GAEP West Development Plan Overlay

Position Paper

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1. Introduction

HARC has been engaged by the Victorian Planning Authority to assist in the drafting of the Development Plan Overlay (DPO) for the Greater Avalon Employment Precinct West (GAEP West).

This Position Paper has been produced to support the drafting of the DPO from a stormwater, drainage and hydrological perspective. This paper is developed based on a review undertaken by HARC of previous work and the recent Stakeholder Engagement process.

It is important to acknowledge that this paper and the DPO are not intended to produce a drainage strategy or provide the solution for the ultimate outfall, rather outline the steps required to be able to plan and achieve this. HARC have reviewed the information provided by the VPA including studies, report and reviews, considered stakeholder input and sought additional data to form our position in relation to the proposed GAEP West development.

HARC have formed the opinion that this site is developable from a stormwater, drainage and hydrological viewpoint. The uncertainty surrounding the impacts of the development on off-site environmental values such as the Avalon Coastal Reserve (ACR) and the Ramsar wetland that envelopes the Corio Bay coastline have been a key challenge in progressing planning phase for GAEP West.

HARC considers it prudent to apply a cautious approach in developing a drainage strategy for the site because of need to resolve complex and bespoke drainage issues. For example, the proposal to include wetlands and open waterways is necessary from a water quality treatment perspective and environmental and landscape sensitivity point view. However, these water quality treatment solutions have the potential create aircraft hazards by attracting wildlife. Similarly, the perception that the development should protect the ACR from changes in hydrological regimes associated with the increased impervious surfaces and yet it appears to be acknowledged that freshwater is important for salt marsh habitats.

Although it is seemingly difficult to reconcile differing priorities for the site, there are a number of key elements that can be included in the DPO to provide guidance and direction in resolving the issues.

2. Overall drainage strategy intent

The key elements of the GAEP West Drainage Strategy should include:

- An indicative drainage layout, particularly in relation to drainage reserves and channels, waterway corridors, indicate water quality treatment locations and retarding basins.
- Determination of the existing environmental and volumetric flows through existing waterway within the Avalon Coastal Reserve. This is important to understand the volume and frequency of flows entering the ACR to sustain the salt marshes. As further salt marshes are restored as a part of the Blue Carbon project the freshwater flows into the site may be greater.
- Confirmation of the volume of extreme event flows (up to and including the 1% AEP flood event) generated on site (in each landholding) and determine how and where the flows should be split and treated for the external flows generated north of the Princes Fwy and west of the site in Avalon Airport.
- Confirm the water quality treatment standards required for the site, considering the question of whether greater than Best Practice treatment is required or will achieving Best Practice Guidelines standards be adequate. This should be guided by evidence or data for the Corio Bay area.
- Confirm the requirements of Avalon Airport regarding waterbodies including wetlands, retarding basins (wet or dry), waterways and sediment ponds.
- Agreement between all landholders regarding where flow paths, drainage lines and waterways will exit and enter the different landholdings and the invert levels that they will be set at. These agreed levels should not be at the detriment to either party.

2.1 Indicative drainage layout

The indicative drainage layout proposed by MAB in Figure 1 below is considered to generally meet the needs of the precinct. The proposed layout includes:

- A conservation reserve is proposed to convey the external flows through the site via existing watercourse that extends through the site. The watercourse has been identified has have environmental values, particularly south of Dandos Road.
- A 100m wide linear reserve to convey the internal flows generated from the site. It is possible that the allocated 100m wide corridor or reserve is oversized from a hydrological perspective. The area required should be determined through modelling as a part of the drainage strategy development, noting that areas within the corridor may be required for environmental or conservation purposes
- A number of water quality treatment wetlands, proposed within or adjacent to the linear reserve to treat the internally generated stormwater runoff to greater best practice standards.
- A large retarding basin or basin or stormwater management area south of Dandos Road and immediately east of Avalon Road.

HARC believes that this proposed layout generally would meet the needs for the conveyance of major and minor flows through the site. However, we are of the opinion that the proposed lake/open water body south of Dandos Road, adjacent to Avalon Road is unnecessary from a stormwater quantity management perspective and has the potential to attract wildlife, whereby creating a potential risk for aircraft safety at Avalon Airport.

Despite the uncertainty around the management of flows in relation to the protection of ACR, HARC considered that it is the lower daily volumetric flows or environmental flows that are more important to manage to protect the ACR. These flows can be controlled through a more considered drainage management approach, splitting or isolating flows at specific locations in order manage regimes for the ACR. This is discussed further below in Section 2.2. The major flows associated with a flood event such as the 1% Annual Exceedance Probability (AEP) can be managed through a dry retarding basin.

Figure 1: Proposed MAB major drainage layout

2.2 Separation of flows

There are a number of studies into the hydrological and hydraulic conditions of the GAEP West site for extreme events such as flooding and changes in intertidal zones associated with climate change.

However, there is a paucity of information in understanding the smaller volumetric environmental flows and first flush volumes. What is apparent, is that there is concern regarding the potential impacts of a change in catchment hydrological conditions on the Avalon Coastal Reserves environmental values – in particular salt marsh. Whilst there is a strong desire to preserve and restore these values, this is to some extent compromised by the future coastal conditions in a changing climate. The intertidal zones will change and areas that are currently intertidal may become permanently inundated unless protected by mitigation works. The yearly volume of freshwater inflows and the frequency of freshwater flows is also likely to reduce.

The natural topography of the GAEP West site lends itself to two clear catchments. Catchment A is predominantly north of Dandos Road and Catchment B is located south of Dandos Road and immediately north of the Avalon Coastal Reserve.

The Avalon Coastal Reserve currently receives untreated catchment flows from part of the GAEP West site as well as the Lara catchment north of the Princes Fwy. The draft ACR Conservation Action Plan suggests that too little and inappropriate regime of water in saltpans degrades habitat for shorebirds and saltmarsh'[1] is an existing identified risk. This infers that continuation of freshwater discharge through the ACR is important, albeit uncertain in terms of the volume.

Many structures and levees associated with the site as a former saltworks would have some interference and impact on current flows reaching the ACR. The former pathway of water distribution is shown in Figure 2. Development of the GAEP West site provides the opportunity to improve the pathway from freshwater inflows in a controlled manner in collaboration with Parks Victoria.

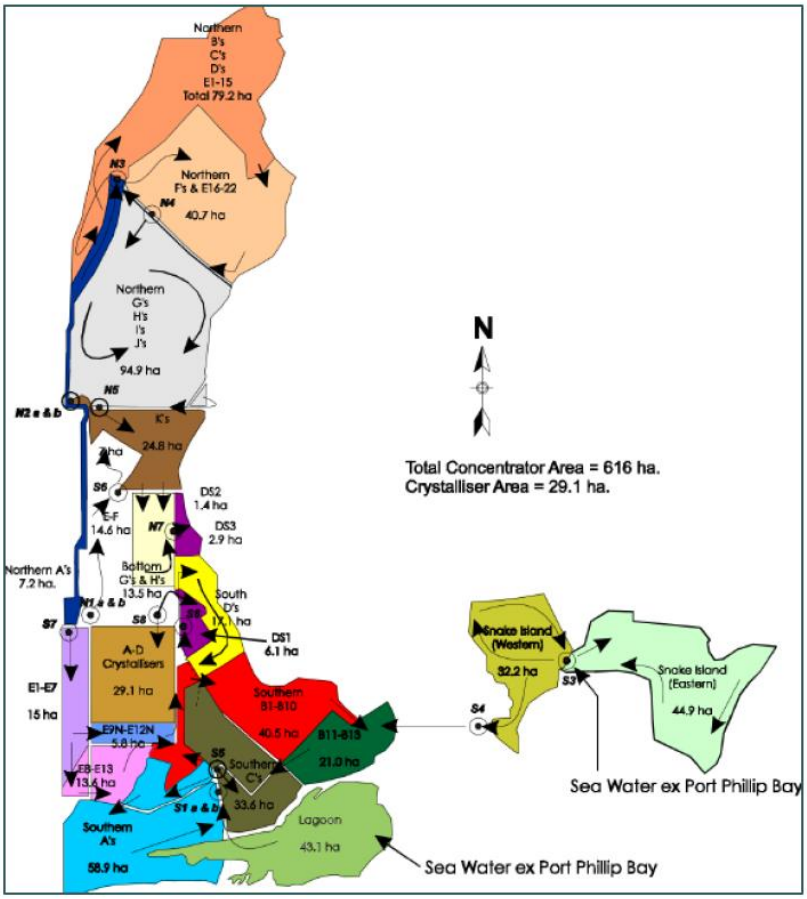


Figure 12:Simplified Section Flow Plan of Avalon Coastal Serve when Cheetham Saltworks was operational (Source: Richard. W (1999) Cheetham Salt- LARA- Standard Operating Procedure).

Figure 2: Flow path of former saltworks (source: EcoFutures 2023)

[1] Avalon Coastal Reserve Conservation Action Plan, EcoFutures 2023 prepared for Parks Victoria

Furthermore, when considering the impacts of climate change, increased dry spells can also affect the salt pans contributing to the problem of too little water in saltpans and degradation of habitat for shorebirds. Couple this with sea level rise and the uncertainty around the health of this area is further increased.

The tidal reinstatement (as a part of the coastal management strategy) aims to reconnect tidal flow to the area and rehabilitate the land that was historically wetland habitat, helping to restore critical coastal wetlands such as seagrass meadows, tidal marshes, and mudflats.

Catchment A, north of Dandos Rd is a complex series of existing structures and levees in various states of disrepairs, however based on Figure 2 above, topographical data and site inspection, this area primarily drains towards the existing waterway in the east of the site that passes through the ACR. Despite not being shown in Figure 2 above, based on topography, Catchment B drains towards the existing waterway, just north of the Southern B1-B10 pans – now ACR.

What this means for the ACR and the potential development of GAEP West is that:

- Some freshwater is important for the ACR based on existing conditions.
- External flows as well as onsite rural flows generated from Catchment A currently discharge to the existing waterway and therefore contribute to freshwater inflows.
- The volume of low flows coming from GAEP West B precinct are likely to see only a small increase compared to the existing waterway environmental flows. Particularly as stormwater runoff from Catchment B would be treated within the development site and be attenuated through any treatment train.
- Water quality treatment will be important for the protection of environmental values from nutrients and total suspended solids. The level of treatment required to protect the values is uncertain.
- It is expected that the volumes of flows from Catchment A will be split from Catchment B flows due to topography of the site. Catchment A will be conveyed through the proposed linear reserve through the MAB site and treated at nominated locations. It is possible that some flows will be required from Catchment A and Catchment B to be conveyed to the existing waterway that flows through the ACR to protect freshwater inflow regimes, but should be limited, pending further investigation.
- It is required that each landowner will be required to treat stormwater quality on site.

2.3 Development drainage strategy continuity

The major landowners (MAB and LIVV) within the GAEP West have developed initial strategies that have evolved to the most recent versions received by HARC. It is essential that these strategies dovetail together seamlessly. This can only be achieved through collaborative sharing of strategies as they develop and evolve, giving due consideration to adjacent land holders.

The invert levels of the existing waterway in the eastern corner at the boundary between MAB and LIVV is critical in the success of any drainage strategy. This point is likely the singular point of discharge for the LIVV site and the invert levels here control the ability of LIVV to drain their site and if set to high, limit the grade of drainage. Similarly, if the invert level at the boundary is too low, then MAB will also have drainage issues. There is a desire by all developments to limit the amount of fill required to achieve adequate drainage and freeboard.

In order to progress the drainage strategy, it is important not only that the invert level of the existing waterway at the boundary is determined and agreed, but the developing strategies are shared where possible with adjacent landowners.

3. Outfall locations

Based on the topography of the site and the unknown potential hydrological limitations of the existing waterway within the Avalon Coastal Reserve, it would be prudent to consider more than one outfall location for the GAEP West site, however the ultimate outfall arrangement should be determined by undertaking a risk assessment. This risk assessment should consider the risk to the values of the salt marshes in the ACR that require some amount of freshwater inflows as well as the seagrasses within the Ramsar wetland located around the northern shoreline of Corio Bay and Limeburners Lagoon.

The Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site Management Plan Summary provides information on the key threats to the site, noting that the Ramsar site is made up of six discrete areas:

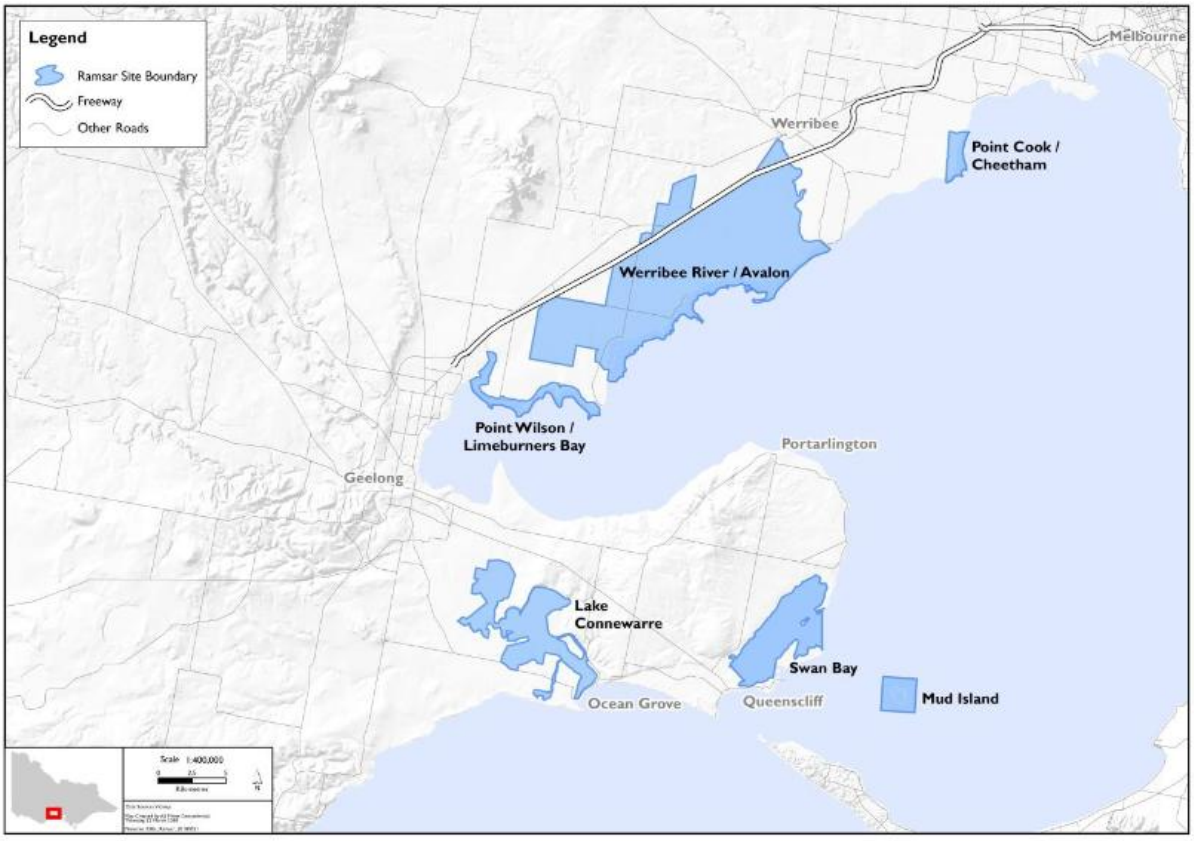


Figure 2: Map of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site.

The Avalon Airport site is part of the Ramsar area, but is also subject to a range of development activity. The Avalon Coastal Reserve is not part of the Ramsar listing. The highest threats to the Point Wilson/Limeburners Bay section of the Ramsar site are:

- Climate Change – sea level rise impacting on intertidal vegetation and waterbird habitat
- Litter (including micro-plastics) effects biota
- Invasive species: salt tolerant weeds impacting saltmarsh and waterbird habitat
- Recreation: boats, jets skis, kite surfers disturbing waterbird feeding, breeding and roosting
- Recreation: walkers, horse-riding disturbing waterbird feeding, breeding and roosting

The Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site Management Plan Summary indicates that stormwater leading to decreases in salinity and altered water regimes is not considered a priority threat to the Ramsar site for the Point Wilson and Limeburners Bay compartment.

Impacts on seagrass are possible, with the Ramsar target being more than 2900 hectares of seagrass across the Ramsar area. The 2015 University of Melbourne Study on Seagrass Resilience in Port Phillip Bay indicated that there was no seagrass identified along the eastern shoreline of the ACR as shown in Figure 3, where the existing waterway/s outfall to Corio Bay. This is possibly because of the depths in this area being slightly larger in the location or the potential slight increase in wave heights that come with north easterly wind events – to which this area is exposed.[2]. There appears to be a clear threshold where mean wave heights exceeded 0.38–0.43 m beyond which little seagrass occurs.

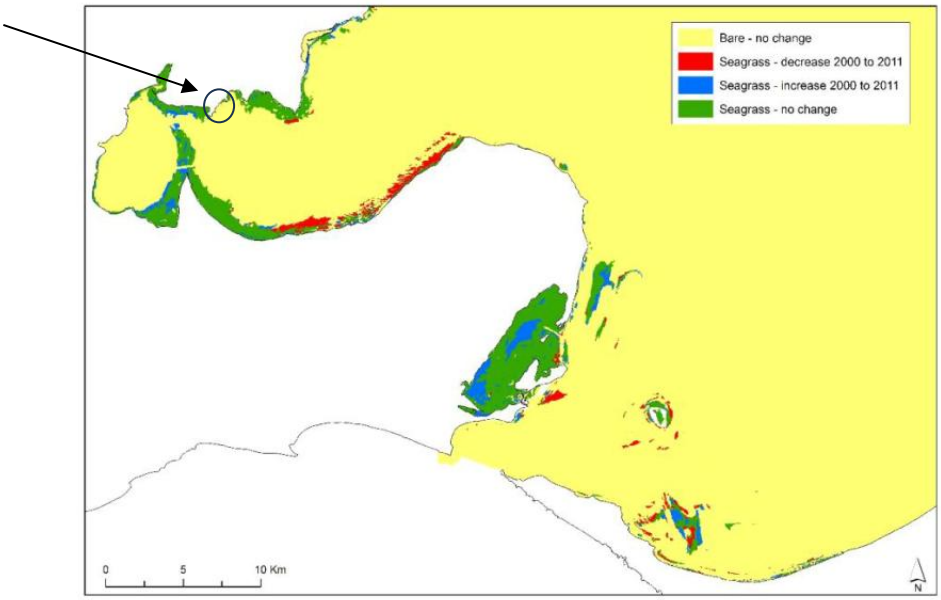


Figure 12 Change in seagrass area between 2000 and 2011 in southern and western Port Phillip Bay.

Figure 3: Seagrass areas in Corio Bay and the eastern shoreline of the ACR outfall

The seagrasses are primarily restricted to depths of less than 2 m in Corio Bay. Zostera muelleri generally exists in the intertidal zone, preferring sand and mud sediments, and requires extended periods of exposure to the atmosphere to survive. Halophila australis is subtidal and grows on the deeper margins. This species is associated with softer, muddier sediments.[3]

The analysis also showed that in this area, there was an increase in seagrass in the Corio Bay/ Limeburners Point Area.

The targets in the Best Practice Environmental Management Guidelines for stormwater were developed specifically to limit the risk of eutrophication and blue green algal blooms in Port Phillip Bay,

[2] Corio Bay Local Coastal Hazard Assessment, Future Coasts, DELWP, 2016
[3] Seagrass Mapping of Port Phillip Bay, David Ball, Sean Blake, Marine and Freshwater Resources Institute, June 2001

based on the 1996 State of the Environment report. The ESR's indicate a much lower threshold for phosphorus and nitrogen in Westernport Bay compared to the Geelong Arm. Any over-treatment of stormwater may not be required to manage the risk to seagrass, noting that developments in Lara, conmprising significantly greater total area, are not required to have any over-treatment.

The design of any outfall/s would need to be identified in the drainage strategy for the entire precinct and appropriate design approaches used to minimise any impacts on the environment.

The current upstream catchment is around 1200 hectares of which more than 50% is north of the Princes Freeway and considered to be uncontrolled and untreated. The 630 hectares of catchment with the GAEP West site can be treated for stormwater quality and volume to pre-development conditions. Whilst there has been flood modelling for the upstream catchment, it is the low flows and environmental flows that are little understood, as well as what those existing flows mean for the ACR. HARC consider there to be two possible outfall scenarios or combination of the two as shown in Figure 4

1) Outfall the entire site through the Avalon Coastal Reserve following stormwater quality treatment and volumetric flow control.

2) Outfall some or all flows from Catchment A to the turbid estuarine environment of Hovells Creek where there is unlikely to be any seagrass due to lack of light. And outfall the quality and volumetrically treated flows from Catchment B to the existing waterway.

3.1 Catchment A

The catchment north of Dandos Road should either be treated and controlled for discharge via the existing waterway or west to Hovells Creek. The outfall for this catchment should consider and include

1. The assessment of impacts of different hydrological regimes on seagrass located at potential outfall points in Hovells Creek.
2. The bathymetry of the Hovells Creek estuary as well as the variability and extent of turbidity associated with the waterway and flows from the upstream urbanised catchment.

3.2 Catchment B

HARC is of the position that with suitable water quality treatment and volumetric control, that outfall is possible to the existing waterway for Catchment B (around 187ha) south of Dandos Road. This is around 15% of the total existing waterway catchment. This is important also in the context that around 410ha of developable land within Catchment A of the GAEP West precinct north of Dandos Road may divert elsewhere such as Hovells Creek to outfall rather than through the reserve as per current conditions. It is acknowledged however, that there has been no comprehensive hydrological modelling for the upstream catchment and the regime through the ACR. The development of the drainage strategy to include outfall for Catchment B (and A) should include a requirement to:

1. Undertake modelling to determine the capability of distributed onsite detention and stormwater quality treatment in reducing the flow back to pre-existing conditions.
2. Provide for flow and volume controlled outfall to the existing waterway.

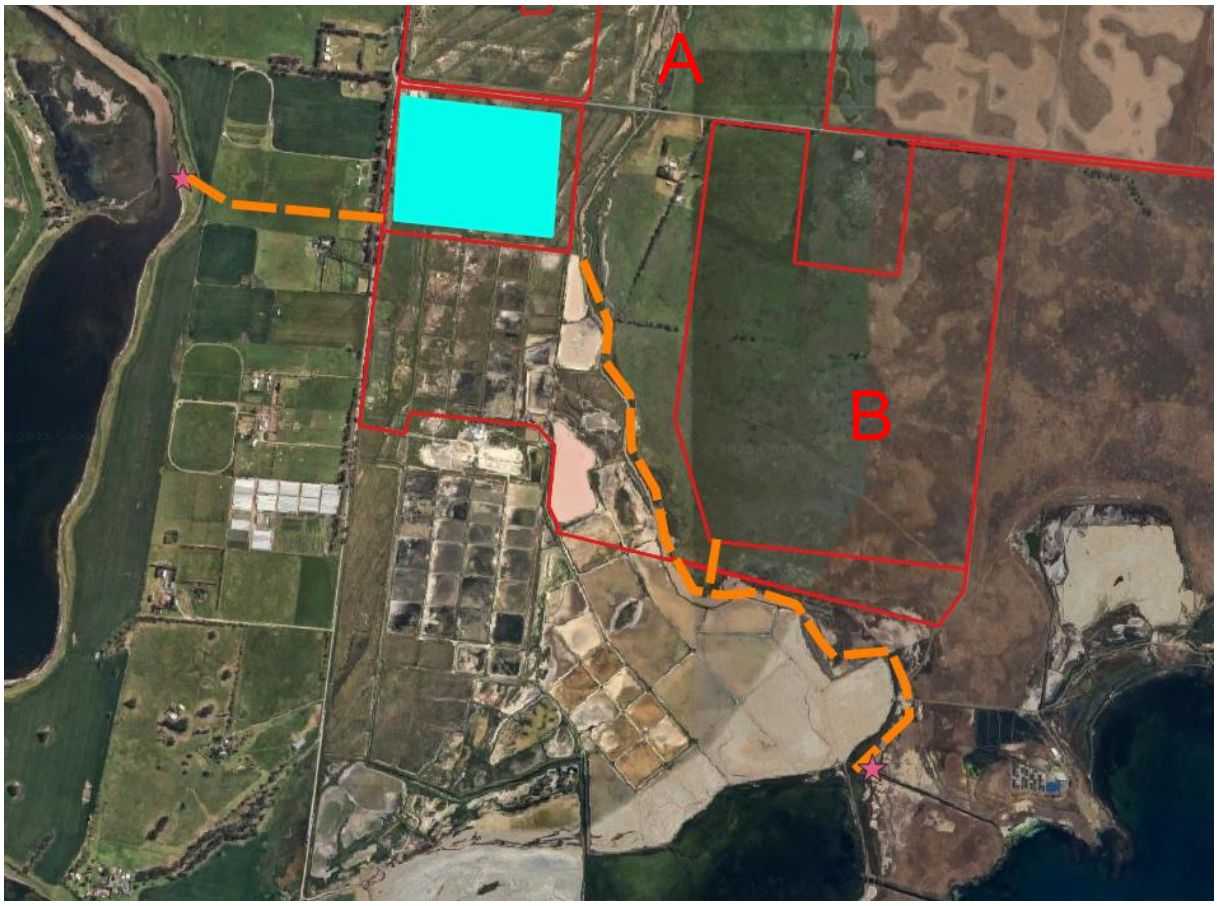


Figure 4: Catchment A and Catchment B potential outfall locations

3.3 Both outfall locations

All drainage strategy outfall locations should be developed in consultation with DEECA and Parks Victoria to ensure the provision of stormwater inflows to support the regeneration and restoration of saltmarshes as part of the Avalon Coastal Reserve Conservation Action Plan and map out potential freshwater inflow points to the reserve based on habitat requirements and areas requiring protection from stormwater. Any outfall location should also be to the satisfaction of City of Greater Geelong.

Any potential outfall location (Hovells Creek and the existing waterway) should undergo evaluation and a risk assessment against environmental criteria. This will be critical when considering the potential risks for the seagrasses within the Ramsar wetlands and the Limits of Acceptable Change.

The mechanism against which change in ecological character is assessed is via comparison with Limits of Acceptable Change (LAC). LAC are defined by Phillips (2006) as:

"…the variation that is considered acceptable in a particular measure or feature of the ecological character of the wetland. This may include population measures, hectares covered by a particular wetland type, the range of certain water quality parameter, etc. The inference is that if the particular measure or parameter moves outside the 'limits of acceptable change' this may indicate a change

in ecological character that could lead to a reduction or loss of the values for which the site was Ramsar listed. In most cases, change is considered in a negative context, leading to a reduction in the values for which a site was listed."

In understanding the LAC, it should also be recognised that change can also have positive outcomes. What is currently a poorly understood and constrained existing outfall arrangement for both the GAEP West site and the ACR, has the potential to be further understood and strategically considered when developing outfall arrangements for the precinct that will benefit the ACR.

4. Water Quality Treatment

Stormwater quality treatment with the GAEP West site is proposed to be met primarily through water quality treatment wetlands.

The current LIVV strategy proposes two wetlands for water quality treatment purposes.

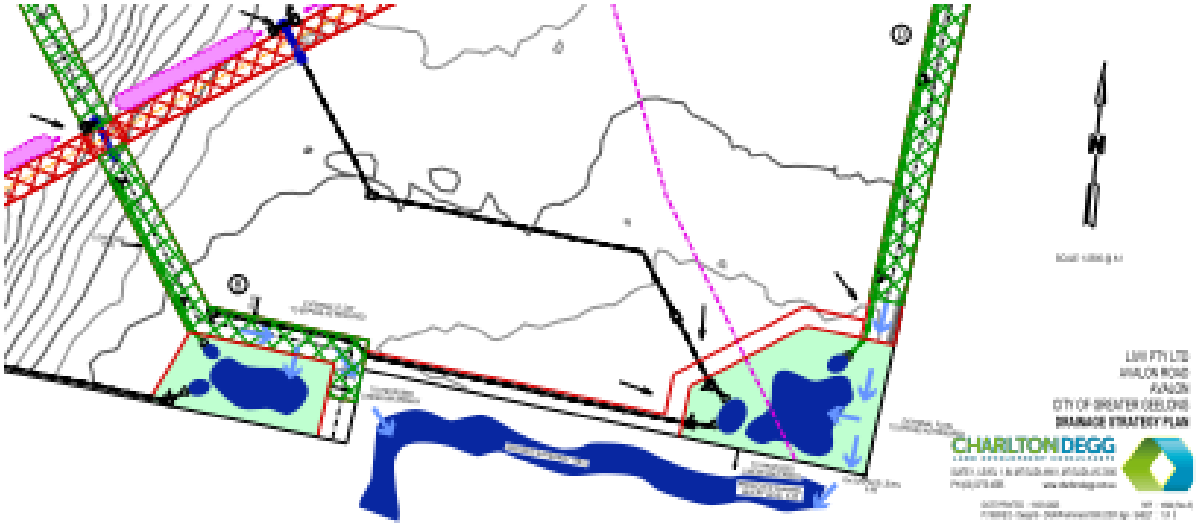
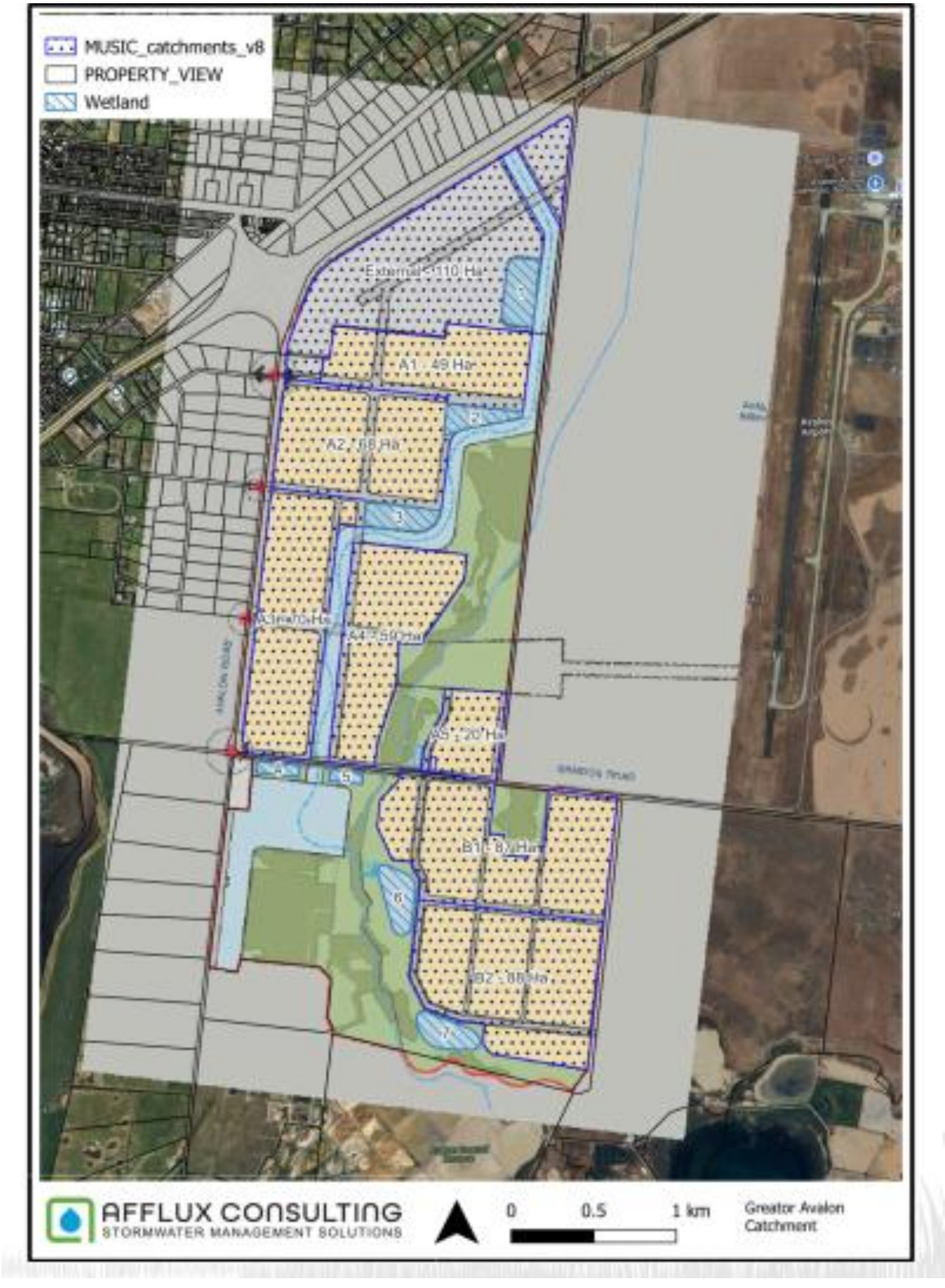


Figure 5: Proposed water quality treatment locations - LIVV

The MAB drainage strategy proposes six (6) water quality treatment wetlands and works off the assumption that LIVV are planning a single wetland at the boundary between the sites to the east. The MUSIC modelling undertaken for the planning stages of the Avalon PSP (now the DPO process) by Afflux has modelled treatment to achieve better than better than Best Practice targets. The better than Best Practice targets align with targets for Western Port Bay. Western Port Bay is also a home to seagrass beds and classified as a Ramsar wetland. It is worth noting that the catchments of Western Port Bay contain significant tracts of agricultural land. Seagrass covers intertidal and subtidal areas of the Western Port Ramsar Site and has been highly variable over time.[4] This location is also different in depths, wind and wave exposure and coverage.

The determined targets for Port Phillip Bay and specifically Corio Bay should be commensurate with the current conditions and risk for the bay and linked to the elements that affect the 'limits of acceptable change' for the downstream Ramsar site. HARC suggests that any targets set for water quality treatment be based of the wetlands and seagrasses specific sensitivities.

[4] Western Port Ramsar Site Management Plan, DELWP 2017



It is acknowledged that nutrients and turbidity of stormwater are a risk to receiving waters, however the study by University of Melbourne in the Seagrass Resilience in Port Phillip Bay undertaken in 2015 suggest a greater level of resilience than expected, particularly in relation to nutrients.

The investigation compared change in sea grass between 2000 and 2011. Interestingly, this study showed that there were either no changes or an increase in area of seagrass over this period in the Ramsar site adjacent to the GAEP West site and the Avalon Coastal Reserve as shown below in Figure 6.

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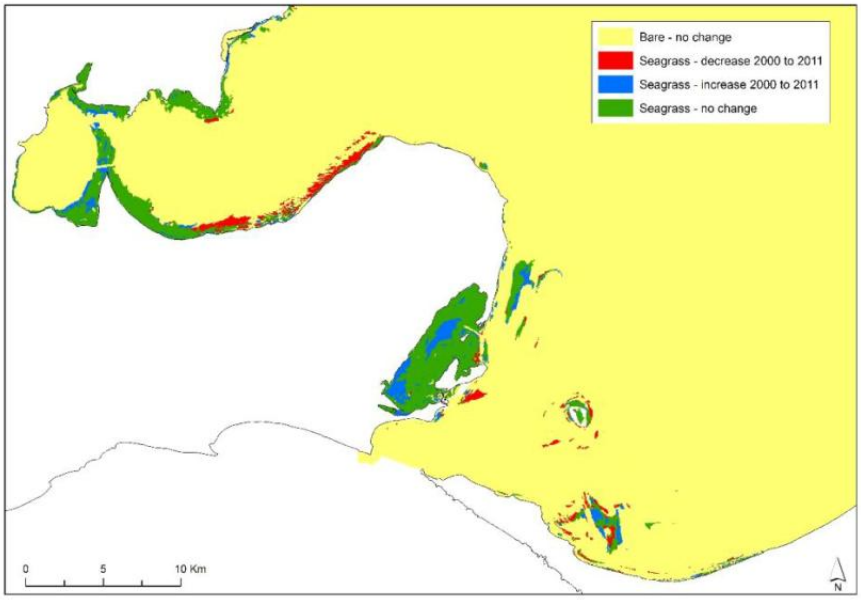


Figure 6: Change in seagrass distribution in western Port Phillip Bay 2000-2011

(Source: University of Melbourne 2015)

The outcomes of the University of Melbourne study is consistent with the mapping undertaken in 2001 by the Marine and Freshwater Resource Institute. Zostera muelleri, one of the main types of seagrass generally exists in the intertidal zone, preferring sand and mud sediments, and requires extended periods of exposure to the atmosphere to survive. Halophila australis is subtidal and grows on the deeper margins. This species is associated with softer, muddier sediments.[5]

Interestingly the University of Melbourne 2015 study investigated the connections between seagrass and nutrients such as nitrogen. Nitrogen can be available in different forms and taken up by seagrass through different pathways. The report said that nutrients from the catchment are initially taken up by phytoplankton which becomes trapped and eventually turns to detritus which is broken down for uptake by seagrass. The study also says that seagrasses potentially acquire nitrogen from a range of sources within Port Phillip Bay such as WTP, the Yarra River, other catchments and creek and other inputs.

What this suggests, combined with the information that seagrass areas in the Hovells Creek estuary (and Limeburners Bay) as well as around the shoreline of the ACR have either not changed or

[5] Seagrass Mapping of Port Phillip Bay, David Ball, Sean Blake, Marine and Freshwater Resources Institute, June 2001

increased, may be less sensitive to nutrients than initially thought. This does not include the area along the eastern shoreline, where no seagrass is identified.

Given that the Hovells Creek catchment is an urbanised catchment with little infrastructure in terms of water quality treatment measures, the nutrients in the waterway are potentially elevated higher than other locations. The no change or increase in this location has therefore demonstrated greater resilience than anticipated. In fact, the total nitrogen results in the study showed an increased in maximum concentration in 2010-11 from catchment inflows – which corresponds to the area of no change or increase in seagrass.

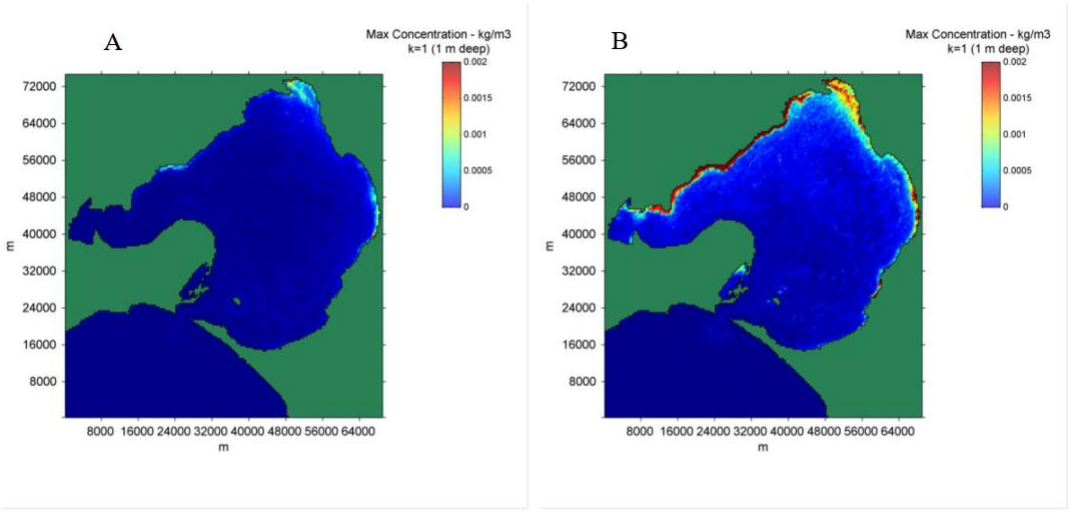


Figure 15 Total Nitrogen results shown as maximum concentration experienced during (A) 1999-2000 and (B) 2010-2011, for catchment inflows only (No WTP).

The University of Melbourne report goes on to say that there is less evidence that variation in water quality, represented by variables such as modelled total nitrogen, suspended solids or salinity, had a major influence on the distribution of seagrass across Port Phillip Bay on the bay-wide scale, suggesting distribution can be predicted by wave exposure and light.

The knowledge surrounding the sensitivity of seagrasses in the Ramsar wetland in Corio Bay is still uncertain, however a risk assessment of water quality impacts on seagrasses may provide more guidance around the level of stormwater quality treatment required by the GAEP West development.

4.1 Ramsar Considerations

HARC has examined the relevant state coastal policy as it pertains to the Marine and Coastal Act 2018. HARC has also considered the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1: Environment Protection and Biodiversity Conservation Act 1999 (Australian Government*). Any referral under the EPBC Act sits outside of the DPO.

The DPO provides the mechanism for these more detailed investigations into the ACR and Ramsar wetlands. A key objective of the DPO is 'to ensure development does not adversely impact existing Ramsar Wetlands to the south, Avalon Coastal Reserve and existing biodiversity values within the development area.' Adherence to this key DPO objective alone aligns development requirements with the objectives of the M&C Act and EPBC Act.

The DPO has a requirement for a detailed assessment of the impact of the proposed works on environmental values of the receiving waters, Avalon Coastal Reserve and Ramsar wetland values, particularly seagrass is a part of the Drainage and Stormwater Management Strategy. This will include consideration of the advice in the of the Environmental Reference Standard for Geelong Arm and the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site Management Plan Summary. It also requires demonstration of how a future drainage scheme considers the requirements of the Avalon Coastal Reserve and has no adverse impact on existing Ramsar wetlands.

Targets for discharge from the GAEP West catchment should be developed based on the environmental receptors in Port Phillip Bay as with any other development that discharges to this environment, including the existing waterway that runs through the site and the ACR. It should not adopt targets for receiving waters in other locations or states. There are also no direct comparisons or examples that can be used for previous development projects upstream of a Ramsar site. The example raised by some parties of port works in Western Port Bay, comprised of works directly in the Ramsar site and Western Port Bay has different water quality treatment objectives.

The BPEM targets referred to in EPA1739.1 derived from pollutant load reduction targets in the *Development of environmental quality indicators and objectives for SEPP (Waters) (EPA 2019)* were specifically developed to manage the risk of algal blooms and water quality issues in Port Phillip Bay and based on the load from waterways such as the Yarra River and Maribyrnong River that flow into it. These targets were set in the existing understanding that there were Ramsar sites in Port Phillip Bay. If higher levels of treatment were required to protect the Ramsar sights, the BPEMG would reflect such.

It is also inappropriate to compare the standards adopted in other Ramsar sites to those surrounding the GAEP West site. The BPEM targets set for Westernport Bay for instance are due to its distinct shallow wetlands, mangrove thickets and tidal mudflats. Nutrient transfer via stormwater and wastewater discharges to the Western Port Bay are a focus for water quality but sediment has been identified as the key indicator of the health of Western Port, and it is believed Western Port Bay is highly sensitive to any further discharges of sediment. Sediment inputs and catchment inflows are identified as the key influence for water quality[6]. The SEPP (Waters) publication (2019) says:

'Excessive sediment loads within the marine waters of Western Port have been associated with large scale seagrass losses in the East Arm. Consequently, SEPP (Waters) includes a target aimed at reducing the amount of fine sediment within the waters of the bay, with the goal of improving water clarity.'

Port Phillip Bay on the other hand is characteristic by sandy beaches and rocky reefs with localised seagrasses and salt marshes and a focus on nitrogen reduction. Western Treatment Plant is also identified as a key influence for water quality[4] in the Geelong Arm of Port Phillip Bay. In relation to Port Phillip Bay, the SEPP (Waters) publication (2019) says

'Targets for Port Phillip Bay The science review and modelling undertaken for the Port Phillip Bay Environmental Management Plan 2017-27 indicated that nitrogen loads entering the Bay should not exceed current levels to reduce the risk of frequent and intense algal blooms. However, catchment

[6] Development of environmental quality indicators and objectives for SEPP (Waters) (EPA 2019)

modelling estimated that nitrogen loads would double without management interventions to reduce inflows of nitrogen.'

'The modelling indicated that the Western Treatment Plant would remain the main contributor of nitrogen loads, with loads expected to increase over the coming decades due to increased sewage flows.'

Proximity to the Ramsar site is one of the driving key concerns in relation to stormwater discharge from the site. However, it should be understood that if this development (same size and type) were located elsewhere in the catchment (such as in Lara), it would not be flagged and scrutinised to the same level. Any discharge from the site would be expected to comply with Best Practice Environmental Management and not held to higher standards of treatment. It must also be considered that the seagrass area within the Ramsar sites already receives significant loads form urban areas both upstream of the site, from the Hovells Creek catchment and other local inflows into Corio Bay.

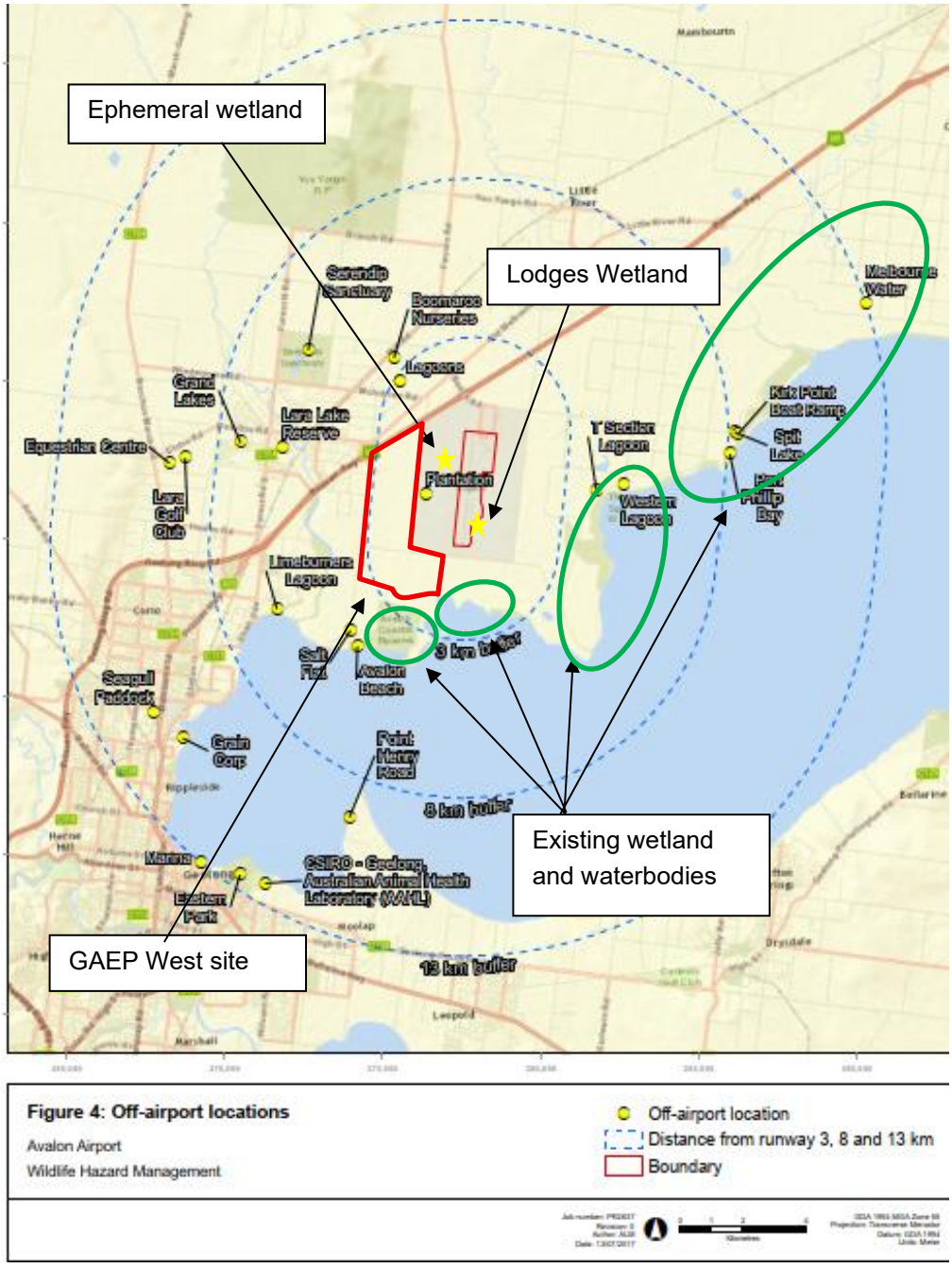
However, HARC acknowledges the need to protect the values within the Ramsar site and Port Phillip Bay and the requirement to meet best practice treatment targets to do so. The DPO includes a key objective to ensure development does not adversely impact existing Ramsar wetlands to the south, as well as the Avalon Coastal Reserve and existing biodiversity values within the development area.

A detailed assessment of the impact of the proposed works on environmental values of the receiving waters, Avalon Coastal Reserve and Ramsar wetland values, particularly seagrass. This will include consideration of the advice in the of the Environmental Reference Standard for Geelong Arm and the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site Management Plan Summary.

HARC agrees that further studies and investigation is required around the hydrological regime in the ACR and the sensitivity to frequency and duration. The Ramsar values however are in located in Port Phillip Bay and therefore additional freshwater flows will not have an impact on salt concentrations. The focus of the impacts on the Ramsar wetlands is the stormwater quality. Both the investigation and management of the hydrological impacts on the ACR and the water quality impacts on the Ramsar wetlands are addressed in the DPO as requirements of the Drainage and Stormwater Management Plan.

5. Wildlife Hazard Avalon Airport

The GAEP West is within a buffer zone (3-8km) for potential wildlife hazards associated with Avalon Airport. There are large areas of existing land both on the airport and surrounds that contain several wetlands (ephemeral and freshwater) and open space areas. The risks associated with wetlands in the buffer zone is considered high for bird strike. This does not however preclude the existence of wetlands and waterbodies in these zones. In fact, Avalon Airport has its own obligations to maintain a regionally significant wetland on their own site (Lodges wetland). This wetland is located at the eastern side of the southern end of the runway.



The Avalon Airport Wildlife Hazard Management Plan (Avisure 2023) identifies wetlands and waterbodies as potential habitats for wildlife and birdlife, that creates a potential risk of birdstrike.

The report identifies a number of wildlife sanctuary and conservation areas (wetlands) that do present a risk of birdstrike. Most of these are high value areas managed specifically for the purpose of maintain and preserving the conservation values as wetland habitats.

This report does not make any specific recommendations as to the limitation of offsite wetlands. The hazard management techniques proposed are specifically for onsite management and recommend liaise with off-airport users to manage appropriately and Consult with local planning authorities within a radius of at least 13 km from the airport and assess development applications for potential to increase wildlife strike risk at the airport.

The wildlife hazard management plan must at least identify sources and locations of wildlife attraction on the aerodrome and in the vicinity of the aerodrome which are likely to cause wildlife to transit the take-off, approach and transitional surfaces.

The National Airports Safeguarding Framework (NASF) Guideline C's Wildlife Hazard Management Action Table indicates that water infrastructure (drains, channels and basins) within the 3km buffer is not incompatible as a new land use and would require risk management and mitigation measures (Attachment 1).

An example of finding a balanced approach between airport operations and minimising the wildlife threats to aviation and the environmental values of wetlands and riparian zones can be found in the draft Sydney Aerotropolis Wildlife Management Assessment Report (Avisure 2020). This report considered case-studies of off-airport wildlife hazard assessments. Each case study was different and a number of different types of mitigation strategies were employed as outcomes at different sites. These strategies include:

- Installing interpretive signage and enforcement to prevent feeding of wildlife.
- Modifying wetlands to remove islands and perching structures.
- Removing rock clumps and felled trees from waterlines.
- Increasing shallow bank gradients.
- Increasing water levels to greater than 1m.
- Using rock gabions to increase water depth and eliminate shallow verges.
- Modifying landscaping to remove plant species that attract hazardous wildlife.
- Eliminating open water sections of wetlands to minimise the attraction for landing waterbirds.

The Aerotropolis report took a risk based approach to identifying the risks and management opportunities including a recommendation that applications within the 3 and 8 km buffer areas require a wildlife hazard assessment and wildlife management plan that incorporates relevant mitigation and monitoring. It also included consideration of existing water based hazards and whether or not any new waterbodies change that existing hazard significantly.

It is evident from the Avalon Airport Wildlife Hazard Management Plan (2023), as well as the NASF and the draft Western Syndey Aerotropolis Wildlife Management Assessment Report (2020) that airports and the aviation industry have adopted a risk based approach to managing wildlife hazards. Attachment 1 (from the NASF - Guideline C) demonstrates that water infrastructure requires a mitigation based approach and is not incompatible with new development in wildlife management areas.

As such, HARC is of the opinion that any ultimate Drainage and Stormwater Management Strategy can be designed to mitigate the risks associated with wildlife hazard at Avalon Airport when developed in conjunction with a Wildlife Hazard Management Plan to the satisfaction of Avalon Airport will adequately manage the risks. This will be a requirement of the DPO.

6. Asset ownership and maintenance

Typically, the creation of new drainage assets – both water quality treatment wetlands and drainage infrastructure are transferred after the initial maintenance period to Council.

City of Greater Geelong need to manage their risk associated with the ownership and management of new assets.

New assets required to service the development will need to be to the satisfaction of Council and comply with all of the relevant building industry standards and guidelines. In determining whether or not an asset is appropriate to be constructed as a Council asset, it is appropriate to undertake a triple bottom line assessment that weighs the financial costs, maintenance and safety aspects of an asset against the social and environmental benefits gained. This is particularly important for water quality treatment assets and large assets with specific environmental values or great importance for the protection of conservation values.

The construction of underground assets must meet all relevant standards. Due to the relatively high water table on the site, potential for saline groundwater intrusion and the potential for acid sulfate or soils, the design of underground assets should minimise excavation into the soils. This will see a balance between filling of the site to create grade and freeboard as well as excavating.

Whilst the sewerage system can be constructed as pressure driven and doesn't require significant depth, the drainage system should preferably be designed to gravity outfall. It is also worth noting that land will need to be set aside within the GAEP West site for a precinct sewerage pumping station and individual sites will also require a small area for sewerage management.

A Drainage Asset staging plan will need to be developed subsequent to the overall site drainage strategy. This staging plan should outline the staged construction of permanent works as well as temporary works required to both provide outfall for the stages of development and protect downstream values. Any temporary works and drainage asset staging plan must be to the satisfaction of Council. Section 173 Agreements attached to the landholding will be required as a part of the construction and use of drainage assets that will be required during the construction phase and any maintenance phases.

A high level of management and treatment is required in temporary water quality drainage assets and site management procedures to protect the conservation values. It will be necessary to employ alternative site management techniques and treatment such as collection, pumping, transport and disposal of sediment. This should be outlined in a detailed Site Construction Management Plan.

Attachment 1

Wildlife Hazard Management Action Table **Attachment 1**

Land use types	Likely attractants ▲ natural elements ■ structural elements ● waste and food			Wildlife attraction risk	Actions for existing development and land uses in wildlife management areas			Actions for new and changed development and land uses in wildlife management areas		
					0-3 km (Area A)	3-8 km (Area B)	8-13 km (Area C)	0-3 km (Area A)	3-8 km (Area B)	8-13 km (Area C)
Agriculture										
Turf farm, piggery, abattoir, aquaculture	▲	■	●	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Fruit tree farm/orchard	▲	■	●	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Fish processing/packing plant	▲	■	●	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Farm (cattle, dairy, poultry, crops)	▲	■	●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Horticulture, viticulture, market farms/gardens	▲	■	●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Forestry	▲		●	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Plant nursery	▲	■	●	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Conservation										
Wildlife/conservation area - wetland, waterways	▲			High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Wildlife/conservation area - dryland	▲			Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Recreation										
Significant open water (ancillary to development)	▲			High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Showground	▲	■	●	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Significant landscaped space (ancillary to development)	▲			Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Golf course	▲	■	●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Park, playground	▲		●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Picnic areas, camping ground	▲		●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Racetrack, horse riding school	▲	■	●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Sports facility (tennis, bowls, football fields)	▲	■	●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Commercial										
Food processing or storage facility		■	●	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Fast food, drive-in, outdoor restaurant		■	●	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Shopping centre		■	●	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Warehouse (food storage)		■	●	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Car park		■	●	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Cinemas		■	●	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Hotel/motel		■	●	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Office building		■	●	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Petrol station		■	●	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Warehouse (non-food storage)		■	●	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Utilities										
Food / organic waste facility		■	●	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility - landfill			●	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility - transfer station		■	●	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Water infrastructure (drains, channels, basins)	▲			High	Mitigate	Mitigate	Monitor	Mitigate	Mitigate	Monitor
Non-putrescible waste facility - landfill			●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Non-putrescible waste facility - transfer station		■	●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Sewage / wastewater treatment facility		■	●	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Potable water treatment facility	▲	■		Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action