birds within the Ramsar wetland just as easily as on site. Notably, the reserve supports other ground-nesting or ground-roosting birds (e.g. ibis, swan, waterfowl) that could also experience higher predation or disturbance due to the development.

The cumulative effect of an encroaching urban edge is a reduction in the **effective undisturbed area** of the Ramsar wetland.

The current paddock provides a buffer function – absorbing some level of human activity (farm fencing, minor access) such that the interior is relatively secluded. Replacing that with housing eliminates the buffer. It is well documented that urban encroachment on wetlands and grasslands can lead to *"a substantial and measurable change in the ecological character"* of the wetland over time, through mechanisms like those described (water regime alteration, pollution, invasive species, disturbance of biota) (Gil et al 2001; Frid & Dill, 2002). Given that the Ramsar site's eligibility under the convention relies on maintaining specific habitat types and species populations, these impacts are of great concern.

4.3 Climate Change Compounding Effects:

The Ramsar ecological character is already **at risk from climate change**, as noted in a 2022 vulnerability assessment by CSIRO. By 2050, the Gippsland Lakes region is projected to see ~25 cm of sea-level rise which will inundate existing shoreline habitats such as saltmarsh, along with more frequent extreme events. The Ramsar site is likely to experience greater seawater intrusion and diminished freshwater inflows (due to changing rainfall), impacting its plant and animal communities. In this context, any additional stressor – such as pollution or habitat fragmentation from the development – reduces the wetland's resilience. For example, if saltmarsh is being lost to sea-level rise on the lake side, we would want to preserve all remaining fringes of it on the landward side.

4.3.1 Coastal squeeze

The project proposes to build right up to some of these fringes, with only minimal buffers (in some cases less than 10m from the Ramsar boundary). That may hinder the natural landward migration of saltmarsh in response to rising sea levels. The best practice climate adaptation for coastal wetlands is to allow for a "living shoreline" with sufficient undeveloped space for habitats to shift inland (Spadalieri, 2020). Here, however, the development proposes placing the drainage assets in the low-lying land directly in the habitat migration pathway. This land is best left unencumbered to minimise the anticipated **squeeze of the wetland** as water levels rise, contributing to a loss of ecological character (e.g. loss of saltmarsh extent, changes in species composition).

It is noteworthy that protecting freshwater inputs is cited as a key need for the Ramsar site under climate change; yet the development could do the opposite by altering freshwater delivery in undesirable ways and reduce the land available for habitat retreat as sea levels rise.

> In summary, the project's impacts are not occurring in isolation – they will interact with climate-driven changes, potentially exacerbating harm to the Ramsar site by contributing to coastal squeeze.

4.4 Conclusion for Ramsar Wetland:

The proposed action poses clear risks of significant impact on the Gippsland Lakes Ramsar site under multiple criteria: it could substantially modify portions of the wetlands' habitat (through altered inflows and possible weed incursions), it threatens to cause a measurable decline in water quality, and it is likely to disturb native species relying on the wetland (through noise/light/predators), thus disrupting the ecosystem.

> The avoidance and mitigation measures proposed—such as a vegetated buffer strip, fencing, and stormwater treatment features—are not sufficiently robust to ensure that these impacts will be effectively avoided

Given the national and international importance of this wetland and the adjoining project area, any approval of the development must be approached with extreme caution. At present, the proposal **does not meet the EPBC Act requirements to avoid significant impacts on a Ramsar wetland**. It is our recommendation that the action be deemed clearly unacceptable unless or until the proponent can redesign and demonstrate (with evidence) that water flows, water quality, and disturbance factors will not adversely affect the Ramsar site's ecological character. The Commonwealth has a responsibility to ensure the **Ramsar Convention obligations** are upheld – allowing this project to proceed under current conditions would be contrary to those obligations.

5. Coastal Hazard Risks and Climate Change Considerations

It's important to note that Mr. Craigie's qualifier—"if predicted sea-level rise occurs"—is no longer scientifically tenable.

> **Recent peer-reviewed research confirms that significant sea-level rise is not a matter of *if*, but *when*.**

In 2024, global sea levels rose at an unprecedented rate of 0.59 cm per year, surpassing the expected 0.43 cm, primarily due to thermal expansion from record ocean heat and accelerated ice melt (NASA, 2025). The World Meteorological Organization reported that between 2015 and 2024, the average annual sea level rise reached 4.7 mm, more than double the rate from 1993 to 2002 (WMO, 2025).

These trends are driven by escalating CO_2 concentrations, which have reached record highs, intensifying global warming and its impacts (IPCC, 2023). Moreover, the Intergovernmental Panel on Climate Change (IPCC) projects that, under high-emission scenarios, sea levels could rise above the 0.8m benchmark level by 2100, and exceed

1.01 meters, with potential for even greater increases if ice sheet instability accelerates (IPCC, 2023). Given this compelling evidence, the inevitability of severe sea-level rise is clear, rendering any conditional language about its occurrence obsolete.

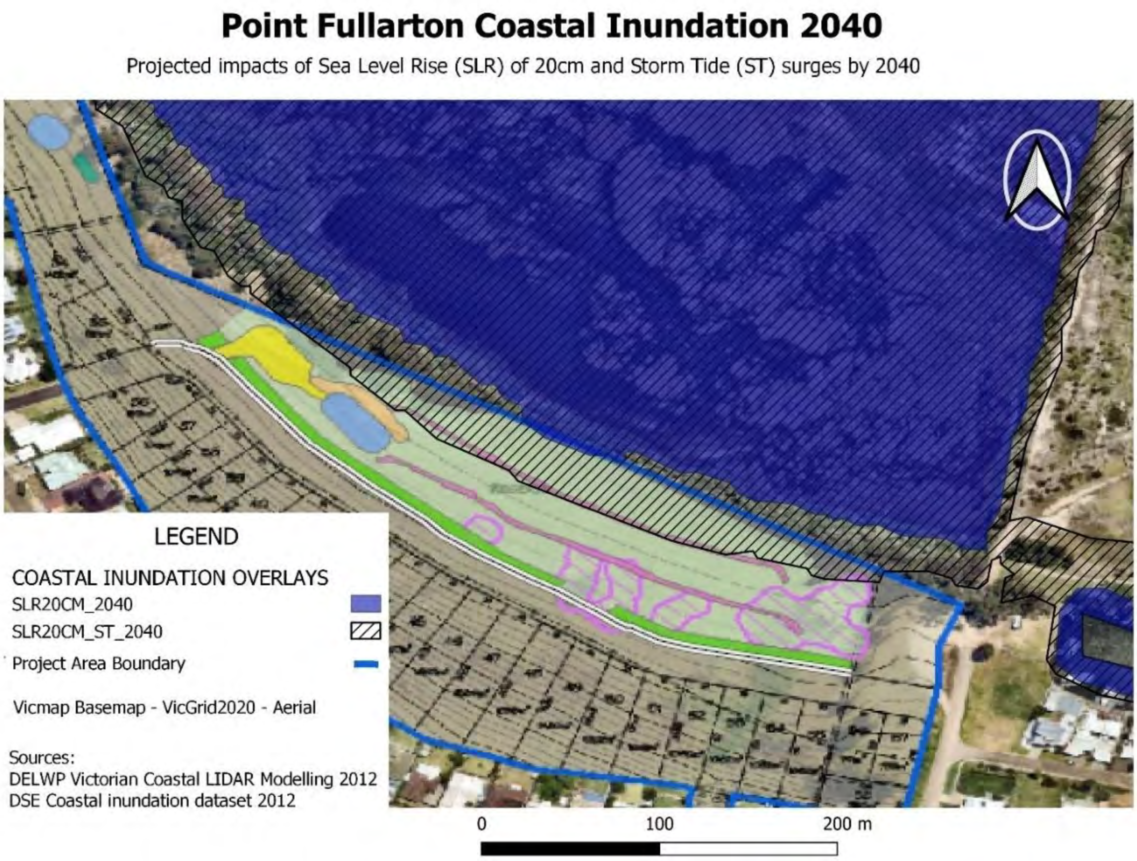


Figure 5.1: Sea Level Rise and Storm – Tide Surge extent by 2040

The location of the project in a low-lying coastal area means it is exposed to **coastal hazard risks** which have implications for both the development's sustainability and the environment. While the proponent has nominally accounted for known hazards (by excluding residential lots below 2.8 m AHD, for instance), the drainage infrastructure and habitat remain in the **hazard-prone zone**. It bears emphasizing how severe these risks are projected to become.

5.1 Sea-Level Rise and Inundation:

By the mid-21st century, sea-level rise of approximately 0.2–0.3 m is expected in the Gippsland Lakes. Though seemingly not a large rise in Lake levels, this is sufficient to almost completely inundate most of the Ramsar wetlands and bring the lake shoreline just into the project area itself (refer to figure 5.1). Mapping by the Victorian Department of Sustainability and Environment (DSE) shows that with 0.2 m Sea Level Rise (SLR), much of the project's stormwater swale/bioretention area would lie within the storm/tide inundation zone (see Figure 5.1).

More concerning is the projected increase in the frequency of high-erosion, 1-in-100 year storm tide events; which by 2050 are projected to **occur every 1.5 to 2.3 years** (CSIRO 2022; p.62)

5.1.1 Projected Coastal Hazard Impacts by 2070

According to the CROSSCO SWMS Report (p.16 or p163 of the PD), "the 'Future Coasts' mapping indicates that: 2070 modelled water levels would not encroach to the proposed allotments or associated proposed municipal infrastructure." A map is included in their report (p.17) to support the above claim (reproduced below).

Figure 5.1(a): CROSSCO 2070 and 2100 Sea Level Rise and Storm – Tide Map

The CROSSCO map however does not show the placement of any municipal infrastructure, just the coastal inundation layers. The 2070 Sea Level Rise and Storm Tide layer is quite difficult to locate on the map, being largely obscured by the 2100 storm / tide layer overlayed on top. In order to substantiate the claim, we have reproduced just the 2070 'Future Coasts' mapping layers and overlayed them on to a geo-referenced stormwater assets layer (refer to Figure 5.1(b) overleaf).

As is evident from the map shown in Figure 1(b), the eastern stormwater assets' lowest porous bank will be impacted by storm and tide surges by 2070. This is even acknowledged in both the Water Technology and Neil Craigie correspondence, which formed part of the Preliminary Documentation (PD).

As stated in the Water Technology letter (p.4 / p.200 of the PD), "from 2070 onwards, depending on the progress of shoreline erosion, some measures may need to be contemplated to protect assets from wave action under severe storm conditions."

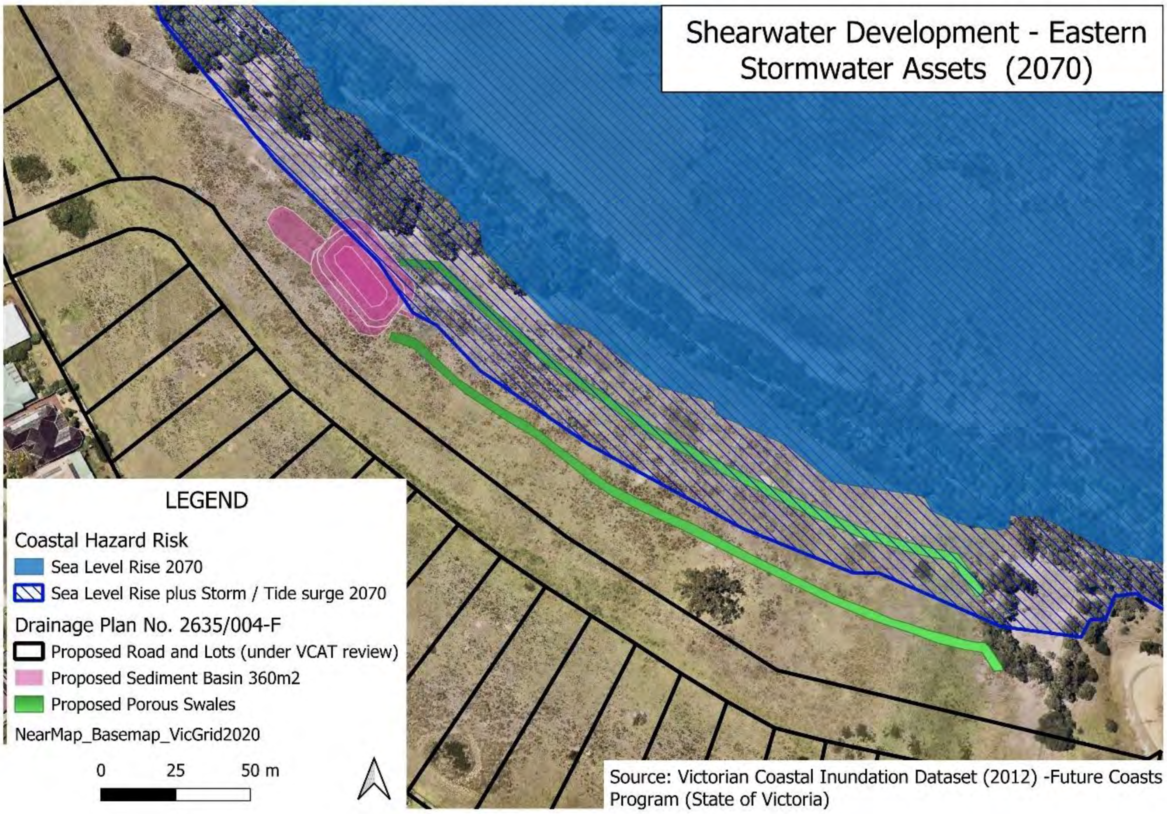


Figure 5.1(b): 2070 Sea Level Rise and Storm / Tide Surge and (East) Stormwater Assets

Likewise, the correspondence from Neil Craigie (p.4 / p.194) confirms that "the northernmost porous bank is proposed at an existing surface level of 1.5 m with its crest at 1.8 m. This is well above the expected impacts of sea level rise through the year 2070." These statements confirm that ***from* the year 2070** the impacts of projected sea level rise and storm-induced erosion on the lower section of the proposed stormwater management system (SWMS)—including the associated Snipe habitat area— are not disputed. This stands in direct contrast to the CROSSCO report, which provides unsubstantiated assertions to the contrary.

5.1.2 Projected Coastal Hazard Impacts by 2100

By 2100, in the absence of substantial and costly coastal protection works, approximately 0.5 hectares of the constructed ephemeral swamp-swale system are projected to be permanently inundated due to sea-level rise (+82 cm). In addition, nearly half of the Offset Habitat Area (1.45 hectares) is likely to be subject to frequent and severe storm surge and tidal inundation. These projections are consistent with accepted climate science and coastal hazard modelling.

Despite this, the Water Technology report significantly downplays the long-term risk, stating that the stormwater assets would "continue to function under normal conditions" and that it is "not unusual for stormwater treatment assets to be inundated under extreme flood conditions." This position is based on a 2010 Coastal Vulnerability Assessment prepared for a substantially different development proposal on the same site.

The application of this earlier risk assessment to the current proposal is fundamentally flawed for several reasons:

1. **Different Site Conditions**: The 2010 proposal involved raising the site level with engineered fill, elevating key assets above projected flood levels—a measure not adopted in the current design nor can it be, since infill is now considered a 'maladaptive' responses to coastal risk.
2. **Different Assets at Risk**: The 2010 assessment focused primarily on residential allotments and roads, not the performance or resilience of ecological or water-sensitive urban design (WSUD) assets.
3. **Different Infrastructure**: The earlier assessment considered large constructed wetlands, not the more vulnerable ephemeral bioretention and swale system currently proposed within the Offset Habitat Area.
4. **Previous Rejection**: The tribunal previously rejected the 2010 proposal, citing excessive coastal inundation risks as a key reason—a precedent that has been ignored in the current assessment.
5. **Lack of Evidence**: The current claim that the stormwater-habitat system would continue to function post-inundation is unsupported by technical evidence or functional modelling.

The assumption that the erosion and inundation risks can be managed through unspecified mitigation measures is speculative and unsubstantiated. Habitat intended to offset ecological impacts cannot serve its purpose if regularly submerged, degraded, or converted into mudflat. Sea-level rise also contributes to lateral erosion of coastal fringes, meaning that berms or constructed banks could fail over time, further compromising the function and integrity of the system.

5.2 Increasing Storm Intensity & Erosion:

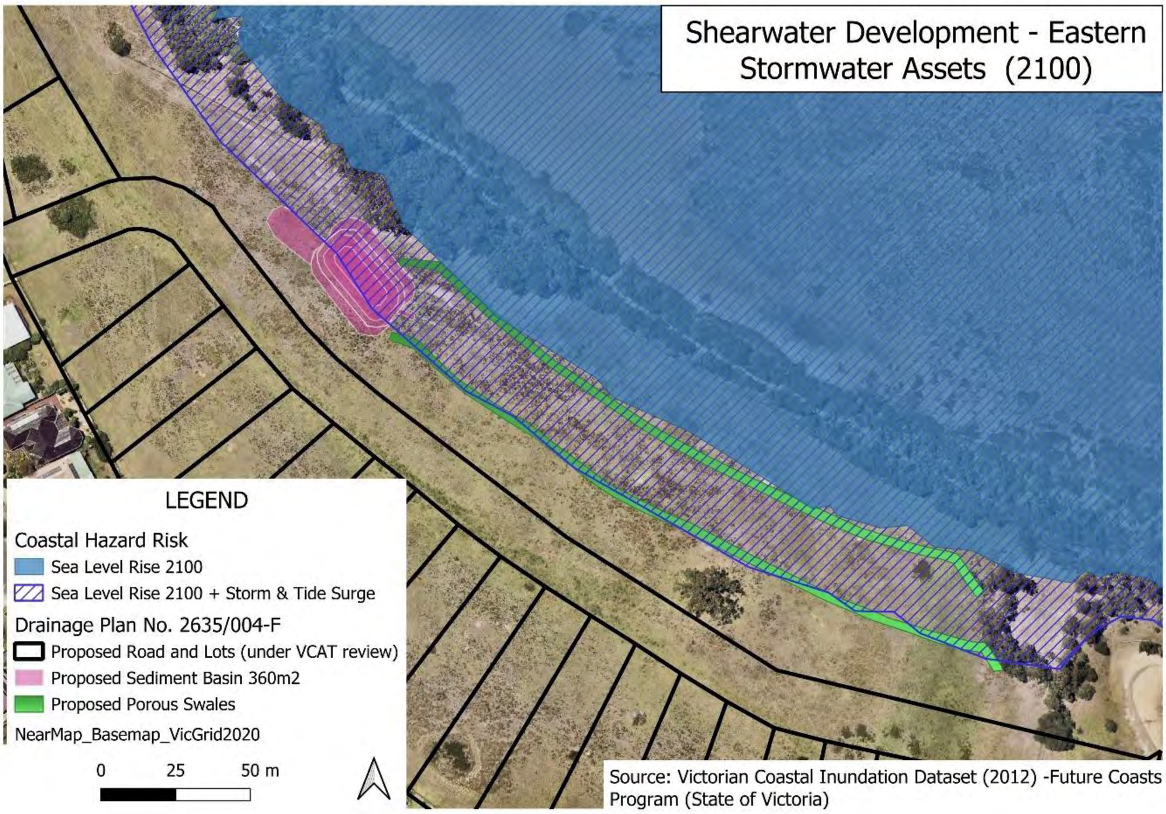


Figure 5.2: 2100 Sea Level Rise and Storm / Tide Surge and (East) Stormwater Assets

Climate models project that severe weather events (extreme rainfall, storms) will occur more frequently in the Gippsland coast (McInnes, 2024; CSIRO 2022).

By the end of the century, climate models project a 1-in-100 year storm flood event will occur 10 to 100 times per year in Gippsland, equivalent to **every 4 to 36 days** (CSIRO 2022: p.62).

The design of stormwater systems and site drainage is generally based on historical rainfall intensity patterns, not projected future extreme weather events. Future projections indicate regional mean rainfall will continue to be highly variable (-24% to +14% annual change by 2080-2099) (CSIRO 2022, p.54,144).

The majority of studies for Gippsland show a decrease in mean rainfall is likely, but with a projected increase of 6% to 33% in extreme (1-in-20 year) rainfall events by 2080-2099, particularly on the hourly to daily scale (CSIRO 2022, p.146).

Projected changes in evaporation rates are even more extreme, with models indicating a 13 to 52% increase in pan evaporation by 2080-2099 (CSIRO 2022, p.144). If future downpours are more intense as projected, the system is likely to be overwhelmed (greater runoff volume than designed). Overflow events that bypass the treatment entirely could become more common, flushing pollutants straight into the lake and any surviving wetlands. As already mentioned, **erosion** is a key concern – with stronger and more frequent storm surges likely to undermine outlet structures or the lakeward edge of the site, potentially breaching any containment and causing a sudden release of accumulated sediments or nutrients. Without robust armouring (not indicated in plans, likely because it would harm habitat value), the system is vulnerable to such damage.

In sum, the coastal context greatly **amplifies the uncertainty and risk** associated with the development's environmental management. The project, if built, could itself become a victim of climate change – a failing stormwater system, frequent flooding, and habitat offset areas transitioning to open water.

From a regulatory perspective, approving a project with such known vulnerabilities could be seen as contrary to the **principle of inter-generational equity and precaution**.

The EPBC Act encourages decision-makers to consider the long-term and broader impacts of actions. Without significant and costly protective works, the long-term scenario shows a high probability of significant environmental harm (when the drainage/habitat system is progressively compromised and eventually fails due to natural coastal processes).

5.3 Adaptive Management Challenges:

All the accompanying reports, plans and expert correspondence (bar CROSSCOs') have all acknowledged sea level rise is expected to impact the stormwater assets from 2070 onwards. Moreover, all have unequivocally stated that future adaptation measures can be readily undertaken without specifying what those mitigation measures would likely be, other than relocating the walking path onto one of the porous gravel swales (Neil Craigie review, p. 194).

However, any engineering interventions—such as bank reinforcement or levee construction—are likely to conflict with key ecological objectives. Such modifications could lead to prolonged inundation, disrupting the intermittent shallow ponding conditions essential for Latham's Snipe foraging and roosting, and may also prevent the inland retreat of wetland habitat in response to sea level rise.

Additionally, major physical adaptations would be very costly and require further approvals, and might not even be feasible once houses and other hard infrastructure are in place. It is far more prudent to factor these risks in *now*, at the assessment stage, and require design changes, including greater coastal adaptation buffers accordingly.

If an action cannot be sustained in the face of reasonably foreseeable coastal hazard risks without losing environmental performance, then it should not be considered an adequate offset or mitigation in the first place.

In conclusion, **coastal hazard and climate risks make the proposal's impact mitigation strategy even less reliable**. The development as planned is likely to face significant challenges that could lead to environmental impacts equal to or greater than those anticipated under current conditions. **The proposal lacks an integrated and detailed coastal adaptation plan.** This adds another compelling reason to either redesign the proposal with these factors in mind or to reject it as unsuitable for the setting.

6. Conclusion

For the MUSIC modelling to be effectively assessed by the Commonwealth, and its output results considered transparent and scientifically robust, the detailed functional design, MUSIC model files, and a MUSIC Auditor Report ought to be submitted along with additional documentation/modelling **justifying the ecological functionality and resilience of the SWMS.**

In light of the above analysis, we conclude that the Shearwater–Paynesville Residential Development, as currently proposed, presents an unacceptable risk to nationally significant environmental values. The project would impact a critical habitat for a protected migratory bird and a sensitive Ramsar wetland ecosystem, with no guarantee that these impacts can be effectively mitigated or offset. The proponent's innovative approach – integrating stormwater treatment with habitat creation – is, in our assessment, not sufficiently proven to meet the EPBC Act's requirements for avoiding significant adverse effects. Key technical content provided in this report and the appendices reinforce that the cumulative effects (habitat loss added to regional declines), hydrological alterations, climate change vulnerabilities, and mapping inaccuracies all tilt the balance toward significant environmental harm.

The EPBC Act and its policies demand a high degree of certainty and precaution in protecting MNES. In this case, too many elements are uncertain or left to future resolution. The ecological character of the Point Fullarton Gippsland Lakes Ramsar Reserve and the local population of Latham's Snipe could be irrevocably altered if this development proceeds without substantial changes. As such, we submit that **approval of the action should be withheld** unless the proposal is fundamentally redesigned to demonstrably avoid these risks (for example, by relocating development further upslope and away from sensitive areas, securing additional alternate offset lands, and presenting a fully engineered and climate-resilient stormwater plan). At **a minimum**, the

Commonwealth should require further assessment and information (as detailed in our recommendations) before making any decision.

In summary, we urge the Department and the Minister to apply the precautionary principle and prioritize the protection of this significant Latham Snipe site and the adjoining internationally significant wetland and its species. The current proposal does not meet the standards of environmental protection and impact avoidance envisioned by the EPBC Act. The proponent should not proceed until it can unequivocally show that no significant impact will occur. Failing that, the appropriate outcome is for the development to be refused under the EPBC Act on the grounds of likely unacceptable impacts to MNES.

7. Recommendations

Based on the foregoing analysis, we make the following recommendations to ensure compliance with EPBC Act objectives and protection of MNES:

1. Do Not Approve as Currently Proposed:

The Minister should refrain from approving the project in its present form, given the significant residual impacts identified. The proposal should either be refused outright or deferred pending major redesign. The onus is on the proponent to **redesign the project to avoid impacts**, for example by increasing buffers (as science suggests ~100 m), reducing development footprint near the wetland, or providing off-site offsets.

2. Require Comprehensive Re-assessment and Design Revision:

If the proposal is not refused, the proponent MUST be required to submit a significantly improved plan addressing all key deficiencies:

- A **complete functional design** of the stormwater and habitat system, with engineering drawings and calculations, demonstrating how water regimes will be controlled within ecological tolerances. This should include modelling of extreme events and climate change scenarios (e.g. +0.2 m and +0.8 m sea-level rise).
- An **independent expert review (audit)** of the stormwater design and the MUSIC model by a qualified hydrologist/water engineer with the report provided to the Department. To avoid conflict of interest concerns, it's imperative the Department instruct the proponent to select an independent expert not previously involved in the design of the project or who has acted as an expert witness in previous tribunal cases on behalf of the landowners.

- A **robust Offset Management Plan** detailing legal conservation measures: how the on-site offset will be secured in perpetuity, funded, monitored, and adapted if initial assumptions fail. This plan must show consistency with EPBC Offset Policy principles (see Appendix 3) including risk mitigation for offset failure, additionality, and long-term management by the proponent (or binding agreements with Council).
- **Supplementary offsets -** given the high risk the on-site habitat may not fully succeed; the proponent should provide additional offset measures (such as protecting or restoring another wetland in the region) to compensate for worst-case outcomes. These should meet the direct offset requirement (≥90% direct on-ground benefits).
- A revised **Habitat Map and Impact Area** calculation for Latham's Snipe, using a precautionary approach that includes all potential habitat on site (not just where birds were seen). This will form the basis for determining offset requirements accurately.
- Enhanced **predator and invasive species management commitments** (e.g. cat-free subdivision requirements, funded fox control in the Ramsar reserve, long-term weed monitoring and removal program) to mitigate indirect impacts.

3. Impose Stringent Conditions if Approved: Should approval be granted (post any redesign), we strongly recommend conditions such as:

- **Pre-construction verification**: All detailed designs (stormwater, landscaping, etc.) must be approved by the Department before works commence, to ensure they accord with what was promised.
- **Monitoring and Reporting**: The proponent must implement intensive monitoring – of water quality entering the Ramsar wetland, of Snipe usage of the offset habitat, and of fence/screen integrity – with results reported annually to the Department (and/or state regulator) and made public. Monitoring should be tied to clear performance criteria (e.g. Snipe return rate, pollutant levels) and trigger adaptive management or contingency offsets if criteria are not met.
- **Long-term funding**: A secure funding mechanism (such as a bond or trust) should be required to cover at least 20 years of management of the offset area, ensuring that maintenance (weed control, fence repair, fox baiting etc.) and monitoring are financed once ownership transfers.
- **Review and Adaptation**: A condition that mandates a formal review of the habitat offset's success at, say, 5-year intervals. If the offset is failing

(e.g. Snipe have not been recorded using it in significant numbers, or water quality targets to the lake are not met), the proponent (or its successors) **must implement additional corrective measures**. The Minister should reserve the right to enforce alternative offsets (such as purchasing and conserving additional habitat elsewhere) if on-site measures fall short of predicted outcomes.

  - **Cat and Pest Controls**: Make the development subject to a binding cat curfew or ban (if legally enforceable) and require ongoing fox control in and around the site, given the heightened predation risk.

4. Apply Precautionary Principle & Consult Experts:

We recommend the Department engage independent experts (e.g. shorebird ecologists, wetland hydrologists) to review the proponent's claims and this submission's points. In case of scientific uncertainty, the **precautionary principle** should be applied as per EPBC Act Section 391. It is better to err on the side of protecting the Ramsar site and Snipe habitat than to approve a risky experiment that could cause irreversible harm to MNES.

5. Apply Enhanced EPA Stormwater Standards for Priority Areas:

As the site directly adjoins Lake King and Ramsar-listed wetlands, it should be treated as a de facto "priority area" under EPA Victoria's Stormwater Guidance (Publication 1739.1), which sets higher runoff and pollutant reduction targets for sensitive receiving environments, including estuaries. Although regional priority areas are yet to be mapped, the well-recognised ecological significance of the site warrants applying the enhanced standards—particularly the 50–90% reduction in mean annual runoff volume via infiltration, harvesting, or evapotranspiration. Applying these measures is essential to protect Ramsar values and ensure compliance with EPBC Offset Policy Principle 1, which requires that actions maintain or improve the viability of the protected matter.

By implementing the above recommendations, the Commonwealth can ensure that any development (if it proceeds at all) will only do so with the highest safeguards for the environment.

Absent these measures, we believe the proposal will not meet the EPBC Act's requirements and should be refused to prevent likely significant impacts on our precious Ramsar wetlands and vulnerable migratory birds.

8. REFERENCES

Backstrom, M. et al (2003) Grassed swales for stormwater pollution control during rain and snowmelt, *Water Sci. Technol.*, 48 (2003), pp. 123-32, 10.1016/j.colsurfa.2017.07.051

Chaves, M.T. et al (2024) Comparative analysis of bioretention design strategies for urban runoff infiltration: a critical overview, *Ecological Engineering*, Vol: 207, Page: 107352 10.1016/j.ecoleng.2024.107352

Commonwealth of Australia (2017) EPBC Act Policy Statement 3.21 - *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species*. Department of Environment, Canberra

DCCEEW (2024) Ground truthing of offset site survey information project 21 June 2024, Document no: IS467100-00-1 Revision no: 1.0

Devak, M. & Dhanya, C.T. (2017) Sensitivity analysis of hydrological models: review and way forward. *Journal of Water and Climate Change* ,1 December 2017; 8 (4): 557–575. https://doi.org/10.2166/wcc.2017.149

Dudrick, R et al (2024) Do plants matter?: Determining what drives variation in urban rain garden performance, *Ecological Engineering* Volume 201, *p.107208, https://doi.org/10.1016/j.ecoleng.2024.107208*

Ekka, S.A., et al (2021) Next generation swale design for stormwater runoff treatment: A comprehensive approach, *Journal of Environmental Management,* Volume 279, p.111756 https://doi.org/10.1016/j.jenvman.2020.111756

eWater Cooperative Research Centre. (2015). *MUSIC by eWater User Guide Version 6.2*. Retrieved from: https://ewater.org.au

Fardel, E. et al., (2019) Analysis of swale factors implicated in pollutant removal efficiency using a swale database, *Environ. Sci. Pollut. Res*., 26 (2019), pp. 1287-1302, 10.1007/s11356-018-3522-9

Frid, A., & Dill, L. (2002). Human-caused disturbance stimuli as a form of predation risk. *Conservation Ecology*, **6**(1), 11.https://doi.org/10.5751/ES-00404-060111

Geedicke, I., Oldeland, J., & Leishman, M. R. (2018). Urban stormwater run-off promotes compression of saltmarshes by freshwater plants and mangrove forests. *Science of the Total Environment*, *637-638*, 137-144. https://doi.org/10.1016/j.scitotenv.2018.04.357

Gill, J. A., Norris, K., & Sutherland, W. J. (2001). Why behavioural responses may not reflect the population consequences of human disturbance. *Biological Conservation*, 97(2), 265–268. https://doi.org/10.1016/S0006-3207(00)00002-1

Hauser, C.E. & McCarthy, M.A. (2009) Streamlining 'search and destroy': cost-effective surveillance for invasive species management. *Ecology Letters*, 12, 683–692

Imteaz, M.A., et al., (2013) Modelling stormwater treatment systems using MUSIC: Accuracy, *Resources, Conservation and Recycling,* Volume 71, February 2013, Pages 15-21 https://doi.org/10.1016/j.resconrec.2012.11.007

Intergovernmental Panel on Climate Change (IPCC). (2023). *Climate Change 2023: The Physical Science Basis*. Contribution of Working Group I to the Sixth Assessment Report of the IPCC. Retrieved from https://www.ipcc.ch/report/ar6/wg1/

McInnes KL (2024) Climate change, sea-level rise and the Gippsland shoreline. *Proceedings of the Royal Society of Victoria* 136, RS24001. https://doi:10.1071/RS2400

Melbourne Water, (2019) *Constructed Waterways Design Manual,* Victorian Government. https://www.melbournewater.com.au/media/10321/download

Melbourne Water, (2024) *MUSIC (Model for Urban Stormwater Improvement Conceptualisation) Guideline*, Victorian Government https://www.melbournewater.com.au/media/24646/download

Moore, A.L & McCarthy M.A., (2016) Optimizing ecological survey effort over space and time, *Methods in Ecology & Evolution*. *https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/2041-210X.12564*

Moore, J.L., Hauser, C.E., Bear, J.L., Williams, N.S.G. & McCarthy, M.A. (2011) Estimating detection-effort curves for plants using search experiments. *Ecological Applications*, 21, 601–607. https://pubmed.ncbi.nlm.nih.gov/21563589/

McCarthy, M.A., Moore, J.L., Morris, W.K., Parris, K.M., Garrard, G.E., Vesk, P.A. et al. (2013) The influence of abundance on detectability. *Oikos*, 122, 717–726. https://www.researchgate.net/publication/248394619_The_influence_of_abundance_on_detectability

NASA. (2025). *NASA Analysis Shows Unexpected Amount of Sea Level Rise in 2024*. Retrieved from https://sealevel.nasa.gov/news/282/nasa-analysis-shows-unexpected-amount-of-sea-level-rise-in-2024/

Palmer, G. C., Fitzsimons, J. A., Antos, M. J., & White, J. G. (2008). Determinants of native avian richness in suburban remnant vegetation: Implications for conservation planning. *Biological Conservation*, 141(9), 2329-2341

Payne, E.G.I., et al. (2015) *Adoption Guidelines for Stormwater Biofiltration Systems*. Cooperative Research Centre for Water Sensitive Cities. https://watersensitivecities.org.au

Razavi, S. et al. (2019) VARS-TOOL: A toolbox for comprehensive, efficient, and robust sensitivity and uncertainty analysis. *Environmental Modelling & Software,* Volume 112, 112:95–107.

Reid, A.J. et al (2018) Emerging threats and persistent conservation challenges for freshwater biodiversity, *Biol. Rev.* (2018), pp. 000–000. https://doi:10.1111/brv.12480

Southwell, C. & Low, M. (2009) Black and white or shades of grey? Detectability of Adelie penguins during shipboard surveys in the Antarctic pack-ice. *Journal of Applied Ecology*, 46, 136–143.

Spidalieri, K. Where the Wetlands Are—And Where They Are Going: Legal and Policy Tools for Facilitating Coastal Ecosystem Migration in Response to Sea-Level Rise. *Wetlands* **40**, 1765–1776 (2020). https://doi.org/10.1007/s13157-020-01280-x

Tansar, H., et al., (2023) Global sensitivity analysis of bioretention cell design for stormwater system: A comparison of VARS framework and Sobol method, *Journal of Hydrology*, Vol 617, p.128895 https://www.sciencedirect.com/science/article/pii/S0022169422014652

Watson, C.A., Weckerly, F.W., Hatfield, J.S., Farquhar, C.C. & Williamson, P.S. (2008) Presence-nonpresence surveys of golden-cheeked warblers: detection, occupancy and survey effort. *Animal Conservation*, 11, 484–492. https://www.researchgate.net/publication/227728146_Presence-nonpresence_surveys_of_golden-cheeked_warblers_Detection_occupancy_and_survey_effort

Winston, R. J., Hunt, W. F., Collins, K. A., & Spatari, S. (2017). A comprehensive review of nutrient removal in green infrastructure for stormwater treatment. *Water Research*, 110, 144–167. https://doi.org/10.1016/j.watres.2016.11.056

World Meteorological Organization (WMO). (2025). *State of the Global Climate 2024*. Retrieved from https://public.wmo.int/en/our-mandate/climate/wmo-statement-state-of-global-climate

Zhang, Y., et al., (2024) The hydrologic nature of swales uncovers remarkable influence of non-topographic factors on catchment-scale soil moisture variation, *Journal of Hydrology*, Volume 635, p.131196 https://doi.org/10.1016/j.jhydrol.2024.131196

zu Ermgassen S.O.S.E et al. (2019), The Role of "No Net Loss" Policies in Conserving Biodiversity Threatened by the Global Infrastructure Boom, *One Earth,* Volume 1, Issue 3, Pages 305-315, ISSN 2590-3322, https://doi.org/10.1016/j.oneear.2019.10.019

The following appendices provide additional technical evidence and analysis to support the conclusions above. All citations are included in the References section of this submission.

Appendix 1: Stormwater and Habitat Design Limitations

This appendix expands on the design and implementation limitations of the proposed stormwater management and habitat creation system. It draws on peer-reviewed research from leading journals, related technical references and feedback from experienced and qualified drainage experts to highlight specific concerns with the engineering and ecological aspects of the design.

A1.1 Vulnerability to Climate and Coastal Hazards

One of the most critical limitations of the proposed Stormwater Management Strategy (SWMS) is its **vulnerability to foreseeable climate-related hazards**. As discussed in the main submission, by the year 2040 the site's stormwater infrastructure (swales, basins, porous filter banks) will be increasingly exposed to coastal inundation during storm tides. The design, however, does not appear to incorporate any protective measures against this eventuality. There are no levees or floodgates proposed (nor would they be desirable environmentally), meaning the system is essentially open to the lake.

Exposure to Saltwater**:** The SWMS is premised on treating freshwater runoff. It uses freshwater wetland plants (macrophytes) in vegetated swales and basins to uptake nutrients and filter pollutants. These plants – often species like sedges, rushes, and aquatic grasses – are **sensitive to salinity**. As noted in the 2023 submission, even occasional intrusions of brackish water (from storm surge or wind-driven tide) can kill or weaken freshwater wetland vegetation. The bullets from that submission make the sequence of failure clear:

- The constructed wetlands and swales are designed for non-saline water; they must utilise freshwater-dependent flora to function effectively.
- These plants are sensitive to saline and brackish water intrusion – exposure leads to soil salinization and plant stress, impacting nutrient uptake and system performance.
- **Regular saline inundation** is likely to kill or seriously stress/weaken freshwater adapted wetland species and significantly stress even salt-tolerant ones, rendering the stormwater infrastructure less effective at capturing nutrients.
- Without a thriving and healthy wetland ecosystem, bioremediation capacity is reduced, and polluted water will pass through untreated or only partially so.
- Given the close proximity to the Ramsar site, any failure of the system will directly result in polluted discharges to the wetland and increased freshwater inflows.

These points illustrate a chain of consequences whereby sea-level rise and storm surge can ultimately lead to water quality impacts on the Ramsar site via system failure or poor performance.

The proponent's documents acknowledge climate change qualitatively but do not solve this issue. The *Water Technology* letter at Appendix 5 of the PD notes the Shoreline Risk Rating of 'Medium' by 2070 – meaning there is a 'high' likelihood of impact but the consequences are deemed 'minor' and "suggests no significant consequences are expected and that erosion hazards can be readily managed with mitigation measures".

For instance, the independent reviewer suggests a future trail relocation as an adaptation (essentially surrendering part of the habitat to water), but that is not a mitigation for the lost functionality. In sum, the **longevity of the stormwater treatment offset is dubious beyond 2070**. This is a fundamental design limitation: it is not "future-proof." Any truly sustainable design would have to either relocate treatment functions entirely out of the hazard zone or accept a shorter design life (and plan alternative offsets later, which is not how EPBC offsets are supposed to work).

Intensity of Rainfall and Runoff**:** Climate projections also indicate more intense downpours. The SWMS uses a network of inlet pipes and spreader swales to dissipate water. However, if rainfall intensities exceed design assumptions, the flow could overwhelm those spreaders and erode channels through the habitat area or bypass treatment.

There is no evidence in the documentation of a rigorous hydraulic analysis of the overland flow distribution.

A standard approach would be to model a range of storm events (1-year, 2-year, 100-year ARI storms) and see how the water depths and velocities distribute across the site. Without such analysis, we must assume a limitation: the design may perform in moderate storms but could fail (with concentrated breakouts or blowouts of filter media) in larger events. This again ties to climate, as the frequency of large events is rising. The consequence of such failure is not only a loss of habitat form but also deposition of sediment or debris that could clog parts of the system afterward.

Coastal Erosion Potential: The Point Fullarton area and Lake King shoreline have historically experienced erosion, especially after floods. If the lakeward edge of the site erodes landward, the Ramsar wetland's shoreline will migrate. This could eat into the offset area from the north/northwest side. A robust design might include some buffer allowance for erosion. The current plan, however, uses all available area for habitat right up to the Ramsar boundary. Therefore, **no buffer for erosion or shoreline change is present**. If shoreline retreat occurs, the functional size of the offset habitat will shrink and its shape could be altered (potentially breaching the spreader banks).

The lack of adequate **adaptation buffers or coastal setbacks** reflects a fundamental flaw in the spatial design—namely, the erroneous assumption that the landscape will remain static in a highly dynamic and shifting coastal environment.

A1.2 Incomplete Design and Engineering Uncertainties

Another category of limitations is the **incompleteness of the design development and transparency**. The EPBC referral's preliminary documentation does not provide a fully resolved engineering design. As a result, there are numerous unanswered questions about how the system will work. Key examples include:

- Porous Gravel Filter Banks (modelled as Swales)**:** These are novel elements – essentially long linear aboveground filters meant to intercept and spread flow. However, specifics like filter media mix, underdrain (if any), and maintenance regime are not given. The MUSIC model treats them as vegetated swales, which is a simplification.

  While swales can contribute to nutrient reduction, they may also act as pollutant sources—particularly when influent concentrations are low—due to resuspension and mobilisation of previously deposited, unbound pollutants from the swale bed (Backström, 2003; Fardel et al., 2019). If the actual infiltration rate of these filters or their storage capacity differs from a standard swale, the model's pollution reduction estimates could be way off. Additionally, gravel filters can **clog over time** with fine sediment, especially without pretreatment. We see no discussion of how clogging will be monitored or addressed – a serious omission because clogging would cause water to back up and possibly concentrate flows (defeating the purpose of even distribution).

- Ephemeral Wetland Planting Plan**:** The success of the habitat depends, in part, on establishing the appropriate vegetation structure—such as a patchy mosaic of tussocks and areas of exposed mud. The Offset Management Plan hints at a biomass management strategy – "periodic biomass reduction at agreed timing/frequency" (p.11 or p.86), and the documentation discusses broad habitat types for foraging vs roosting areas. Numerous plant species are listed as potentially suitable and control methods such as manual removal, grazing, burning and herbicide application are considered appropriate. However**, no detailed planting plan was included,** with the **selection of control methods** left up to Council.

  Without a detailed planting schedule and a clearly defined adaptive vegetation management plan, it is unclear how Council intends to engage contractors to maintain the desired structure and ecological function of the ephemeral wetland habitat over time. For example, if initial hydro-seeding or tube stock planting yields too dense coverage over time, will Council contractors know how to thin it out and do so regularly enough to maintain patchiness? If certain areas are too wet and cattails (Typha) for instance invades, will Council have a **detailed vegetation management plan** on hand to guide its contractors on how effectively to manage this (and other emerging threats)? This absence of detail is a limitation – essentially the ecological design is at concept level, not detailed design.

Finally, the proposal appears to overlook the influence of plant species selection, vegetation density, and soil–water interactions on nutrient uptake performance in its MUSIC modelling. These factors significantly affect treatment efficacy but are not adequately captured due to inherent limitations of the MUSIC software. As a result, key habitat and ecological variables cannot be accurately parameterised, reducing confidence in the modelled pollutant reduction outcomes (refer to Table 4.2 for further detail).

- Lack of Flow Control Structures**:** In the diagrams, water is delivered via pipes to the spreader swale and then ostensibly just flows overland. Are there any weirs, level spreaders, or sill structures to ensure even distribution? The SWMS does not specify. If the land grading is uneven or if sediment builds up in spots, water could short-circuit to low points. A limitation here is the reliance on *"natural" sheet flow*, which in practice often doesn't occur uniformly without engineered assistance. A robust design might include spreader weirs or a level sill at the outlet – none are described. Thus, the design may not actually achieve the uniform shallow inundation assumed.
- Gross Pollutant Traps (GPTs): The text from the referral material indicates a Gross Pollutant Trap is included at one outlet (presumably to catch litter). It also notes some outlets don't show GPTs. The **rationale for placement of GPTs** is unclear. This is a small point, but if any stormwater inlets lack GPTs, then trash and debris from the street could be discharged onto the habitat area or into the lake. It is unclear how gross pollutants from other outlets will be handled and this needs to be explained. This indicates incomplete integration of standard treatment elements.
- Operation and Maintenance (O&M) Clarity**:** A critical aspect of any stormwater system is the O&M manual. How often will sediment basins be dredged? Who will reset the system after large storms? The **design's viability is limited by uncertain maintenance**. For instance, porous filters need periodic flushing or replacement of media every X years- depending on inflows. Same for Gross Pollutant Traps, which require regular servicing and cleaning. Vegetated

swales also need occasional replanting and regular weeding to maintain the preferred habitat mosaic over time.

The Offset Management Plan provides high-level actions over 20 years, but it is not clear it includes all engineering maintenance – it focuses on ecological management (weeds, etc.). If maintenance is not rigorously done (which is a risk once handed to Council given its very limited environmental programs budget and conservation reserve management capacity), the performance will degrade. Therefore, the limitation is not solely in the design per se but in the *real-world implementability*: it's likely to be too complex or costly for the Council to maintain as conceived, without **secure, ongoing external funding** to engage experienced contractors and consultants.

In summary, many design details including input parameters for proxy or surrogate nodes (designed to approximate the performance of non-standard nodes) are yet **"to be determined"**, which is a serious limitation in itself.

It's important to understand that MUSIC works best, and with the greatest degree of confidence in output results, when standard WSUD treatment train nodes are utilised

Because of this, it is hard to accept the proponent's optimistic impact predictions. A truly robust proposal would have fleshed out these details upfront or at least acknowledged the need for them with firm commitments, especially from the Council the future land manager and DEECA as the regulator.

Table 4.2 Detailed Water Sensitive Urban Design (WSUD) MUSIC assessment.

WSUD Elements	Detailed Design	Comments
Climate Data Climate data including rainfall and evapotranspiration are essential inputs to MUSIC.	Six-minute Sarsfield East rainfall and evaporation data was utilised A claimed 30 year meteorological template of climate data records (13/04/1996 – 13/04/2026), Mean annual rainfall (MAR) = **537mm/yr**,	Despite claiming an extended modelling period of 30 years was used, the MUSIC climate template file listed in Appendix 3 (p.193) indicates only a 10-year modelling period was used. Eg : 2635 Fullarton Drive Sarsfield East 1996-2006 REV E 17 Jul23.sqz. MUSIC guidelines recommend using longer time series data for regions with more variable rainfall (such as East Gippsland) to ensure a representative range of conditions are modelled. Longer time series are

	Evaporation = **1051mm/yr**) was used in the analysis. The Sarsfield East weather station is approx. 16.5km from Point Fullarton in Paynesville	also encouraged for assessment of effects on downstream hydrology and flow duration curves and where catchments have an imperviousness fraction < 20% or where pervious flows are substantial (Melbourne Water, 2024). The 1996-2006 time series period modelled was not representative of the region's rainfall variability, and fell just short of including the record-breaking rainfall event of June 2007 (311mm monthly total with a daily high of 70mm, with 99.2mm recorded in Bairnsdale). It is unclear why a more representative and complete time series data set was not modelled, particularly the 2006-2012 period. Shifting the rainfall data period to July 2006 to July 2012 would capture three major flood events (June 2007, Aug 2011 and the June 2012 mega floods), making the model far more robust. The six minute time step interval for rainfall complies with guideline minimums. However, the completeness of the rainfall data record for Sarsfield East during the period was only 88.31%, with extended data gaps (incl. from June 1997 to June 98) resulting in Mean Annual Rainfall records not available for half of the 10 year period. It's unclear if these significant data gaps were infilled with data from nearby gauges with good statistical correlation (eg. Bairnsdale Airport) in accordance with the MUSIC guidelines? According to data from the nearby

		Bairnsdale Airport weather station (Station ID: 085279), the mean annual rainfall for the Paynesville area over 1996 to 2016 was approx. **645.3 mm/yr, or 18.3%** greater than the Mean Annual Rainfall (MAR) used in the model. The discrepancy between the MAR for Bairnsdale and Sarsfield East could indicate **issues with model integrity.** It's important that the total annual rainfall depth of the 6-min data file be **validated** and **compared** to BoM's observed annual average (e.g. for Bairnsdale Airport). Our preliminary comparison with the Sarsfield and Bairnsdale series-data has found substantial irregularities and discrepancies, suggesting the 6-min data might be: • **Incomplete** (465 days missing for the period) • Taken from a **dry subset** of years: a) every year for the period was below the historical annual mean; b) 70 months of recorded data (i.e., 63.6%) were below the historical monthly mean c) Compared to Bairnsdale rainfall data for the same period, Sarsfield recorded just: - 3 vs 5 months of above 95 percentile rainfall, and - 5 vs 9 months above the 90 percentile, and - 34 vs 43 months above the historical monthly mean (BoM Climate data). Underestimating mean annual

		rainfall by 18.3% could result in: - underprediction of peak flows, baseflows, and total stormwater volumes. - underestimation of pollutant loads since less runoff equals lower total pollutants (TSS, TP, TN) The net effect of lower rainfall is **artificially inflated treatment performance** which directly affects WSUD system sizing, effectiveness, and compliance. Moreover, long term BOM data highlights considerable natural variability in regional precipitation on the decadal or multi-decadal scale, as seen in the 20-year rolling mean. The 10-year data period used in the analysis was the lowest it has been over the historic record (see CSIRO 2022, p.51-52). Future projections indicate mean rainfall will continue to be highly variable (-24% to +14% annual change by 2080-2099) (CSIRO 2022, p.54,144). The majority of studies show a decrease in mean rainfall is likely, but with a projected increase of 6% to 33% in extreme (1-in-20 yr) rainfall events by 2080-2099, particularly on the hourly to daily scale (CSIRO 2022, p.146). Projected changes in evaporation rates are even more extreme, with models indicating a 13 to 52% increase in pan evaporation by 2080-2099 (CSIRO 2022, p.144). There is **no evidence supplied** in the Preliminary Documentation (PD) that any assessment of potential climate change impacts has been modelled;

		including projected variations in regional rainfall patterns, evaporation rates, or the increased frequency and intensity of extreme weather events such as flash flooding.
Source nodes	**Detailed Design**	**Comments**
Site and external catchments Catchment area and surface permeability are key determinants of stormwater runoff volume and associated pollutant loads, as they control how much rainfall becomes runoff and how effectively pollutants are mobilized and transported.	Catchments have been split (via surface types) as detailed in Table A.5.2, with each sub catchment further delineated to define the overall connected imperviousness fractions (F_{imp}) for: • Impervious roof areas discharging to stormwater harvesting tanks. • Impervious areas not discharging to tanks, and • Pervious areas.	Due to a lack of available data, the Melbourne water corporation MUSIC tool guidelines for surface zonings and pervious soil storage parameters were utilised. The source node parameters adopted appear consistent with the MUSIC guidelines (2024).
Treatment nodes	**Detailed Design**	**Comments**
Spreader swale	The proposed spreader swale system will follow contours immediately north of the proposed new road and outfalls and disperse stormwater downstream to the proposed porous banks to provide Latham's Snipe habitat. The SWS Report	Only one contour swale proposed for Porous Bank 1; none shown for the Porous Bank 2. – this could present a heightened tunnel erosion risk at the eastern sediment basin outfall. It's unclear how stormwater discharged from the eastern basin outfall will disperse evenly along the entire length of Porous Bank 2 without a spreader swale (as for Porous Bank 1)? Spreader swales provide relatively minor treatment benefits (Melbourne

	included in the PD (p.170) acknowledges the swale system is still only a concept design: "the extent of swales and **finalisation of geometric design will be further refined and documented during the detailed design phase**".	Water, yet are described as a bioretention system in Table A.5.3 (p.203). Furthermore, swales are shown in the MUSIC schematic as the principal treatment node for around 32% of total source catchment runoff (excluding Water Tanks and the Gross Pollutant Trap). Peer-reviewed research on swale design for stormwater quality treatment is limited, primarily due to a lack of comprehensive data synthesis (Winston et al., 2017).
Porous banks – North and South	The plan drawings show the porous banks to consist of two parallel gravel banks placed within a proprietary HDPE product on top of the in-situ soil. It is unclear how this design can provide any of the functions claimed, i.e. treatment, retain water or habitat. It is referred to as a bioretention system in the Table A.5.3 and appears to be modelled as a swale. Both swale and bioretention differ significantly in their designs and are completely different to the porous bank design shown on the plans and described	The two 'porous media filter banks' are designed to achieve "hydraulic control over flow spread and rate of discharge" primarily to create swampy conditions for Latham's Snipe by retaining surface water, whilst "prevent[ing] waterlogging and extended ponding" (p.209). For reasons that are not explained, the two raised, gravel-filled porous filter banks have been represented as "swales" (Swale 1 and Swale 2) in the MUSIC model schematic. This is potentially misleading, as swales are typically shallow, vegetated channels designed to convey and infiltrate stormwater, whereas raised filter banks are elevated structures intended to slow and filter flow horizontally through a gravel matrix. The two systems have distinct hydraulic and treatment functions, and should not be treated interchangeably in modelling. Unlike the other standard treatment nodes, the SWMS report does not provide a typical example or

	in the Neil Craigie report. Only the geometric dimensions detailing the design of the porous bank is included. However, the functional design related to the ephemeral wetland or swamp this treatment node is primarily designed to create (shown as Swale 1 and 2 in the MUSIC schematic) are absent. As noted on the drainage plans "Water Sensitive Urban Design detail will be determined during detail design".	precedent for this unusual design, likely because it is an experimental, custom-built treatment element. This node relies on horizontal flow through gravel-filled porous filter banks—fundamentally different from conventional sediment basins, which use vertical settling and can be drained for routine sediment removal. In contrast, no maintenance strategy is described for removing fine sediments that will inevitably accumulate in the 240 m long, 2.6 m wide, and 0.3 m high gravel filter banks. It remains **unclear how these structures will be cleaned or maintained once they begin to clog**? Further, Table A.5.3 categorises the two porous banks as a "Bioretention System" and lists "Effective Plants" as a key design parameter (p.203). Bioretention systems (unlike swales) achieve deeper filtration and extended detention time. So is this node modelled as a swale or bioretention system? There is a lack of detail for this swale/bioretention/filter node. Typical swale or bioretention node details include: - width and depth of the channel - surface area (m^2) - vegetation type and planting density - longitudinal slope - soil type to determine infiltration rate It is unclear how pollutant removal performance can be accurately calculated without these functional design details tailored to the actual site conditions. Accurate stormwater

		modelling requires well-defined and calibrated input parameters tailored to site-specific conditions. In the case of vegetated swales or bioretention systems, treatment efficiency can vary significantly depending on soil type, local climate, plant species, and vegetation coverage—all of which remain undefined in this design. Moreover, MUSIC cannot model plant death due to long dry periods, or more commonly, excessive water depth (Melbourne Water, 2024). As stipulated in the MUSIC Guidelines (Melbourne Water, 2024; p.26), "further analysis and input from practitioners with knowledge of aquatic ecology are needed to make sure the plants selected will survive and contribute to pollutant removal over the life of the treatment node if non-standard designs are used." Additionally, extended detention depths, soil type and depth, the size of the saturated zone, and an established hydraulic detention time, are necessary to accurately calculate vegetated swale pollutant removal loads (kg/yr) in MUSIC (eWater, 2015).
Sediment Basins	The eastern and western catchments outfall to sediment basins via a piped system. Both basins have a drying zone and access track to provide for future maintenance	Two small sediment basins treat approximately 68% of stormwater inflows during low-flow events. Only partial routing of stormwater to the eastern sediment basin occurs. Around 32% of inflows are treated by gravel-filled, porous filter banks, bypassing both sediment basins altogether. During high flow events (<20% AEP), around 82% of total stormwater

		flows, comprising 100% of external sub-catchments A and B plus 75% of the eastern sub-catchment run-off, bypasses both sediment basins.
Bioretention system	A bioretention basin is included to treat the western sub-catchment and is proposed to be well planted, and like the swale will follow contours to ensure a gentle grade.	MUSIC schematic indicates that there is no bioretention basin treatment for the main eastern sub-catchment or 86.7% of source catchment inflows (i.e., Lots 34-59 and both external catchments). However, Appendix 3 – Table A.5.3 (p.203) somewhat confusingly classifies the 'Porous Banks' as 'bioretention systems,' which does not align with conventional definitions of such systems. This creates significant uncertainty around how pollutant load reductions are calculated when the treatment nodes used in the MUSIC schematic do not match the actual design characteristics of the WSUD elements they are intended to represent. Non-standard nodes like the 1.3ha ephemeral wetland comprising grasses and sedges for Latham's Snipe are far more challenging to model in MUSIC. They require detailed custom data-inputs to estimate detention time and nutrient uptake, like: - wetland/swamp geometry (surface area m2), - extended detention and saturated zone depth - estimated outflow rate (dependent on soil impendence and vegetation characteristics - Vegetation Factor - conservative low nutrient uptake curves (k-C)

		Moreover, Bioretention System Guidelines (Melbourne Water, 2019) recommend the use of bioretention systems only in specific circumstances, specifically when the terrain won't support wetlands (as they are far more effective) or when the footprint needs to minimised. In this instance, neither circumstance applies; as the original drainage design supported a 2146m^2 constructed wetland, 360m^2 sediment basin, and small 35m^2 bioretention basin with a significantly smaller combined footprint than the proposed hybrid habitat-stormwater treatment system. Similarly, the Bioretention Guidelines also include criteria for when **not** to use a bioretention system. Many of the criteria apply now or will in the future (as sea level rise, and more frequent extreme weather events such as storm surges, which erode and risk inundating parts of the system), namely: - Sites that are too wet or receive frequent flows - Catchments >10ha - On floodplains - In flow paths with restricted drainage into waterways - Sites without appropriately sized pre-treatment measures such as sediment traps - Sites subject to velocities >1m/s for the 1% AEP (1 in 100 year ARI) - Sites with tidal influence or shallow saline groundwater - Sites with acid sulphate soils
Gross Pollutant Trap (GPT)	No design or maintenance details provided for the GPT	Only one of the proposed pipe outlets is proposed to discharge to a

	other than its proposed location.	GPT, multiple other outlets discharge without any gross pollutant capture. The rationale behind this choice is unclear. It should be explained how gross pollutants and litter discharging from the other proposed outlets will be dealt with and proposed GPTs and their maintenance requirements need to be explained in the report.
Re-use tanks	2000lt re-use tanks connected to toilets	The model assumes that 100% of each roof catchment drains to the tanks, however it is typically less (~80%) as not all downpipes can be directed to one tank. The MUSIC modelling should be updated to assume the actual feasible roof catchment that can be connected to the tanks.

A1.3 Ecological Suitability and Modelling Gaps

The hybrid nature of the design means it was modeled with a tool (MUSIC) not intended for ecological forecasting. **MUSIC is limited to water quality and quantity simulation** – it cannot predict ecological outcomes like habitat suitability. Appendix A explicitly tabulates how MUSIC lacks the ability to model critical ecological parameters. For example:

- Vegetation structure: MUSIC allows the user to select a generic vegetation density (low/med/high) that affects nutrient removal rates, but it **does not capture spatial heterogeneity or vertical structure** of vegetation. For Snipe, the ideal habitat has a mix of dense cover and open patches, with vegetation of varying heights (20–60 cm tall). MUSIC cannot ensure or evaluate that; it only cares about vegetation from a pollutant removal perspective. This is a limitation – the engineering model might say "high density vegetation gives best nutrient removal," but ecologically that might be worst for Snipe if it means uniformly dense reeds.
- Plant species traits: The type of plants (e.g. salt tolerance, rooting depth) is not considered in MUSIC. However, these traits are crucial for whether the planted habitat will survive and provide food (invertebrate communities) for

Snipe. A limitation here is that the design's success requires species that can handle wet-dry cycles and possibly some salinity. There's no way that MUSIC can test the performance of the species mix under different climatic conditions, or when the habitat might fail. The gap between model outputs and ecological reality is significant.

- Wildlife usage and behaviour**:** Obviously, no hydrological model can simulate how a bird will use a site. But the limitation is that **the proponent has not used any ecological modelling or reference analogues to substantiate the habitat creation**. An offset of this kind would ideally refer to precedents (has something similar been done elsewhere successfully?) or use habitat suitability indices. We see a lack of such evidence. This suggests the design is somewhat speculative from an ecology standpoint.

- Drawdown and soil wetness: One key aspect for ephemeral wetlands is the drawdown rate (how quickly water recedes after filling). Snipe need the mud to be exposed yet soft (not baked dry) for foraging. This is influenced by soil type and evapotranspiration. MUSIC lumps these into simple parameters and does not, for instance, ensure that water will linger in depressions for a certain number of days. The **fine-tuning of hydrology for ecology is thus a limitation** – it's not guaranteed by the design process used.

To reinforce these points, the following points highlight important limitations of MUSIC relative to ecological requirements:

- Plant species / functional traits*:* Not modelled in MUSIC, yet the offset needs specific tussock/grass species adapted to episodic inundation and possibly slight salinity. The model's limitation is no input for species – it assumes any plant works as per default. The design risk: chosen plants might not establish or might not support necessary food (invertebrates) for Snipe depending on climatic conditions.

- Plant height or architecture: Not modelled. The ecological requirement is for layered vegetation with open sightlines under 0.6 m for Snipe to feel secure but hidden. Limitation: No guarantee the constructed wetland will have the right structure; if it grows too tall or too uniform, that's unsuitable, but MUSIC would still count it as treating water fine.

- Root depth / soil interaction*:* Not modelled. Ecological need: deep roots can maintain soil permeability and create microhabitats. Limitation: If compaction occurs or shallow-rooted species dominate, hydroperiod might shift (waterlogging or quick drying) beyond what Snipe prefer.

- Evapotranspiration (ET): MUSIC uses climate data for ET in a simplified way, not accounting for seasonal vegetation changes. The **timing of wet vs dry** spells is crucial for habitat – e.g., ideally the area holds water through early summer when Snipe are still here, then dries later. Without dynamic modeling, they can't assure that timing.

Overall, these limitations mean the SWMS's **ecological performance is essentially unquantified**. It is a trial that will only be proven (or not) after construction, by observing whether Snipe use it and whether water quality metrics are met. Such an approach is fundamentally at odds with EPBC Act expectations, which require demonstrating likely success *before* impacting the environment, not after.

A1.4 Unverified model assumptions and generalisations

Model limitations

In MUSIC and other environmental models, small changes in parameter values can lead to large variations in output results due to the model's sensitivity to key inputs and assumptions. This is particularly important when modelling natural treatment systems like swales and bioretention designed for both hydrological function and ecological outcomes. Studies on bioretention cell design have found that certain parameters, such as soil media depth and hydraulic conductivity, have a substantial impact on model responses (Tansar et al 2023). Recognizing these influential parameters is essential for effective model calibration and optimization, particularly since studies validating MUSIC model performance are scarce, and show limited accuracy (+/- 30%) to measured pollutant reduction data (Fowder et al, 2022 ; Imteaz et al, 2013). Given that the modelled output performance for all parameters are well within a 30% margin of error, (especially for TSS and TN), caution should be exercised in accepting the projected pollution reduction results at face value.

Table A1.4 – Analysis of the MUSIC modelling assumptions

Category	**Assumption or Generalisation**	**Explanation - Why it's a Generalisation/Misrepresentation**	**Supporting Sources**
Hydraulics	**Standard swale flow (open-channel conveyance)**	The filter bank is represented as a conventional vegetated swale, implying continuous open-channel flow along a sloping channel. This assumes runoff simply flows through vegetation, as MUSIC's swale module is designed for an *open channel system*. In reality, the banks are **on-contour and act like**	eWater MUSIC v6 documentation (Swale as open channel); Derwent Estuary Program WSUD

Category	Assumption or Generalisation	Explanation - Why it's a Generalisation/Misrepresentation	Supporting Sources
		check-dams, causing water to pond rather than freely convey. Near-zero longitudinal slope leads to stagnant or waterlogged conditions – a regime outside MUSIC's normal swale assumptions. The model must ignore the intentional energy dissipation and ponding; for example, any "exfiltration" used to mimic seepage through the porous bank is treated as a loss to groundwater, whereas in reality water slowly passes through to the next pond. **Flow attenuation** is thus oversimplified. Notably, Melbourne Water's MUSIC guidelines caution that MUSIC is **not suitable for detailed flow conveyance or flood design**, so using a swale node for what is essentially a small detention structure is a necessary but significant generalisation.	Guide (swale slope & ponding limits); Melbourne Water (2022) MUSIC Modelling Guideline (flow conveyance limits)
Pollution Removal	**Assumed swale treatment performance**	The model assumes the filter banks remove pollutants like a vegetated swale – via sedimentation, filtration by vegetation, and some infiltration. This is an unsupported generalisation because the banks are designed for habitat creation and flow control, not specifically optimized for pollutant removal. In practice, **swales alone rarely achieve all stormwater pollutant targets**, especially for nutrients; they mainly trap coarse sediments	Derwent Estuary WSUD Guidelines (swales as pre-treatment, coarse sediment focus); Imteaz *et al.* (2013) – MUSIC accuracy study (variable pollutant removal predictions)

Category	Assumption or Generalisation	Explanation - Why it's a Generalisation/Misrepresentation	Supporting Sources
		and serve as pre-treatment. Representing the banks as swales may thus overstate their nutrient removal or ignore differences in water quality processes in ephemeral pools (e.g. longer settling time but potentially less bio uptake). Moreover, MUSIC's built-in k–C* parameters for swales might not match the filter bank's actual performance. Studies evaluating MUSIC indicate that while flow volumes can be simulated well, **MUSIC's predictions of pollutant removal (TSS, TN, TP) are variable and often do not precisely match field results**. In other words, using a generic swale model introduces uncertainty in how accurately it reflects the filter banks' true water quality function. In the absence of proper maintenance at the prescribed frequency, swales can lose both runoff conveyance and water quality treatment ability	Ekka et al., (2021)-crucial role of regular system maintenance to maintain system performance Zhang et al., (2018) – importance of the right balance between infiltration and retention capacities of bioretention soil media
Habitat Representation	**No ecological/habitat function in model**	MUSIC does not account for ecological or habitat outcomes – it treats the swale purely as a hydraulic treatment device. Representing the filter bank as a swale therefore **omits the ephemeral wetland habitat function** that is central to the design.	Hansen *et al.* (2024) – *Latham's Snipe Wetland Habitat Guidelines* (shallow water habitat needs); Melbourne Water *Constructed Waterway Design*

Category	Assumption or Generalisation	Explanation - Why it's a Generalisation/Misrepresentation	Supporting Sources
		MUSIC does not simulate **habitat parameters** like depth-duration thresholds, hydroperiod class, or connectivity — all critical to Latham's Snipe and other wetland fauna. Similarly, the software **cannot track inter-event surface water presence,** as no functionality exists to model ephemeral surface water bodies that persist for weeks or months after rain. The banks are meant to create shallow, temporary ponding that provides habitat for fauna (specifically Latham's Snipe). The model, however, **cannot simulate intermittent ponding duration, water depth variations, or the vegetation structure/dynamics needed for habitat.** For example, Latham's Snipe require wetlands with very shallow water (<10 cm) and muddy margins for feeding, and a dense but gappy vegetative cover. These conditions – variable periodic inundation and drawdown, appropriate vegetation heights and spacing, and mudflat exposure – are not represented in a MUSIC swale node yet are crucial for habitat function. Crucially, vegetation characteristics cannot be modelled as there are no inputs for species type, height, patchiness / spatial structure, open mud areas, layered vegetation, root depth architecture, transpiration dynamics, species-specific water use (i.e. drought tolerance), or	*Manual* (2018 – habitat diversity in design) Dudrick et al. (2024) - Plant structure, height, and succession not modelled in MUSIC Payne et al. (2015) - MUSIC cannot evaluate biodiversity or ecological function, as they are not built to simulate habitat structure or long-term plant performance. Tanser et al, (2023) - understanding of the behaviour of design parameters of bioretention structures under different rainfall conditions is crucial for effective implementation (Chaves et al, 2024)-need to calibrate soil-water interactions (suction head,

Category	Assumption or Generalisation	Explanation - Why it's a Generalisation/Misrepresentation	Supporting Sources
		succession in MUSIC. All these parameters are essential for ecological function and known to influence treatment outcomes. MUSIC does *not* model plant root architecture or root depth, as there are no input parameters for **root depth**, **root biomass**, or **root density.** Therefore MUSIC cannot simulate how roots alter infiltration rates, soil porosity, or nutrient uptake dynamics. Hydroperiod/intermittency or seasonal wetting and drying is also not modelled, as MUSIC assumes event based, flow-through, not ponding-drying cycles; as it uses a daily timestep rainfall-runoff engine based on event frequency, not seasonal soil moisture balance or groundwater-surface water interaction. Using proxy input parameters like "Vegetation Density" (High/Med/Low to capture ecological function is inappropriate. This parameter value relates to TN/TP removal rates rather than habitat structure (eg. tussock spacing, roost cover, muddy foraging zones). As a result, the **ecological benefit is entirely unaddressed** by the model. This is a significant generalisation because the design's success is measured not just by water quality but by habitat criteria. Indeed, stormwater design guidance emphasizes providing physical	porosity, wilting point) using site specific data inputs to determine biological treatment capacity and hydrological dynamics in a changing climate

Category	Assumption or Generalisation	Explanation - Why it's a Generalisation/Misrepresentation	Supporting Sources
		habitat diversity (e.g. a mix of pools, riffles, benches, varied vegetation) to support fauna, which a conceptual water quality model like MUSIC cannot capture. Thus, using a swale in MUSIC treats the filter bank as if it were solely an engineering device, overlooking its purpose as an ephemeral wetland habitat.	
Transparency	**Surrogate modelling requires explicit documentation**	Because MUSIC has no dedicated feature for a "raised porous filter bank", using a vegetated swale node is a surrogate approach. This approach involves numerous assumed parameters (flat grade, high roughness, added exfiltration to mimic seepage, etc.) and could be **misleading if not clearly explained**. The generalisation is that the filter bank is "close enough" to a swale to model – an assumption that must be justified to regulators. Without transparency, a reviewer might see a swale in the model and interpret it as a normal conveyance swale, missing the fact that it's actually an impounding habitat structure. Therefore, all these modelling assumptions need to be made transparent. Best-practice guidelines call for **clear documentation of modelling**	WaterNSW (2017) *MUSIC Modelling Guidelines* (record assumptions in model notes); Melbourne Water (2022) *MUSIC Guidelines* (document design intent for treatment assets)

Category	Assumption or Generalisation	Explanation - Why it's a Generalisation/Misrepresentation	Supporting Sources
		assumptions in reports and even within the MUSIC file (using the built-in notes feature). Melbourne Water similarly requires designers to **document and explain the design intent** of any non-standard stormwater asset in the concept stage. By explicitly stating that the swale node is used as a proxy for an ephemeral filter bank (and detailing the parameter tweaks), the submission maintains transparency. This ensures regulators understand the generalisations made and their implications, addressing the limitations of the MUSIC representation upfront.	

A1.5 Conflicting Objectives and Design Trade-offs

Finally, it's worth highlighting the inherent **trade-off between water treatment efficiency and habitat quality** – a limitation that no design can fully escape when trying to serve two masters. For instance:

- To maximize stormwater pollutant removal, one might design for longer retention times and dense plant uptake (to remove nutrients). But longer retention could mean more standing water (less mud exposure) and dense emergent vegetation, which is *worse* for Snipe habitat needs.
- Conversely, to maximize Snipe foraging, one would want periodic drawdown and a mix of vegetation and open areas. But if the water is not retained long enough, or much of the area is open mud (less vegetated), pollutant removal may be insufficient to meet water quality targets.

These competing demands mean the design must strike a balance. However, it's quite likely that in trying to do both, it does neither optimally. The **Nature Advisory report itself notes** the stormwater outcome is a "byproduct" of habitat design. This implies some compromise on treatment efficiency. The risk is that regulators for water might not accept sub-par performance, forcing retrofit or changes that then compromise habitat. Or vice versa: if water authority insists on, say, more wetland area for treatment, they might impact too much of the habitat with unsuitable drainage infrastructure.

In essence, the **dual-use approach is a limitation in reliability**. A standard single-purpose system can be optimized for that purpose. A dual-purpose system is always managing compromise. Without extensive trials, it's speculative to claim you can hit the sweet spot that satisfies both water engineers and birds.

A1.6 Underestimation of Habitat Extent

Previous submissions raised serious concerns relating to the Nature Advisory Snipe habitat map, particularly its striking similarity with the BirdLife East Gippsland map, and the failure to acknowledge it as a primary source in their previous submission. Nature Advisory has since acknowledged the map supplied but has not addressed or adequately responded to the flaws in mapping methodology highlighted by the Gippsland Environment Group EPBC submission. Consequently, the proponent's PD contains the original Nature Advisory habitat map essentially unmodified.

Flawed Snipe habitat mapping: Nature Advisory's map of Latham's Snipe habitat (Figure 5) and subsequent habitat area calculations, were largely derived from survey mapping data supplied by BirdLife East Gippsland (Figure 6). This is demonstrated by overlaying the BirdLife East Gippsland map of Latham's Snipe observations from 2016 to 2023 with Nature Advisory's mapped Latham's Snipe habitat (see Figure 7).

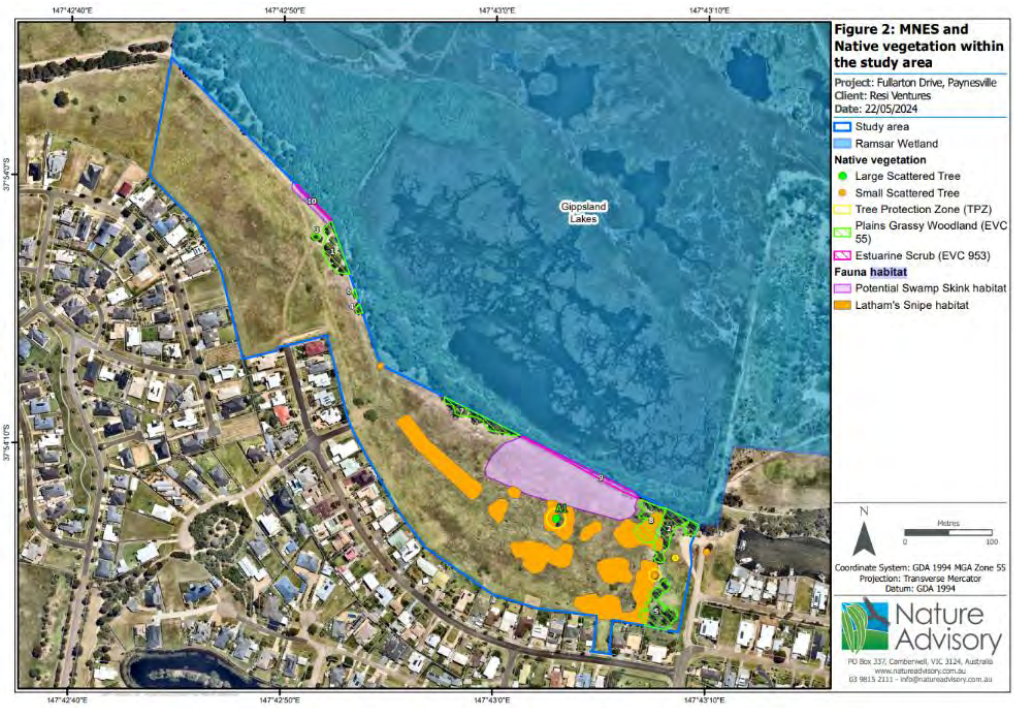


Figure 5. Nature Advisory Map of Latham's Snipe habitat

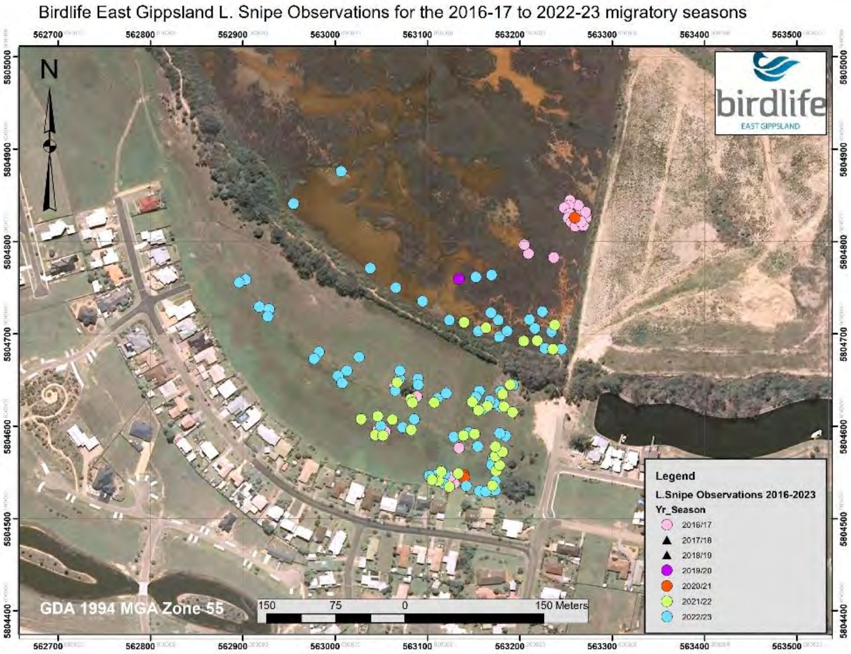


Figure 6. BirdLife East Gippsland map of Latham's Snipe observations 2016-2023

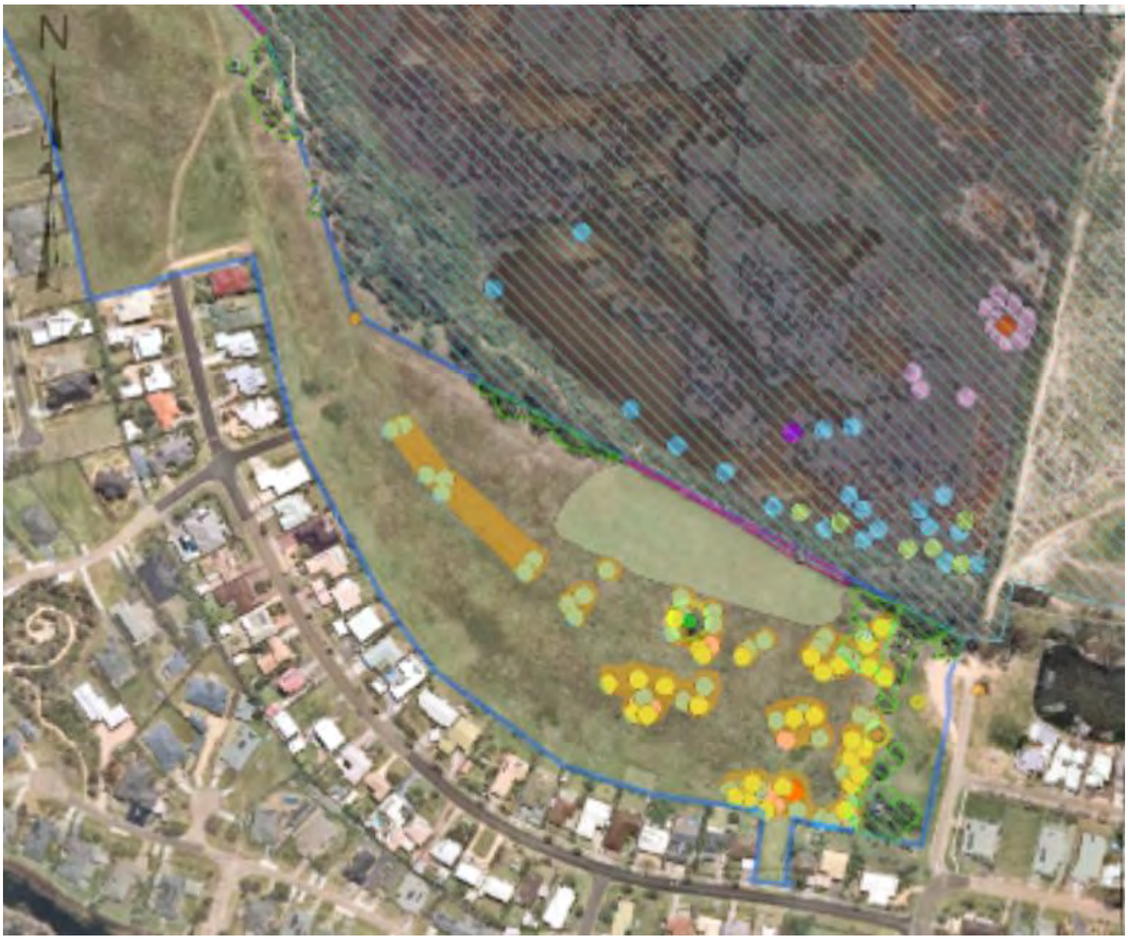


Figure 7. Overlay Analysis: BirdLife East Gippsland's Latham's Snipe survey data compared to Nature Advisory's snipe habitat map

The incredibly close correlation between the BirdLife and Nature Advisory maps is unmistakable.

The key distinction between the two Snipe habitat maps is the inclusion, in the Nature Advisory version, of a linear extension of habitat along the underground sewage pipe that runs east–west through the eastern portion of the study area (refer to Figure 8). According to the referring party, “this underground pipe has impeded the downhill flow of water, and kept that section of ground damper than surrounding areas” (Referral, Section 4.1.5.2, p.20).

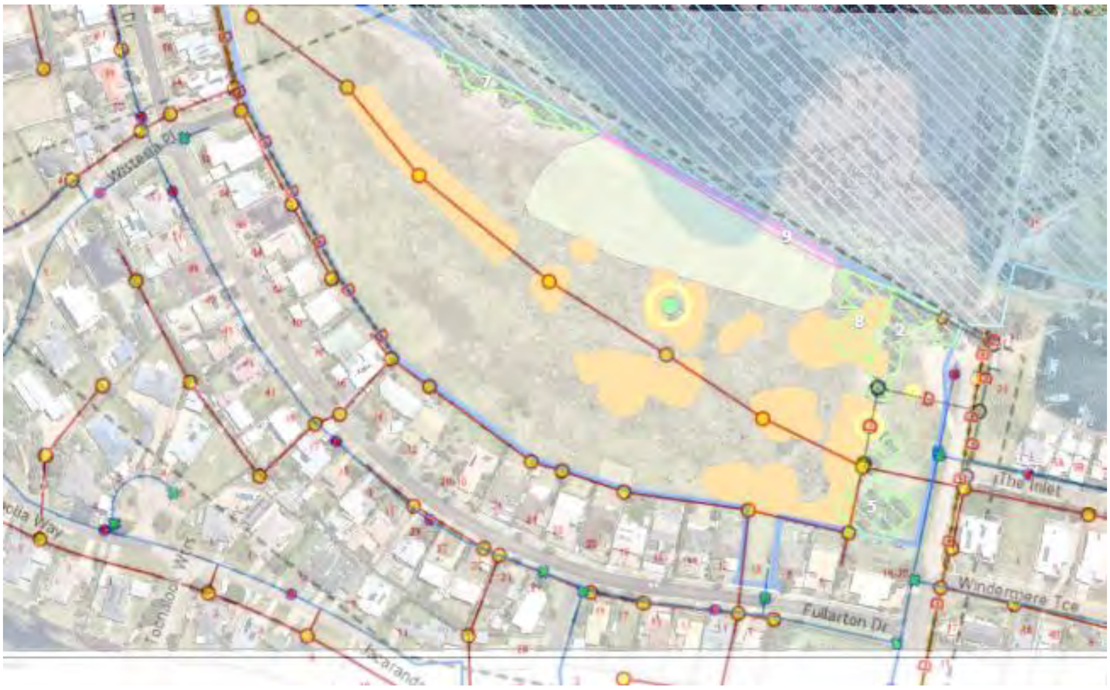


Figure 8. Overlay of underground sewage pipe (red line) with Nature Advisory's Snipe habitat map

Curiously, Nature Advisory's mapped habitat does not appear to follow the full length of the underground pipe despite the damper ground conditions generally occurring along the entirety of the pipe's path (NB: pipe shown as the red line in Figure 8 above).

Figure 9: Nearmap aerial view of the eastern outfall (circled in blue) - Photo taken Feb. 2024

Similarly, the damper conditions around the stormwater outfall pit (circled in blue in Figure 9) are clearly visible from this aerial image. Note the dark green patch leaching downslope all the way down to the Ramsar boundary. Following periods of adequate rainfall the soft soil conditions and excellent ground cover usually make this area ideal Snipe habitat.

Once again, significant Snipe habitat also appears to have been omitted from Nature Advisory's habitat map, and consequently, from total Snipe **habitat area estimations**.

Notably, Biosis were commissioned by the proponent to undertake the initial flora and fauna assessment which led to the recommendation for an EPBC referral and the engagement of Nature Advisory as the referring party. The Biosis fauna surveys conducted over the course of a couple of survey hours between 2-3 February 2023 by consultant zoologist Dr Jonathan Botha, detected 3 Latham Snipe within the project area (Attachment 3 -Flora & Fauna Assessment (2023); p.20; map reproduced in Figure 10).

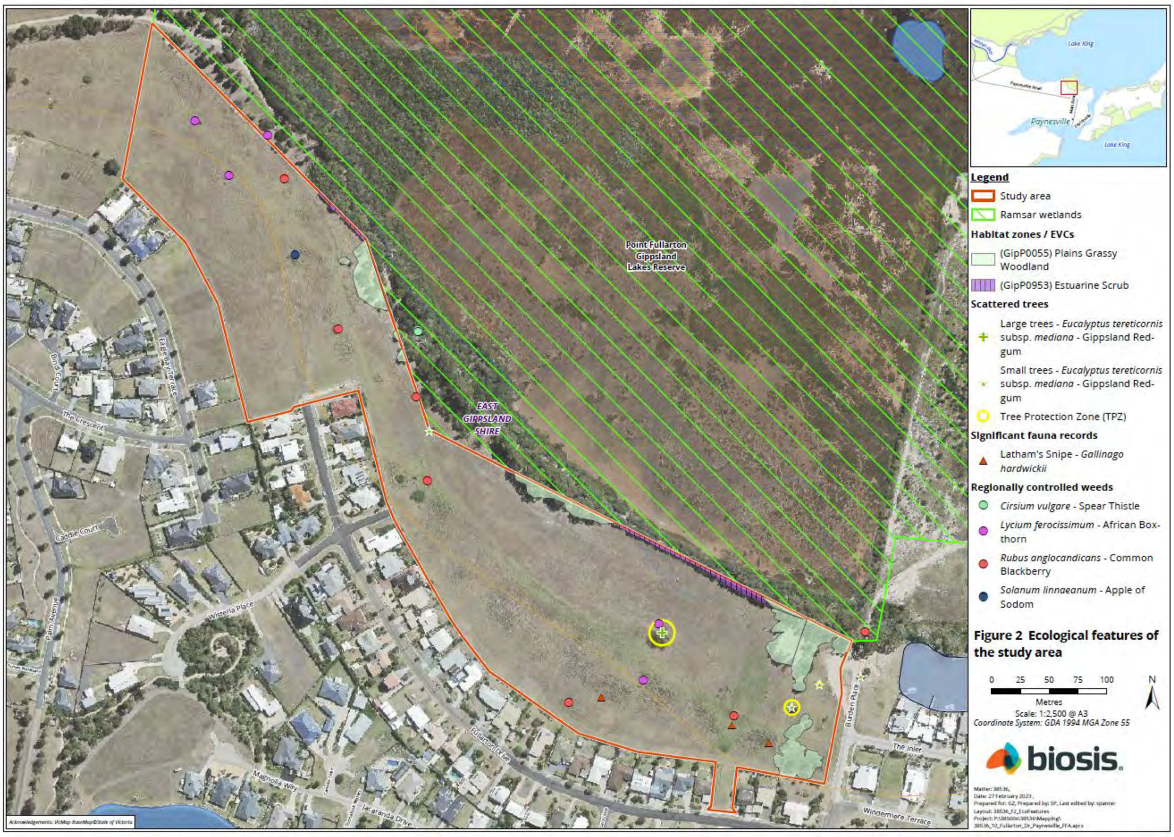


Figure 10: Biosis ecological features map showing Snipe locations (red/orange triangles)

When overlaying both maps however, it appears Nature Advisory's Snipe habitat map omitted two of the three observations made by Biosis (see Figure 10 overleaf). The net effect of this and other omissions of ground surveyed Snipe locations is to **substantially underestimate** the actual Snipe habitat area on site.

Figure 11. Overlay Close-up: Comparing the Biosis and Nature Advisory maps shows two of three Latham's Snipe detections (orange triangles) not included in Nature Advisory's mapped habitat.

When overlaying both maps however, it appears Nature Advisory's Snipe habitat map omitted two of the three observations made by Biosis (see Figure 11). The net effect of this and other omissions of ground surveyed Snipe locations and potential habitat is to **substantially underestimate** the actual Snipe habitat area on site.

Flawed Snipe habitat mapping methodology: Nature Advisory's mapping methodology is said to include both foraging and roosting habitat of Latham's Snipe, being derived from aerial interpretation and ground truthing (Attachment 2 - MNES Report, p.10). The Nature Advisory Snipe habitat map is labelled as "Figure 2" in their referral documents, and Snipe habitat is defined as:

- "Where this grass is particularly damp, muddy, and supports some tussock-forming native grasses, it is known to be used as foraging habitat by Latham's Snipe *Gallinago hardwickii* (Figure 2)"

- "Grassed areas on the slope are used predominately as roosting habitat by Latham's Snipe (Figure 2)"

Aside from the exclusion of substantial areas of foraging habitat adjacent and downstream of the stormwater outfall on the eastern slopes and along the damp sewer line, the main issue with this methodology is that it is not systematically applied.

This inevitably leads to the exclusion of most of the foraging and roosting habitat within the project area.

- The *prima facie* evidence suggests the referring party's Snipe habitat map was *primarily* derived from observational records, rather than the composition, condition and structure of vegetation and underlying soils repeatedly emphasised throughout the referral documents.

- The overlay analysis presented in section 3.1 (Figure 7) contradicts the ambit claim that aerial photograph interpretation and ground-truthing were the primary methods used to map the habitat of Latham's Snipe.

- We contend that the very close correlation between Nature Advisory's habitat map and BirdLife East Gippsland's map of Snipe observations is irrefutable, and inconsistent with the claimed mapping methodology.

Mapping habitat of any given species predominantly on the basis of observational records or detections is problematic for several reasons:

- Maps derived from species observations tend to reflect survey effort rather than species distribution or the exact location of preferred habitat. Detectability of a species at a particular site depends on the time, or effort, spent surveying the site and the detection rate (probability of detecting the species per unit of survey effort) during the survey. (Moore & McCarthy 2016)

- The BirdLife East Gippsland map (which the Nature Advisory Snipe habitat map is largely modelled on), was the result of three 45-minute surveys per season (Aug- March) over the past 7 years, for a total survey effort of approximately 15.75 hours.

- Moreover, the detectability of a species may vary between sites due to differences in the terrain (Hauser & McCarthy 2009) or abundance of the species (McCarthy *et al*. 2013).

- In addition, the detection rate may vary temporally, due to changes in the activity or visibility of a species through time (Watson *et al*. 2008; Southwell and Low 2009), changes in survey conditions or variation between observers (Moore *et al*. 2011).

This means that species observations are dependent on a broad suite of variables; and not detecting a species in suitable habitat is always a possibility.

> The inherent variability of survey detections therefore makes observational data a poor indicator of habitat distribution and should not be relied upon as the primary basis of habitat mapping.

Even though Nature Advisory acknowledge that sedges and grasses on damp, muddy soils are the preferred foraging habitat within the site, extensive patches of this vegetation are excluded from their Snipe habitat map (see photos 1-4).

Depending on the prevailing weather and the frequency and intensity of site disturbance (slashing, cattle grazing), the entire north eastern floodplain can be covered by tall grasses and sedges on soft, damp ground (see photos 1 and 3).

Photo 1 –Tall grasses, sedges of foraging and abutting the Plains Grassy Woodland along northern Ramsar boundary excluded from the Snipe habitat map

Photo 2 –Tall grasses and scattered Bracken Fern along the north-sloping southern boundary. Most of this roosting habitat is excluded from the Nature Advisory Snipe habitat map.

Photo 3 –Grasses and sedges within the depression in the central eastern area are mostly excluded from the Snipe habitat map. Linear patches of Plains Grassy Woodlands and Estuarine Scrub can be seen along the freshly slashed northern Ramsar boundary.

Photo 4 –Tall Grasses, Sedges, Bracken Fern & scattered African Box-thorn bushes on the north-sloping southern boundary of the project area (Latham's Snipe circled in red).

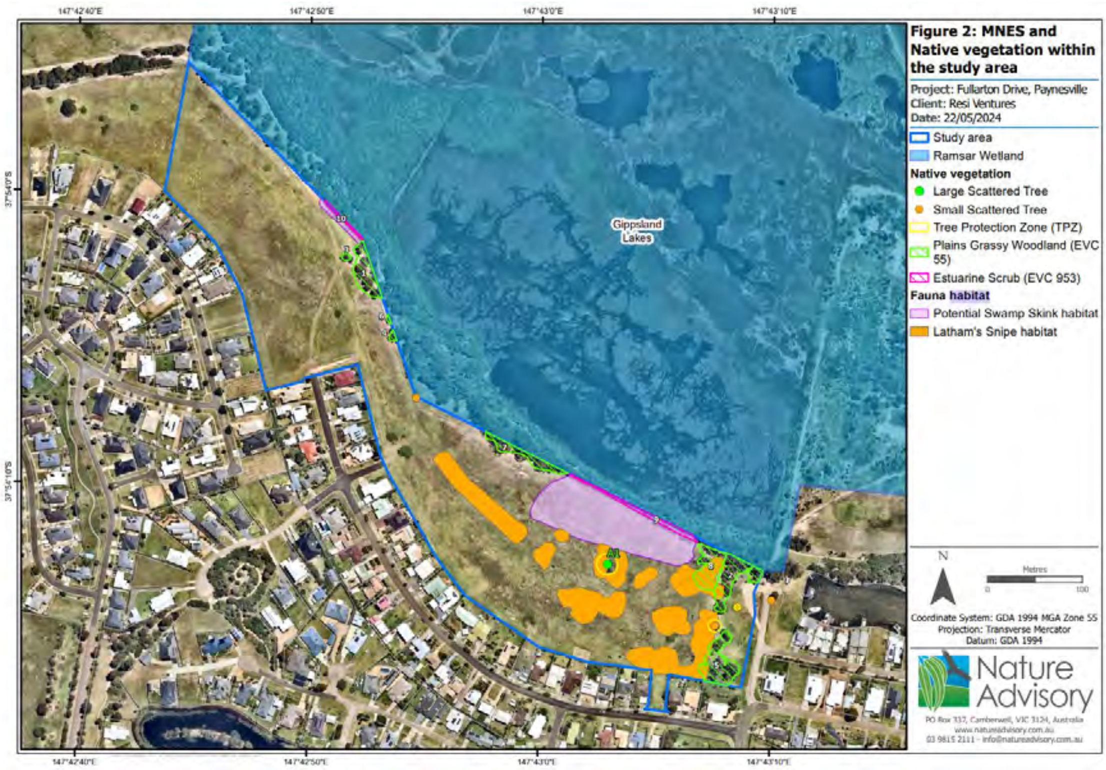
Furthermore, the proponent's Biosis report found:

- "Grassy vegetation **across the slopes** and **within the depression in the central eastern area** also provide refuge and resting sites for Latham's Snipe and possibly for other water birds which forage in the adjacent wetland areas". (Attachment 3-Flora & Fauna Assessment, p.11).
- Biosis also noted that the "grassy vegetation on **the north facing slopes of the study area may provide habitat for the listed migratory species of Latham's Snipe**" (Attachment 3- Flora & Fauna Assessment, p. 33-34 and see photos 2 and 4).

Once again, most of the northern slopes and the low-lying central eastern area is excluded from the Nature Advisory Snipe habitat map.

Further mapping irregularities

The Latham's Snipe habitat map (Figure 2) is inconsistent with Latham's Snipe Habitat Offset Management Plan (Figure 4) (both reproduced below)



The Offset Snipe Habitat map includes the Plains Grassy Woodland as additional existing roosting habitat, despite never having identified this EVC as existing habitat in either the original MNES Snipe habitat map or the current one.

No justification for the inclusion of previously unidentified additional roosting habitat has been provided. The rationale for such a significant alteration to the roosting habitat area has not been established nor supported by any evidence

Dynamic vs static habitat mapping

The referring party does however partially acknowledge the importance of weather and climatic variables on the overall extent and condition of Snipe habitat. In the Appendix of the MNES Report (Habitat Description), which cites BirdLife East Gippsland data, it admits “during wet years when overland flow is more extensive Latham’s Snipe has been observed using a wider area of the site, whereas in dryer years, habitat is more confined and activity more limited.” (Attachment 2 MNES Report 2023, p.50).

Yet despite this acknowledgment;

- the Nature Advisory habitat map is restricted almost exclusively to Snipe observation records supplied by BirdLife East Gippsland, and,
- very little allowance appears to have been made for weather variations or disturbance impacts on vegetation and soil condition in the formulation of their Snipe habitat map.

Moreover, mapping habitat must necessarily be a *systematic* exercise that assesses a site's dynamic habitat potential across a wide temporal and spatial scale. Otherwise, one risks capturing just a single snapshot of potential habitat that is;

a) a largely static or coincidental representation of habitat extent and condition at the time one of one's visit,

or as appears to be the case in this instance,

b) reflects a snapshot of Snipe detection point data, irrespective of the entire site’s actual habitat potential.

For this reason:

- the Nature Advisory habitat map is not a comprehensive map of important Snipe habitat. It does not include all potential foraging and roosting habitat in any given wet year, nor account for the disturbance history of the site.
- In fact, this critical map excludes most of the Snipe roosting and foraging habitat on the slopes, and much of the important habitat on the floodplain, due to the

flaws in its undeclared methodology (i.e., limited survey data interpretation with selective ground truthing).

The net effect of excluding large areas of suitable or potential Snipe habitat is to significantly under-report the total area of Latham's Snipe habitat directly impacted by the proposed action. This in turn substantively **reduces the Area of Habitat** utilised for the **Offset Assessment**, **reducing the residual impacts** on the protected matter and **overstating the net gain** in habitat derived from the compensatory measures.

Conclusion (Appendix 1):
The stormwater/habitat design as proposed has multiple limitations: it is exposed to climate hazards that threaten its longevity; it remains partially un-designed or unproven in crucial details (especially the determination of existing habitat area); its modeling does not cover ecological success; and it embodies inherent trade-offs that introduce uncertainty. All these factors underline why **a far more cautious approach is needed**.

The proponent's optimistic projections should be tempered by recognizing these limitations – many of which were pointed out in previous submissions and remain pertinent.

If the project proceeds, these design limitations need to be fully addressed through an improved Onsite Offset Habitat Area assessment, more detailed engineering, robust contingency planning, and stronger assurances via a redesign of lot yield and infrastructure siting plus other conditions) to avoid significant impacts on MNES.

Appendix 2: Hydrological and Ecological Feasibility Critique

This appendix provides a focused critique on the feasibility of achieving the intended hydrological and ecological outcomes of the proposal. It examines whether the conceptual plan for the created wetland habitat is realistic given known ecological requirements and hydrological constraints, and whether the claims of "no significant impact" are technically justified.

A2.1 Hydrological Feasibility for Habitat Support

The feasibility of the created wetland to support a functioning Snipe habitat depends on whether the **water regime** (inundation depth, frequency, duration) can be maintained within suitable bounds. Based on the information provided, there are reasons to doubt this feasibility:

- Dependence on Uncertain Water Inputs: The only water inputs to the offset wetland will be stormwater runoff (plus direct rainfall). This means during dry weather, the wetland will dry out completely, and during wet weather it might receive large pulses. Natural Snipe wetlands (such as wet meadows or seasonal marshes) typically have more gradual hydrology or groundwater influence that keeps moisture available even in between rains. Here, unless rain falls, the site will become dry and possibly hard.

  The proponent has not indicated any supplemental water source or design feature to retain moisture (e.g., subsurface clay liner). Thus, in a dry summer or during below-average rainfall periods, the supposed foraging habitat could be a dry pasture for weeks or months. Snipe can tolerate some dry periods (they may leave if too dry), but if the wetland is only intermittently suitable, it undermines the offset's goal.

  Hansen (2024) was cited noting Snipe site utilization drops off when water is either too little or too much. This offset will likely swing between those extremes – too little water in drought, too much immediately after heavy rain. Designing a purely rain-fed wetland to reliably mimic the hydrology of a marsh is not straightforwardly feasible.

- Drainage and Dry-Down Rates: After a storm fills the wetland area, how fast will it drain or evaporate? If the soil is sandy and there's an underdrain (not specified, but if not lined it will percolate to groundwater), the water might drain away within a day or two – leaving dry soil. If it's more clayey, water might pond longer, which could be good initially, but then risk being too prolonged (stagnant water leading to mosquito issues, etc., which residents will pressure to "fix"). The feasibility concern is that it's hard to engineer an ephemeral wetland to hold water for, say, 1–2 weeks after rain (ideal for invertebrates to flourish for Snipe feeding) and then dry, without either drying too fast or holding too long.

  Fine-tuning that would require either controlled outlets or a lot of trial and error. The documentation doesn't show any such control structures. So, feasibility-wise, hitting that sweet spot hydrologically is very uncertain.

- Interaction with Existing Groundwater: It's not stated whether groundwater is shallow on site. If groundwater is high, the basins could become semi-permanently wet (which could breed reeds; Snipe tend to avoid deep continuous water). If groundwater is deep, then during dry spells the wetland won't have any baseflow.

> Without a hydrogeological assessment provided,
> there's an unknown variable. Feasibility of maintaining
> a target hydroperiod is limited by these unknowns.

- Handling Extreme Wet and Dry**:** Climate variability means back-to-back storms will at times saturate the area (possibly making a large portion more like a lake for a while), and sometimes long dry spells will turn it into hardpan. Is the created habitat capable of withstanding these and bouncing back? A natural wetland has resilience (seed banks, etc.). Here, for example, if an extreme flood scours out the area, is the land manger (Council) willing and able to re-grade or replant in a relatively short period of time? If a drought kills most wetland vegetation, will they irrigate or replant? The absence of contingency for these scenarios suggests a questionable feasibility – it assumes "normal" conditions will prevail, and a land manager with the capacity and willingness to actively manage the site, which may not always be true.

> The presumption made in the Onsite Offset Management Plan (p.47)
> that the experimental stormwater basin and swales have zero chance
> of failure is not supported by the available evidence.

In summary, the **hydrological regime is likely to be highly variable and hard to control**, which casts doubt on the feasibility of consistently providing quality Snipe habitat year-in, year-out. It may function in some years (particularly average rainfall years), and fail in others (very wet or very dry years). From an EPBC standpoint, that inconsistency is problematic because the offset is supposed to continuously compensate for the loss of the natural habitat.

A2.2 Ecological Feasibility and Habitat Quality Concerns

Even if the hydrology could be managed, there are ecological feasibility issues as to whether the site will truly replicate the habitat that was lost or meet the species' needs:

- Vegetation Succession and Management**:** Creating a wetland from scratch in a disturbed paddock invites ecological succession processes that might be counterproductive. Initially, after earthworks, one might establish pioneer plant species. But over a few years, wetlands often undergo succession – for example, open mudflats get colonized by fast-growing sedges, which can become too dense; or invasive weeds find open niches. The proponent's plan calls for maintaining some areas as foraging (short vegetation) and some as roosting (taller grass) for Snipe. In practice, keeping those areas in that state requires **active management**. Foraging areas need to be kept relatively open; roosting areas need to be periodically slashed to avoid becoming woodland (if shrubs invade).

> This essentially means human intervention will be needed **indefinitely** to freeze the habitat in a desired state. Is that feasible and likely to happen? No evidence has been submitted to suggest it will.

The offset management plan lists weed control and possibly some mosaic slashing, but it relies on on-going funding and management effort over decades. If management lapses (a common issue in offsets after initial years), the habitat structure could change unfavourably. Thus, the feasibility of maintaining habitat quality is tied to long-term contractual commitments (not yet shown) that are hard to enforce once the development is done (zu Ermgassen et al. 2019).

> This is a well-known issue with offsets: created habitats often degrade without ***perpetual* management** (DCCEEW, 2024).

- Predator and Disturbance Free: Even if the physical habitat is good, Snipe might not use it if they feel unsafe. The fenced reserve is small (~3ha) and bordered by houses on one side and open to the lake (predators) on the other. *Feasibly, can this small patch support the same number of Snipe with increased edge effects?* Snipe prefer some isolation. Birds of prey will quickly learn of this patch (if it attracts rodents or frogs, for instance, raptors will patrol). The original paddock was larger and more contiguous with open land, meaning Snipe had multiple escape routes and choices to more effectively evade predators.

  > From a predator's perspective, the new reserve functions as a smaller, confined area that facilitates easier detection and capture of prey.

  There is a significant feasibility concern that, even if habitat looks suitable, the behavioural avoidance by Snipe due to perceived predation risk or disturbance may prevent the offset from achieving its intended usage. This is something that cannot be engineered away easily—except by maximizing buffer, which is not done.

- Connectivity for Wildlife: The proposed habitat is isolated by design (fenced off). While this may keep most people out, it also might hinder wildlife movement. For example, amphibians or other organisms that would naturally move between the Ramsar wetland and the ephemeral wet areas might be impeded. If frogs or invertebrates don't colonize, the food availability for Snipe might be lower than expected. The feasibility of the wetland quickly developing a rich food web is not guaranteed. Natural colonization could take time, and if the site dries too often, some aquatic invertebrate populations might not be sustainable. They might rely on egg banks or repeated re-colonization from the adjacent lake. The fence could prevent the free movement of larger fauna (like turtles) that often contribute to ecosystem function in wetlands.

These subtle ecological connectivity issues can mean the offset wetland is a bit of an artificial bubble that doesn't fully integrate ecologically with the surrounding wetland system.

- Habitat area calculations are flawed: As is evident in Table 11 (p.49) (reproduced below) which notes the comparison of habitat quality - condition, context and stocking rate of the original habitat and the proposed offset; the area of roosting and foraging habitat does not add up. According to the Offset Area Quality Table 11, the total area of Snipe habitat features is 3.16ha yet it only adds up to total 0.87ha using the figures shown in the table. Presumably, the Swales listed as 0.134ha are actually 1.34ha as mentioned in the Neil Craigie letter (p.192). However, even allowing for a typographic error, the total Snipe Habitat Area (2.076ha) still falls short by over 1ha of the claimed total.

Habitat Feature	Type of habitat	Area (ha)
Boundary tree planting	Roosting	0.547
Swales	Foraging	0.134
Wetland	Foraging	0.055
Drying zone	Foraging	0.085
Sediment basin	Foraging	0.039
Bio retention basin	Foraging	0.010
	Overall Total Habitat	3.160
	Total Foraging	2.613
	Total Roosting	0.547

Setting aside the inaccurate offset area calculations, the classification of habitat features as foraging and roosting habitat is not consistent with the Latham Snipe habitat guidelines (Hansen et al, 2024). According to the expert guidelines:

Daytime roosting habitats are characterised by thick, hummocky vegetation of highly heterogeneous (“gappy”) cover. This vegetation is characterised by tussocks with gaps between them and can also be composed of weedy species like Kikuyu. The vegetation structure is more important than the specific species (20-60cm high).

Feeding or foraging habitat usually consists of vegetation clumps (e.g. sparse sedges or rushes) in open shallow water or open muddy substrates.

The habitat features identified in the Offset Area Quality Habitat (Table 11) are not consistent with these definitions, as per the comparative table below.

Table A2.2: Suitability of Offset Area Snipe Habitat

Snipe habitat features (ha)	Type of habitat	Suitability of habitat
Boundary tree plantings (0.547ha)	Very dense (up to 10m wide), long and low shrub fence line running directly alongside the road reserve. Some contain thick fringing vegetation to stabilise the banks and assist with nutrient uptake	**Very Low** – the vegetated densely planted native shrubs in close proximity to a road is unlikely to be suitable Snipe roosting habitat. The boundary vegetation will need to be high enough to visually screen the reserve, meaning it will need to be taller than preferred height of roosting vegetation (20-60cm) for Latham Snipe to feel safe and hidden from potential predators whilst still providing a clear line-of - site (Hansen, 2024).
Sediment basin (0.39ha)	Sediment basins are ponds with open water that capture coarse sediment and litter carried by stormwater. Some contain thick fringing vegetation to stabilise the banks and assist with nutrient up-take	**Very Low -** Basins are engineered to drain quickly to protect downstream assets rather than provide persistent shallow inundation. The deepwater pools of (2-3m NWL) with steep side slopes are not suitable foraging habitat. Snipe prefer to wade and forage in 10cm of water

	(Melbourne Water 2022 and p.171 PD).	(max). Sediment basins are often compacted and periodically disturbed by desilting machinery, leaving them with a hard base with sparse or absent vegetation due to sediment accumulation and disturbance. Snipe prefer soft, saturated soils and patchy, low vegetation cover.
Wetland (0.55ha) – incorrectly labelled as is actually marked as a 'sediment basin' in the drainage plans.	As above	As above
Bioretention basin (0.010ha)	Bioretention systems are also known as raingardens. Bioretention systems promote the filtration of stormwater through a means of a vegetated filter media, utilising dense vegetative cover to maximise pollutant absorption.	**Low** - Bioretention basins are engineered to drain water quickly (typically within 24–48 hours) to protect downstream assets, which contradicts Latham's Snipe's preference for persistently damp or shallowly inundated soils. Bioretention systems are planted densely with species like *Juncus*, *Carex*, and *Lomandra* to maximize pollutant removal and stabilise the filter media. This creates dense vegetative cover, not the patchy, open structure preferred by Latham's Snipe for foraging and visibility. The steep batters and pool depth is not consistent with shallow gradients and broad, open, low-lying areas Snipe prefer.

		Inundation is highly seasonal and storm-dependent, unlikely to align with the Snipe's August–March residency.
Drying zone (0.085ha)	The drying zone refers to the area at the base or margins of a basin that periodically floods and dries, depending on rainfall, infiltration, and drainage conditions. It typically forms part of the ephemeral wetland or extended detention zone.	**Low-Medium** - The drying zone *might* provide usable foraging habitat for Latham's Snipe if the following conditions are met: -soil remains damp for weeks (soft, moist soil 0-15cm depth) and is rich in invertebrates (low pollutants and sufficient organic matter accumulation) - vegetation is appropriately spaced and not too dense (patchy vegetation) -temporary ponding with shallow water post rainfall due to outlet design and sufficient spring-summer rains
Swales (1.34ha)	A vegetated swale is a shallow, *linear* depression planted with grass or wetland species, designed to convey, filter, and infiltrate stormwater runoff. They are engineered for quick drainage, erosion control, and pollutant removal—not habitat creation.	**Low-Medium** Vegetated swales, as commonly implemented in Water Sensitive Urban Design (WSUD), are generally not suitable as primary foraging habitat for Latham's Snipe — though under heavily modified and/or incidental conditions, they may offer limited ecological value. The modifications of the proposed swale/bioretention system to allow slower conveyance and infiltration over a far wider and shallow area, have not been properly detailed; but it would appear the typical swale design will

		be significantly modified to overcome the following limitations: - Dense turf or juncus species replaced with open, patchy tussocks and sedges and intensively managed to maintain a mosaic habitat structure with open soil patches - Limited organic accumulation and low invertebrate density within typical swale channels. The suitability of this engineered Snipe habitat is unproven and will require regular and ongoing maintenance (refer to Appendix A1.2, A1.3, A1.4

- Scale and Carrying Capacity: Setting aside the Offset area calculations do not add up and the highly irregular habitat mapping, the proponent suggests the offset provides ~2.6 ha foraging and 0.5 ha roosting habitat, which ostensibly exceeds the area of habitat they acknowledge as impacted. However, the **quality** of habitat matters as much as quantity as outlined in the table A2.2.

  Larger reserves are more likely to support higher carrying capacities for Latham's Snipe and other wetland-dependent birds because they reduce edge effects, provide greater habitat heterogeneity, and allow for multiple individuals to engage in critical behaviours like foraging and roosting without disturbance. Hansen et al. (2024) emphasise that due to the loss of large, undisturbed habitat across their range, Snipe often occur in elongated or small habitat patches in urban areas, where high edge-to-interior ratios increase their vulnerability to human disturbance. This spatial constraint can reduce the functional habitat area, even if the site appears physically intact.

  Furthermore, the Birgita et al. (2025) study found that most urban wetlands used by Snipe are not only small, but also highly disturbed, and therefore recommended vegetated buffer widths between 75–110 m to reduce vigilance and flight responses. These findings imply that larger reserves not only reduce behavioural stress but also increase the effective usable area within a site. In essence, both studies highlight that reserve size strongly influences the ability to accommodate the ecological and behavioural needs of species like Latham's Snipe, making scale a critical factor in offset feasibility and success (Hansen et al., 2024; Hansen et al., 2025).

Time Lag to Functionality: Feasibility also concerns *when* the offset will achieve the desired state. Construction will cause disturbance (heavy machinery, soil settling) that likely makes the site unusable for at least one migratory season if not more. Vegetation might take a couple of growing seasons to establish. It could be, for instance, 3-5 years post-construction until the habitat is in a semi-mature, functional condition for Snipe (if it succeeds at all). Meanwhile, the impact (loss of current habitat) is immediate upon clearing for development. This time lag is important – **even if the offset eventually works, the interim years are a net loss** for the species. The EPBC Offsets Policy principle of *"timely"* implementation is at risk here. Many created habitats for offsets experience significant delays in achieving target conditions, or never do. Thus, there is a feasibility issue in terms of temporal scale: can the species endure the gap?

A2.3 Offsite and Cumulative Context

This critique also looks beyond the site at feasibility of the approach in a broader context. The development's impacts are not isolated; they add to regional trends of habitat loss. Regionally, Latham's Snipe habitats are under pressure from urbanization and drainage. For instance, the Latham's Snipe Project and BirdLife have documented multiple urban sites in Victoria being lost or degraded (e.g., the Ballarat site turned into a car park, as pictured in the 2024 guidelines). Each local loss incrementally reduces the network of sites the birds rely on.

> The proponent's strategy is essentially to convert this natural site into a semi-artificial one and claim no net loss. But **cumulatively,** this represents **a net change** – instead of a natural floodplain, it becomes an engineered system requiring maintenance.

Feasibly, can a network of engineered micro-wetlands replace natural wetlands across a region? It's a risky proposition. If this becomes a model – offsetting wetland development by building tiny on-site wetlands – the cumulative effect could be a landscape of fragmented, human-maintained habitat islands with questionable long-term viability. This is more a policy perspective, but it touches on feasibility: one or two such projects might work in isolation, but if many developments do this, the chance of multiple failures is significant, potentially leading to a larger-scale collapse in habitat availability.

From the Ramsar perspective, cumulative impacts are also relevant. The Gippsland Lakes Ramsar site is large, but margins around it are steadily being encroached upon. One development may seem minor, but multiple like it (or other activities like agriculture, infrastructure) can collectively degrade water quality or disturb wildlife. The feasibility of preserving the Ramsar site's values in the face of incremental encroachments is low unless each is rigorously managed or disallowed. Therefore, any single project must be viewed as setting a precedent. In this case, approving a project with such an **experimental offset** raises concern that others might propose similar offsets in lieu of genuine avoidance. The ecological feasibility of offsetting at scale is not established – indeed offsets for wetland-dependent fauna have a very mixed record globally.

In conclusion of this feasibility critique: the **burden of proof** that this creative approach will work lies with the proponent. As of now, there are clear doubts on hydrological control, ecological resilience, and offset adequacy.

The significant information gaps, coupled with an overreliance on future management actions by a Council already burdened with an extensive portfolio of under-resourced conservation reserves, raise serious concerns. In our assessment, the project—as currently designed—does not present a feasible pathway to achieving environmental outcomes that are equal to or better than those under a no-development scenario. Put simply, the weight of evidence suggests that partial or complete failure is more probable than long-term success under current conditions.

Appendix 3: EPBC Environmental Offset Policy – Principles Analysis

This appendix analyses the proposed on-site offset (the stormwater habitat area for Latham's Snipe) against the principles of the Commonwealth EPBC Act Environmental Offsets Policy (2012). It identifies where the current proposal falls short of these principles and thus why it should be considered an inadequate offset under EPBC standards.

The EPBC Environmental Offsets Policy sets out **ten principles** to ensure that any offsets genuinely achieve environmental protection goals. Principles 1–8 detail what an offset must do to be considered suitable. Below, we evaluate the Shearwater–Paynesville offset concept against the most relevant of these principles:

Principle 1: Improve or Maintain Viability – *"Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action."*.

- **Analysis:** The proposed offset is **inherently uncertain in delivering an equal or better conservation outcome**. The aspect of the environment in question is the local Latham's Snipe population and its habitat (as well as the adjacent Ramsar wetland's values). The action will remove all of the existing in-situ habitat and replace it with a smaller, human-designed habitat. It is not at all clear that this will *improve or maintain* the viability of that Snipe population – on the contrary, we expect a net decline in habitat quality and perhaps quantity available to the birds, at least during some periods.

  The viability of the local Snipe (e.g., their ability to return each year in similar numbers) could be compromised if the offset habitat fails to support them. Additionally, the viability of the Ramsar site (in terms of water quality and ecological character) could be impaired if the system fails. Thus, the offset as proposed **does not convincingly maintain, let alone improve, the baseline situation**. A genuine "maintain" outcome would mean the Snipe continue using the area in the same numbers with no drop-off, and the Ramsar wetland sees no water quality or habitat degradation. Given all the risks identified, that standard is unlikely to be met. Therefore, the offset in its current form conflicts with Principle 1.

Principle 2: Direct Offsets – *"Suitable offsets must be built around direct offsets but may include other compensatory measures."*. Typically, at least 90% of the offset should be a direct on-ground benefit to the protected matter.

- **Analysis:** The on-site habitat creation is indeed a form of **direct offset** (habitat restoration for the same species impacted). In that sense, it aligns with Principle 2's preference for direct offsets over indirect actions. However, it is worth noting that the offset is **located on the development site itself**. This raises a conceptual issue: usually an offset is a separate area conserved or improved to compensate for the loss at the impact site. Here, they are combining impact and offset on the same footprint (part of the site is destroyed for houses, another part enhanced for habitat). While not explicitly disallowed, this approach blurs the line between mitigation and offset.

  One could argue the habitat area is actually an impact area too (since it's being used to treat stormwater and will be altered). Nonetheless, for Principle 2, the offset is largely direct. The **concern is if the offset fails**, the proponent has not offered additional indirect measures (like funding research or off-site protection) to make up the difference. The proponent here has put all offset "eggs" in the one on-site basket. To fully satisfy Principle 2, normally one would ensure the direct offset is robust or bolster it with other actions. Here it's just the single direct offset, which is inherently risky. Therefore while nominally meeting the direct offset emphasis, it's not backed by a diversified offset package that could secure the outcome if one element fails.

Principle 5: Risk of Offset Not Succeeding – *"Suitable offsets must effectively account for and manage the risks of the offset not succeeding."*.

- **Analysis:** The proposal **does not effectively manage the risk of failure** – arguably, it barely acknowledges it. Principle 5 is critical in this case. The Offsets Policy text explains that a good offset proposal will put in place measures via an Offset Management Plan to ensure the offset's success. The current offset plan is experimental and has a relatively high risk of not delivering the intended conservation gain (for reasons of design failure, climate impacts, etc., detailed earlier). What measures are in place to manage this risk? The documentation mentions a 20-year management and monitoring period, which is good, but it doesn't propose any *contingency offset* if monitoring shows the habitat isn't being used by Snipe or stormwater treatment isn't meeting targets. In other words, **there is no backup plan**.

  Effective risk management might include:

- binding commitments to implement alternative offsets (like securing another wetland off-site) if certain performance criteria aren't met within a set time period;
- financial assurances to fund major remedial work if needed;
- adaptive management triggers that are enforceable.

None of these are clearly articulated. The only risk mitigation is the independent review and the ongoing maintenance promise. Given the high stakes, this is inadequate. By Principle 5 standards, the offset proposal is weak – it essentially assumes success and provides little recourse if that assumption proves false. The policy even gives an example: if revegetation doesn't produce good habitat, that risk should have been accounted for. Here we have exactly that scenario – revegetation might not produce good habitat or the high *edge-to-area* effects prove insurmountable– and the proponent has not accounted for it beyond saying "the Council and regulators will deal with it." Thus, the proposal **fails Principle 5** unless significantly amended to include risk mitigation commitments.

Principle 6: Additionality – *"Offsets must be additional to what is already required by law or planning and must be new actions not already planned."*.

- **Analysis:** This principle asks whether the offset is delivering gains above baseline obligations. In this case:

  The proposed offset does not meet the requirements of the EPBC Act Environmental Offsets Policy, particularly the principles of **additionality** and **like-for-like equivalence**. The offset area is not subject to any existing statutory conservation obligation and would likely not have been protected in the absence of the proposed development. While this may superficially suggest a gain, the proponent is not securing any **new or off-site habitat** beyond what already exists within the project footprint. As such, the offset fails the principle of additionality, which requires that offsets provide conservation outcomes *above and beyond* what is already required by law or would occur in the absence of the action. Furthermore, there is insufficient evidence that the proposed offset delivers **ecological equivalence** to the impacted habitat, as required by the *like-for-like* principle, given differences in site conditions, hydrological context, and management certainty.

  There are also state local planning requirements for stormwater management which overlap, therefore offset elements cannot be counted fully as additional. The documentation suggests this design is mainly driven by EPBC needs (the state permit might not have required habitat creation to this extent). Thus it's probably additional in intent. But since the proponent would have had to treat stormwater anyway to meet state environmental regulations, then the portion of works that do that is not additional – only the habitat augmentation is.

  Overall, the offset likely satisfies additionality in a basic sense (because it's driven by EPBC, not something that would happen otherwise). However, one could critique that **the offset is partially serving a dual purpose (stormwater treatment)** that the proponent would have had to do in some form regardless. They are trying to get "credit" (as an offset) for something that also helps them meet water regulations – thus it might not be 100% additional purely for conservation. The dual-use nature slightly muddies additionality.

  In summary, while Principle 6 is probably not the strongest failure here, the proposal does raise questions because the offset measure is not wholly separate from other project utilities.

Principle 7: Efficient, Effective, Timely, Transparent, Scientifically Robust & Reasonable.

Analysis: There are many adjectives here, but key ones stand out:

- **Effective**: The effectiveness of the proposed offset in compensating for the residual impacts remains highly doubtful. The Offset Management Plan is centred on a relatively small protected habitat area and depends heavily on long-term implementation by local government, which has limited capacity and a documented history of under-resourcing its conservation reserves. Critically, the offset lacks defined and measurable ecological outcomes. There are no quantifiable benchmarks for key success indicators such as **species occupancy, abundance,** or habitat condition over time. Without clear **performance targets and time-bound milestones**, it will be impossible to evaluate whether the offset is **achieving ecological equivalency** with the impacted site. This absence of measurable objectives substantially undermines both the credibility and enforceability of the plan.

  Moreover, the most effective habitat is that which consistently supports the highest ecological value—namely, **frequent and stable occupancy by the target species**. In this case, it's well established that Latham's Snipe have been recorded at the site in significant numbers and over multiple years. A reasonable and ecologically meaningful measure of success would be the **presence of at least 18 individuals in three out of every five years**. If this threshold is not met, the offset cannot be considered to have achieved equivalency or better, and the Offset Management Plan must be deemed ineffective.

- **Timely**: Offsets implemented before or at the same time as impact have better outcomes. In this case, the offset will be implemented during construction (concurrently). But it likely won't reach full functionality for some years after the habitat is removed. So there is a time gap where the environment is worse off (this violates the spirit of timely implementation).

- **Scientifically robust**: The offset proposal must be based on robust data and modelling. As we saw, it's an **experimental concept with scant precedent.** This is not what we'd call scientifically proven; it's more of a pilot project. By contrast, a robust offset might rely on well-established restoration techniques. Here, the uncertainty undermines scientific robustness.
- **Transparent**: The process and underlying assumptions should be transparent, yet the modelling lacks clarity. Key parameters—particularly those relating to

habitat requirements and species preferences—cannot be modelled with MUSIC. Significant data gaps remain, preventing any confident conclusion that the proposed offset is ecologically sufficient. Crucially, fundamental **flaws in habitat mapping have not been addressed**, undermining the credibility of the evaluation. Overall, the level of transparency falls short of what is required for rigorous environmental assessment.

- **Reasonable**: If "reasonable" is interpreted as realistic or fair, then the assumptions underpinning this proposal are not reasonable. It is questionable to assume that a small on-site offset can adequately account for the full extent of ecological impacts. Moreover, it is neither fair nor reasonable to transfer long-term Offset Management Plan (OMP) responsibilities to a local Shire that lacks the capacity, resources, and institutional support to implement and maintain those obligations effectively. In the absence of secure funding and resourcing mechanisms, it is in fact reasonable to assume that the OMP is likely to fail.

In conclusion, **Principle 7 is not fully met** – especially on the counts of timely implementation and scientific robustness. A more robust approach might have done pilot trials or used reference wetlands to demonstrate likely success.

Principle 8: Governance and Long-Term Management – *"Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced."*.

- **Analysis:** The offset will presumably be subject to a management plan condition in any EPBC approval, which would set monitoring and reporting requirements. The proponent has committed to some monitoring. However, we have concerns about **enforceability and long-term governance**:

- The offset area will become Council-managed land (a reserve). The Policy clearly states that if a third party will manage the offset, **clear contractual arrangements** must be in place and costs borne by the proponent. Has the proponent set aside funding or signed an agreement with Council for this critical management? If not, governance is weak. There is risk of "handoff" where the proponent washes their hands after a few years and the offset quality declines due to lack of active management and enforcement.

- Measurement and auditing: We would need **baseline data** (pre and post development Snipe counts, pest animal surveys, water quality readings) to measure offset success. The plan should **specify performance indicators** (e.g., at least X Snipe using site each year by year 5; pollutant loads below Y). Without concrete criteria, you can't audit success. Counting and removing weeds, excluding dogs/people and maintaining a vegetation mosaic suitable to Snipe is of little benefit if the birds aren't using the engineered habitat. It's unclear if success criteria have been set, other than for weed and vegetation cover, fence maintenance and an undefined "biomass management strategy". The Onsite Offset Management Plan (OMP) requires **quantitative success criteria, beyond weed percentage cover**. For enforcement, the Department (and/or State regulators) would need to compare results against those criteria annually.

  - Given the novel nature, **independent audits** are a wise proposition. However, the 6 monthly audits of the Offset Management Plan appear an aspirational rather than realistic goal. Who will fund these 6 monthly OMP audits, yearly reports and 5 yearly reviews? It is incredibly unlikely that the offsets management plan's actions, limited ecological monitoring, bi-yearly auditing and yearly reporting would be a high priority for Council, unless contractual arrangements and **funding for the plan are built-in** to the offset proposal. The Shire's almost non-existent *conservation* budget and lack of active management of Council-owned conservation areas, underscore the need for secure ongoing funding to see at least some of the OMP effectively implemented.
  - There is also the matter of **duration**: Offsets under EPBC are effectively required to be maintained for the life of the impact (usually in-perpetuity if habitat is permanently removed – which it is in this case). How will the offset be maintained and values protected 30, 50 years from now? — Principle 8 demands that it be enforceable long-term, but as no third party review rights apply to s. 69 Agreements, enforceability is wholly dependent on government regulators taking action.
  - Thus, **Principle 8 is at risk of not being satisfied**, unless conditions are imposed to strengthen governance (like a requirement for a legally binding agreement on management responsibilities ***and funding***).

In summary, evaluating the offset plan against the EPBC offset principles reveals several shortfalls:

- It does not convincingly **maintain or improve** the viability of the protected matter (likely net loss of habitat quality).
- It does **not adequately manage risk** of failure – no contingency offsets are provided.
- Its **implementation timeline** means a lag, conflicting with timely delivery.
- The approach lacks **scientific certainty**, making it less than robust.
- **Long-term governance** is questionable, depending on local council follow-through and in the absence of third-party review rights. the legally binding measures are weak.

Collectively, these issues mean the offset plan, as it stands, would likely score poorly if assessed with the Department's Offsets Assessment Guide. In a strict sense, the offset **may not fully compensate for the residual significant impact**, which is the overarching requirement. According to the Offsets Policy, if an impact is so uncertain to offset, the action may be considered unacceptable in the first place.

We recommend that the Department insist on improvements aligning with these principles before considering any approval. If the offset cannot be made to clearly satisfy the Offset Policy principles, the project should not proceed as it would set a poor precedent and risk net environmental loss, contrary to the intention of the EPBC Act offset system.

Thank you for the opportunity to comment on this referral. Please don't hesitate to contact the principal author of this submission if you have any queries whatsoever.

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