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REPORT:

Hanna Swamp Investigation

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Summary

Hanna Swamp is located south of the township of Wallan covering approximately 70 ha and straddling the Wallan South and Beveridge North West Precinct Structure Plan (PSP) areas. The PSP plans do not include Hanna Swamp. The rationale for this decision is under review, with Planning Panels Victoria recommending the VPA "*include explicit recognition of the need to plan for Hanna Swamp in the revised Precinct Structure Plan document*" and that "*further consideration of the protection of Hanna Swamp is required*".

In response, this report addresses the following questions:

1. What is the current condition of the swamp and what are the resident ecological values?
2. What is the potential for the swamp to be to be restored or rehabilitated and what factors would influence the likely success of those efforts both in the medium term and when the catchment is urbanised?
3. What are the options for a future Hanna Swamp and how do these futures align with the PSPs as they are presented today?
4. What are the implications for ongoing maintenance and management of the swamp should it be retained?

Site surveys have identified the southern portion of Hanna Swamp qualifies as high value Seasonal Herbaceous Wetland (SHW) based on the composition of its remnant vegetation. SHWs like Hanna Swamp were listed as critically endangered within the Environmental Protection and Biodiversity Act (1999) in 2012. The north of the swamp however has been managed for intensive agriculture and from an ecological perspective is highly degraded.

From a policy perspective, Hanna Swamp has been reviewed in the context of broader land development policy within Melbourne's northern growth corridor. In 2009 the Victorian and Commonwealth Governments agreed to undertake a strategic assessment of the Victorian Government's urban development program (DELWP, Accessed June 2021). The resulting Melbourne Strategic Assessment (MSA) was made under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC, 1999), and sets out the State Government's approach to managing the impact of urban development on "matters of national environmental significance".

The Biodiversity Conservation Strategy for Melbourne's Growth Corridors (2013), or the BCS, was prepared to "evaluate(d) the impacts of the State Government's program Delivering Melbourne's newest sustainable communities on matters of national environmental significance" (BCS, 2013). Environmental and ecological data was gathered through site access (when permitted), or desktop analysis. The BCS identified 36 conservation areas, including Hernes Swamp, that have been deemed to achieve the conservation outcomes specified within the *Delivering Melbourne's newest sustainable communities program report* (2009).

Hanna Swamp was not accessed during this period with assessment undertaken based on modelled data and interpretation of aerial photography. It was not identified as a conservation area under the BCS and is therefore not required to be protected under the MSA. In 2013, the Commonwealth Government approved urban development in the northern growth corridor under the EPBC Act and in accordance with the outcomes of the BCS. This is regardless of the outcomes of site surveys that may have been undertaken since 2013. The removal of Hanna Swamp will however require the payment of environmental mitigation levies under the Melbourne Strategic Assessment (Environmental Mitigation Levy) Act 2020 (MSA Act).

The Panel reviewing the Mitchell Planning Scheme Amendment in relation to the Beveridge North West PSP, considered this in relation to submissions around the future of Hanna Swamp. They concluded that "*not being identified in the Melbourne Strategic Assessment does not provide sufficient justification (for the removal of the swamp) given the broad range of state, regional and local planning policy that points to wetland protection and restoration*" recommending that "*further investigation as to how Hanna Swamp might be protected*".

This report contributes to that investigation.

In terms of restoration or rehabilitation of Hanna Swamp, restoration implies a return to a previous, pre-damaged condition. While aspects or components of ecosystems can be restored, their comprehensive restoration is generally unrealistic. Therefore, this report generally refers to the potential to rehabilitate the site. The rehabilitation of the southern section of Hanna Swamp, within the Beveridge North West PSP, is possible and recommended, however there are a number of factors that will contribute to the success of that effort including, amongst other things, the suitable regulation of water flow and quality into the swamp. This is particularly important in the context of a future, urbanised catchment where hydrology will be significantly altered. There is no proposition that the northern section can be rehabilitated to its historical SHW form and quality. It is however proposed that the protection of the southern section may require a contribution of area in the northern section for the purposes of improving stormwater quality and regulating flow to the SHW.

Four 'ecological futures' were reviewed for Hanna Swamp. Each considered the implications of retaining different spatial extents of the swamp: from the removal of the swamp entirely (as per current PSP plans and in accordance with the BCS) to retention of the full spatial extent (as that is understood).

Comment is also provided as to how each future 'aligns' with the PSP as they are currently presented. In summary, retaining the SHW is largely inconsistent with the PSP plans as presented and with land uses envisaged under the MSA. This is particularly relevant with regard to transport alignments or roadways that are currently shown to bisect the swamp and create artificial boundaries, particularly along the border of the two PSP areas. Each ecological future is reviewed in turn with comment provided as to the implications of that future, or approach across a range of factors.

In summary, while it is recognised that the MSA process has removed EPBC Act (1999) protections from the southern section of Hanna Swamp (within the Beveridge North West PSP), the protection of the existing SHW is highly recommended. The implications include changes to the PSP as it is currently presented, particularly in relation to the interaction of the swamp and planned transport corridors. Also, the consideration as to whether an area in the north can be set aside to contribute to the stormwater treatment and flow regulation requirements of the southern section.

Contents

1 Introduction 6

1.1 Background 6

1.2 What is a Seasonal Herbaceous Wetland (SHW)? 9

1.3 Climate, geology and soils 9

1.4 Existing drainage conditions 10

2 Policy and planning context 12

2.1 The Melbourne Strategic Assessment 12

2.2 Beveridge North West PSP Panel Report 12

2.3 Strategic and policy summary 13

3 Current condition and values 14

3.1 Biodiversity values 14
Desktop findings – vegetation 14
Field survey findings (Alluvium 2021) – vegetation 14
Fauna and fauna habitat 17
Providing seasonal hydrology and suitable water quality 18
Summary 18

3.2 Cultural and heritage values 20

4 The potential to rehabilitate Hanna Swamp 21

4.1 Restoration versus Rehabilitation 21

4.2 Nature Glenelg Trust panel submission – Peer review 21

4.3 Factors influencing rehabilitation and restoration potential 23
Buffer requirements 26
The presence of a seedbank in Hanna Swamp North 26

4.4 Case studies 27
Barnbam Swamp 27
Waterways (Braeside) 27
Gisborne Racecourse Marshlands Reserve 28

4.5 Summary 28

5 What are the options for Hanna Swamp? 29

Values considered 29
Other considerations 30

5.1 Summary 30

5.2 Future 1# – No swamp 32

5.3 Future 2# - Retain SHW values in Hanna South 33

5.4 Future 3# - Retain SHW (HS South) and restore a portion of the northern wetland 34

5.5 Future 4# – Retain full extent of HS South and North 35

6 Site ownership and future management 36

6.1 Challenges 36

6.2 Opportunities 37

7 Conclusion and recommendations for Hannah Swamp 38

7.1 Future work and next steps 40

8 References 41

Attachment A Strategic context detail 44

Attachment B Excerpts from Alluvium (2021) relating to Hanna Swamp, Meade Swamp and Hernes Swamp 60

Attachment C NGT Submission on Hanna Swamp (2020) 74

Attachment D Components of Seasonal Herbaceous Wetland Vegetation 89

Attachment E Evaluation criteria and questions applied to NGT proposal and comparison of Scale Swamp and Hanna Swamp 91

Figures

Figure 1. *Hanna Swamp location in the context of the Wallan South and Beveridge North West PSP boundaries in the northern growth corridor of Melbourne, Victoria.* 7

Figure 2. *1850s parish map showing the extent of Hernes Swamp, Hanna Swamp and Meade Swamp at the time (Victorian Places, 2015)* 8

Figure 3. *Evidence or sodic soils and erosion, Wallan South PSP –Rowes Lane (north side of bend)* 9

Figure 4. *Hanna Swamp before and after comprehensive drainage. Red line is the boundary between PSP areas. (Friends of Merri Creek, 2020)* 10

Figure 5. *Photos taken on April 4th, 2020 showing inundation of Hernes Swamp (left) and Meade Swamp (right). Source: NGT 2020.* 10

Figure 6. *Hanna Swamp north showing drainage lines and site images* 15

Figure 7. *Hanna Swamp south location and site images* 16

Figure 8. *Combined map of aboriginal and historic sensitivity within the broader Wallan-Beveridge area, showing Hanna Swamp as an area of cultural significance (Biosis 2020).* 20

Figure 9. *Illustration of some key principles of wetland buffer design (Figure 5 in DERM 2011) - including both an inner wetland support area and outer wetland separation area and providing connectivity between wetlands.* 26

Figure 10. *Option 1 - No swamp* 32

Figure 11. *Option 2 - Retain SHW values in Hanna South* 33

Figure 12. *Option 3 - Retain SHW (HS South) and restore a portion of the northern wetland* 34

Figure 13. *Option 4 - Retain full extent of HS South and North* 35

Figure 14. *Progress of PSPs within the Stage 1 study area.* 46

Figure 15. *North Growth Corridor Plan* 47

Figure 16. *Yarra catchment SDS outcomes* 49

Figure 17. *Merri Creek Upper sub-catchment (Co-Design Catchment Program for the Yarra Catchment)* 52

Figure 18. *Hernes Swamp (Co-Design Catchment Program for the Yarra Catchment)* 53

Figure 19. *Desired IWM Outcomes of the Water Futures North project (Water Futures North 2015)* 54

Figure 20. *Wallan Regional Park study area (DELWP)* 56

Figure 21. *Wallan Structure Plan including links to Hanna and Meade swamps (Mitchell Shire Council, 2015)* 59

Tables

Table 1. Preliminary recommendations for Hanna Swamp from Alluvium (2021). 19

Table 2. Impacts of relevant land use types on seasonal herbaceous wetlands (Papas et al 2016) 25

Table 3. Values descriptions 29

Table 4. Target summaries across the Yarra catchment 50

Table 5. Summary of long-term key value outcomes Yarra catchment 51

Abbreviations

Alluvium	Alluvium Consulting Australia Pty Ltd
ARI	Average recurrence interval
DSS	Drainage Services Scheme
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth legislation)
EVC	Ecological Vegetation Class
FFG Act	Flora and Fauna Guarantee Act 1988 (Victorian legislation)
MW	Melbourne Water
NGT	Nature Glenelg Trust
PSP	Precinct Structure Plan
SHW	Seasonal Herbaceous Wetland
PPV	Planning Panel Victoria
VVP	Victorian Volcanic Plains Bioregion
Water Act	The Water Act 1989 (Victorian legislation)
YVW	Yarra Valley Water

Glossary of technical terms

Drainage	The natural or artificial removal of surface or sub-surface water from an area. Typically, urban drainage is designed to convey up to the 1 in 5 year average recurrence interval (ARI) flows via sub-surface drains. Larger flows, up to the 1 in 100 year ARI are conveyed via roadways and waterways.
Drainage Services Scheme (DSS)	Prepared by Melbourne Water to provide catchment-based drainage strategy and functional designs of drainage infrastructure needed for urban growth.
Ephemeral wetland	A wetland that holds water temporarily, may be dry intermittently and difficult to detect for large parts of the year. It may be dry for multiple consecutive years.
Ecological Vegetation Class (EVC)	The standard term for classifying vegetation types in Victoria.
Impervious area	A paved area that surface water is unable to infiltrate often associated with roads, pavement and roofs. An increased impervious fraction will generate increased stormwater volumes and associated pollutant loads.
Plains Grassy Wetland	An ecological vegetation class (EVC 125) in Victoria with an Endangered Bioregional Conservation Status in the VVP bioregion. It is one of multiple EVCs considered equivalent to SHW.
Precinct structure plan (PSP)	High level master plans developed by the VPA in consultation with key stakeholders for whole communities, typically laying out roads, shopping centres, schools, parks, housing, employment, drainage infrastructure, and transport connections.
Seasonal herbaceous wetland (SHW)	'Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains' is a threatened ecological community, federally listed as Critically Endangered (EPBC Act 1999).
Swamp	A type of wetland. Often used in a formal/technical context for wetlands dominated by woody vegetation, but also applied informally to non-woody wetlands.
Wetland	Area subject to permanent or temporary inundation, that holds static or very slow moving water and develops, or has the potential to develop, biota adapted to inundation and the aquatic environment. May be natural, modified or artificial, and includes freshwater and saline lakes, swamps and shallow waters in estuaries, bays and inlets.

1 Introduction

Hanna Swamp is located south of the township of Wallan within the Northern Growth Corridor of Melbourne. The subject site covers approximately 70 ha and straddles the Wallan South and Beveridge North West Precinct Structure Plan (PSP) areas. The PSP plans do not include the area known as Hanna Swamp. The process and rationale for the removal of Hanna Swamp from the PSP plans is a decision that is under review. Specifically, Planning Panels Victoria's (PPV) recommendation was that the Victorian Planning Authority (VPA) should "include explicit recognition of the need to plan for Hanna Swamp in the revised Precinct Structure Plan".

This report aims to contribute to that planning by addressing the following questions:

1. What is the current condition of the swamp and what are the resident ecological values?
2. What is the potential for the swamp to be to be restored or rehabilitated and what factors would influence the likely success of those efforts both in the medium term and when the catchment is urbanised?
3. What are the options for a future Hanna Swamp and how do these futures align with the PSPs as they are presented today?
4. What are the implications for ongoing maintenance and management of the swamp should it be retained?

Alluvium Consulting Australia (Alluvium) has been involved in two waterway, catchment and ecological investigations in this region on behalf of the VPA (this report) and Melbourne Water. This report draws on the findings of both pieces of work.

1.1 Background

Hanna Swamp lies within the Merri Creek catchment which is a tributary to the Yarra River. The Yarra (Birrarung) catchment encompasses the traditional lands of the Kulin Nation, including the Wurundjeri Woi Wurrung people. Archaeological evidence shows that Aboriginal Wurundjeri Woi Wurrung people lived and prospered in the Yarra (Birrarung) catchment for at least 30,000 years (Foundary Associates, 2019). A catchment and context map is shown in Figure 1 including the location of Hanna Swamp in relation to existing development surrounding Wallan, local waterways including Strathaird Creek, PSP boundaries and other historical swamps and wetland within this section of the northern growth corridor, including Meade and Hernes Swamps.

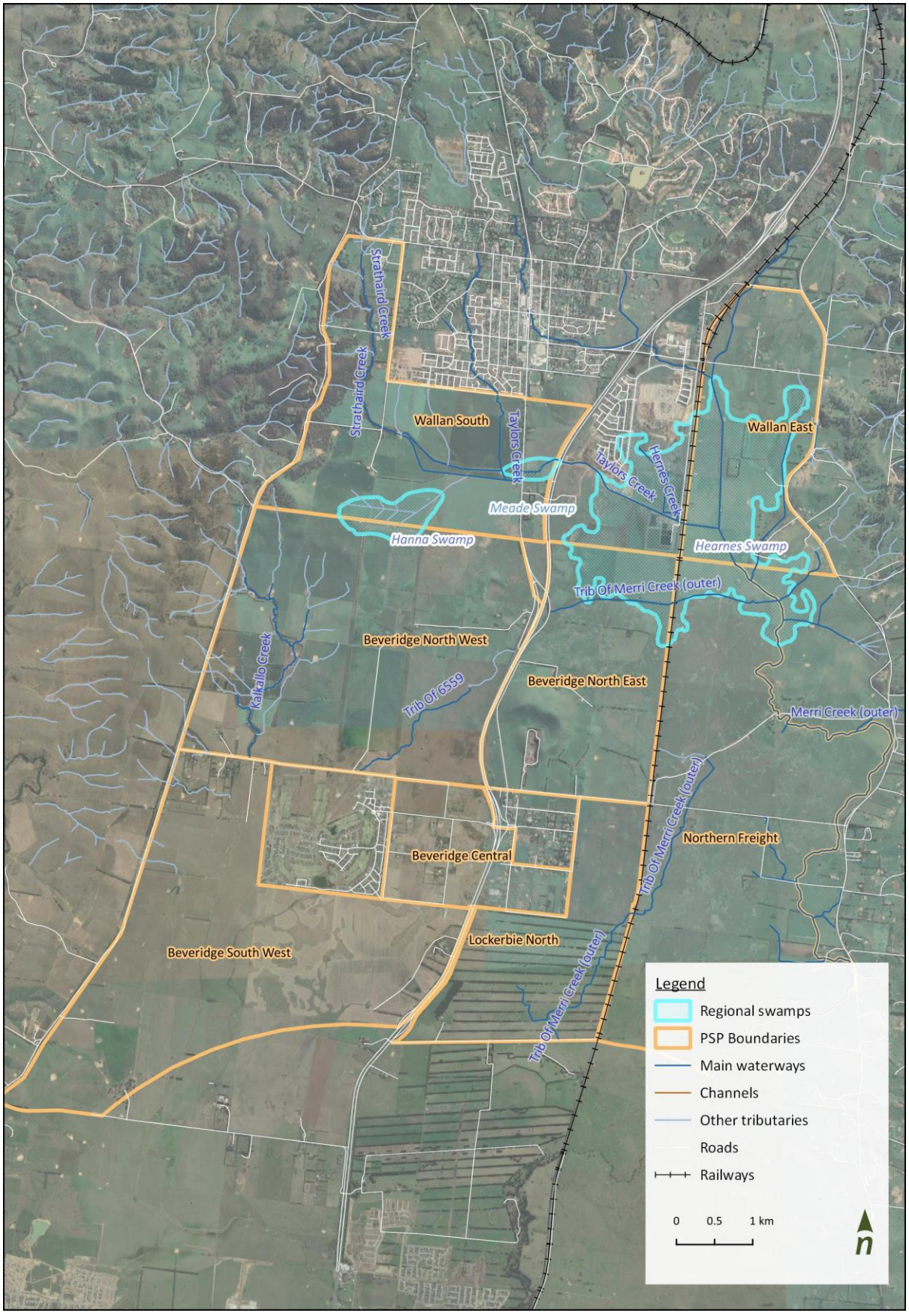

Figure 1. *Hanna Swamp location in the context of the Wallan South and Beveridge North West PSP boundaries in the northern growth corridor of Melbourne, Victoria.*

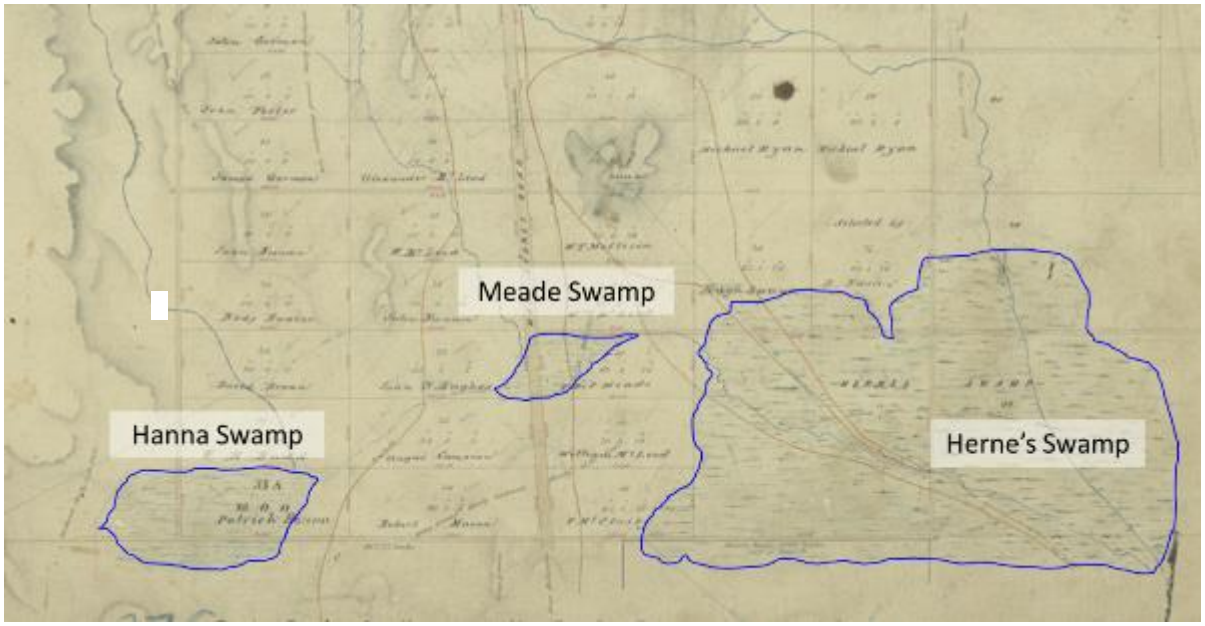

Figure 2. *1850s parish map showing the extent of Hernes Swamp, Hanna Swamp and Meade Swamp at the time (Victorian Places, 2015)*

Historical mapping shows Hanna, Meade and Hernes Swamps within the northern growth corridor south of Wallan (Figure 2). Site surveys have identified the southern portion of Hanna Swamp as a Seasonal Herbaceous Wetland (SHW) based on the composition of its remnant vegetation. SHWs like Hanna Swamp are listed as being critically endangered within the Environmental Protection and Biodiversity Act (1999), with this listing occurring in 2012. They typically receive the majority of their water from local catchments as part of the swamp's wetting and drying regime. The filling of SHWs is typically intermittent and driven by local catchment and hydrological function. It is unlikely that Hanna Swamp received predictable inflows of the same duration, depth and timing on a regular and predictable annual cyclical basis.

Figure 2 does suggest that Hanna Swamp was once hydrologically connected to Strathaird Creek and could therefore have received periodic/intermittent inflows from that waterway.

In recent times the landscape has been extensively cleared of significant vegetation (Parsons Brinkerhoff, 2008) for grazing and agricultural purposes (Victorian places, 2015). This is reported to have had a substantial impact on areas of ecological value (Victorian places, 2015). The upper part of the Merri Creek catchment where Hanna Swamp is located is now predominantly rural (Melbourne Water, 2016) with the township of Wallan and its surrounds urbanising rapidly.

In response to the development of growth corridors, Growth Corridor Plans are prepared that define land use and transport planning for these areas. The VPA also works with stakeholders to prepare Precinct Structure Plans that set out land uses within urban development areas.

1.2 What is a Seasonal Herbaceous Wetland (SHW)?

"Seasonal Herbaceous Wetlands (SHW) are isolated freshwater wetlands that are seasonally or intermittently filled by rainfall. They are usually inundated in the cooler months (winter – spring), and generally dry out by late summer, so surface water is not permanently present. Being dry for part of each year means they often disappear from the landscape (or at least seem to) and as a result most have been cropped or drained during dry periods, as SHW often occur on fertile soil in agricultural landscapes" (Glenelg Hopkins Catchment Management Authority, 2017).

SHWs are dependent upon seasonal wetting and drying patterns (Threatened Species Scientific Community TSSC, 2012), where the depth, duration and frequency of inundation is highly variable, however typically they are inundated for up to a few months and the depth of water is usually shallow (<1m) and there may be little to no inundation for several years during drought periods. They are typically treeless, freshwater systems. Salinity is generally between 0 and 1000 mg/L (increasing to 3000 mg/L as water evaporates). Wetlands that are saline or have either groundwater or overbank flooding as their dominant water source are excluded from the SHW threatened community.

Different types of wetlands (e.g. large and permanent freshwater lakes, saline marshes, and seasonal herbaceous wetlands) each provide habitat for a selection of fauna and flora species and the full diversity of wetland types need to be protected to conserve that range of biodiversity. Removing or replacing a SHW with another type of wetland will result in reduced species and functional diversity (TSSC 2012).

1.3 Climate, geology and soils

The rain gauge at Wallan (086350) indicates that the median annual rainfall for the area is 666.5 mm between 1979 and today (Bureau of Meteorology), with most rainfall occurring in winter months to early spring. The area surrounding Hanna Swamp is largely dominated by geologic units of the Newer Volcanic group, with Wallan and its surroundings swamps and wetlands forming part of a large area overlaying Pleistocene sandy alluvial terrace deposits characterised by sodic soils.

A review of the literature shows that sodic soils are present across the Wallan area. A land capability study by the Mitchell Shire Council identified the major landform group as the Wallan floodplain landform formed over alluvial floodplain deposits. Topsoils within this landform unit were found to have varying levels of dispersibility, whereas subsoils were found to have high levels of dispersibility (Jones et al. 1996). Hydrological investigations conducted within the Strathaird Creek (Alluvium 2010) and Taylors Creek (Stone 2008) area show evidence of gully erosion, indicating the likely presence of sodic subsoils that are highly susceptible to erosion.

Figure 3. *Evidence or sodic soils and erosion, Wallan South PSP –Rowes Lane (north side of bend)*

1.4 Existing drainage conditions

Hanna Swamp is prone to inundation during large rainfall events and currently receives water from its surrounding catchment. A series of formal drains have been cut through the swamp that drain the northern section of the swamp to the lower end of Strathaird Creek. These drains have been constructed in support of agricultural activities and have significantly altered the swamps hydrology ensuring that flows reaching the swamp are drained efficiently. The existing drainage lines across the northern sections of Hanna Swamp are visible in Figure 4.

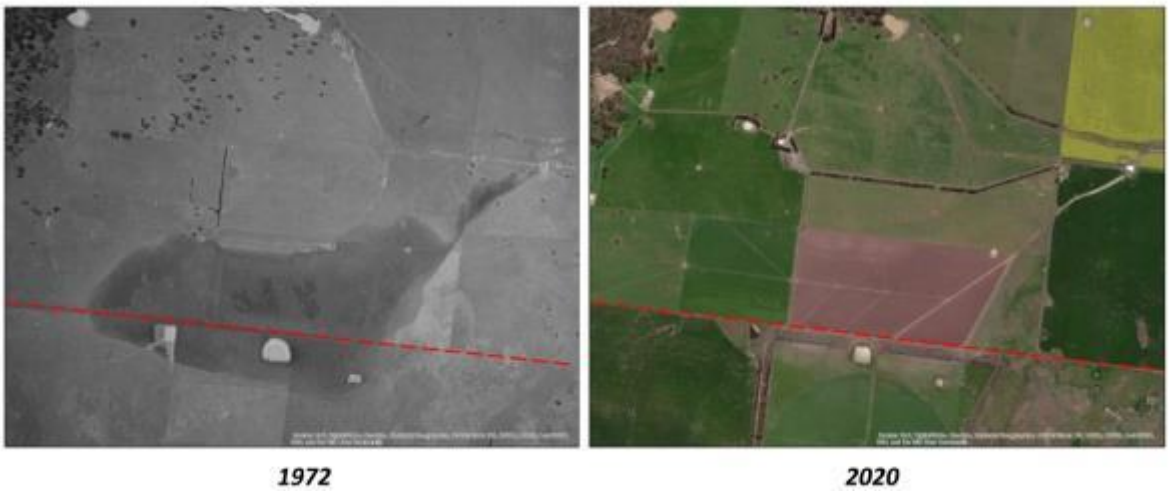

Figure 4. *Hanna Swamp before and after comprehensive drainage. Red line is the boundary between PSP areas. (Friends of Merri Creek, 2020)*

An investigation was conducted in 2020 to understand the sites current hydrology and the potential impacts of urbanisation on Hanna (and Meade) Swamps (Alluvium, 2020). This work included a water balance assessment for Hanna Swamp that estimated inflows, outflows and losses assuming the swamp was reinstated to its full area (i.e. north and south sections across Wallan South and Beveridge North West PSPs). The work also considered the option of diverting Strathaird Creek to Hanna Swamp (as proposed by Nature Glenelg Trust, 2020).

The investigation found that the current catchment for Hanna Swamp covers approximately 250 ha. The water balance estimated that a reinstated Hanna Swamp could experience 5% evaporative losses and 12% seepage losses of the total flows from the contributing catchment (17% in total). This could be increased if a diversion from Strathaird Creek to Hanna Swamp was implemented in line with a Nature Glenelg Trust (NGT) assessment of past river morphology (NGT 2020).

The need for a diversion from Strathaird Creek would depend on the objective of the work i.e. what type of wetland community was being re-established on the northern side of the swamp, with consideration for the implications of such a diversion on the high value SHW community on the southern side of the swamp.

Figure 5. *Photos taken on April 4th, 2020 showing inundation of Hernes Swamp (left) and Meade Swamp (right). Source: NGT 2020.*

Analysis recently undertaken by Afflux Consulting (2021) notes that the site drains quickly and inundation events are likely to last less than 24 hours and as such cannot support 'permanent or ephemeral' vegetation. This conclusion is based on the efficient function of the existing drainage network. These drainage conditions could be changed, and are likely to as part of development works. Flood mapping undertaken as part of that work also indicates that Hanna Swamp lies within the floodplain of Strathaird Creek, draining to Strathaird Creek.

2 Policy and planning context

2.1 The Melbourne Strategic Assessment

For the purposes of this report, a review of the policy and planning issues surrounding Hanna Swamp arguably begins process undertaken to deliver the Melbourne Strategic Assessment (MSA) program. In 2009 the Victorian and Commonwealth Governments agreed to undertake a strategic assessment of the Victorian Government's urban development program (DELWP website, Accessed June 2021). This program was made under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC, 1999). The resulting Melbourne Strategic Assessment (MSA) sets out the State Government's approach to managing the impact of urban development on "matters of national environmental significance".

The Biodiversity Conservation Strategy for Melbourne's Growth Corridors (2013), or the BCS, was prepared to *"evaluate(d) the impacts of the State Government's program Delivering Melbourne's newest sustainable communities on matters of national environmental significance*" (BCS, 2013).

To prepare the BCS, environmental and ecological data was gathered through site survey when access to site was permitted, or through desktop analysis when access was not. On the basis of this analysis, 36 conservation areas were identified in the BCS that require protection to achieve the conservation outcomes specified within the *Delivering Melbourne's newest sustainable communities program report* (2009).

Hanna Swamp was not accessed during this period and an assessment was undertaken based on modelled data and interpretation of aerial photography. It was not identified as a conservation area under the BCS and has not been identified as an area requiring protection under the MSA.

In 2013, the Commonwealth Government approved urban development in the northern growth corridor in accordance with the outcomes of the BCS. Therefore, Hanna Swamp is no longer afforded protection under the EPBC Act (1999), including a note that this is "without regard for site surveys that may have been undertaken since 2013". Should Hanna Swamp be removed however, the payment of environmental mitigation levies would be required under the Melbourne Strategic Assessment (Environmental Mitigation Levy) Act 2020 (MSA Act).

2.2 Beveridge North West PSP Panel Report

In considering the status of Hanna Swamp, the Beveridge North West PSP Panel Report recommended that "further consideration of the protection of Hanna Swamp is required". In discussing future options for integrating Hanna Swamp into the landscape, Mitchell Shire Council noted that "*the portion of Hanna Swamp located between the SR-01 and Hadfield Road has the potential to be integrated with the open space area, albeit in modified form*". The panel agreed that the expansion of SR-01 could be positive for reasons including the retention of a portion of Hanna Swamp.

The panel concluded that "*not being identified in the Melbourne Strategic Assessment does not provide sufficient justification (for the removal of the swamp) given the broad range of state, regional and local planning policy that points to wetland protection and restoration*", recommending that "further investigation as to how Hanna Swamp might be protected".

This report contributes to that investigation.

2.3 Strategic and policy summary

In addition to the above, there are numerous planning and strategic documents, prepared by the state government and water industry stakeholders, that refer to the region's waterways, natural assets and swamps like Hanna Swamp. These documents were reviewed previously as part of Alluvium's Wallan – Beveridge Waterway Assessment (2020). This work was reviewed with summaries of these documents provided in Appendix A.

As a summary statement however it is noted that the overarching objectives expressed within these documents indicate an intent to manage urban growth and development while protecting and enhancing landscape, biodiversity, ecological, cultural, amenity and liveability values while also providing affordable and sufficient housing and infrastructure.

Strategies, like the recent IWM Forums Strategic Directions Statement for the Yarra Catchment, support a co-ordinated and integrated approach to planning, development and the protection of the environment while calling for collaboration across stakeholders and sectors to achieve these outcomes.

The protection and management of wetlands is consistent with the broad policy intent expressed at a local and state level. The protection of a site like Hanna Swamp would be consistent with the outcomes sought in documents like Water for Victoria (State Government, 2016) and specifically Chapter 5 "Resilient and liveable cities and towns" that calls for Healthy and valued urban landscapes where:

- water is prominent in the urban landscape
- Urban landscapes retain moisture for cooler, greener cities and towns
- Waterways are accessible as valued open spaces and
- Aboriginal cultural values associated with waterways are protected.

3 Current condition and values

This section summarises the first question of the investigation: What is the current condition of Hanna Swamp and what are the site's existing, resident ecological values?

3.1 Biodiversity values

The resident biodiversity values for Hanna Swamp were assessed during a field investigation by Alluvium (October 2020). Shallow inundation had occurred in the weeks to months prior, triggering the growth of a range of seasonal wetland flora enabling detection of wetland flora elements key to the determination of a SHW. These flora elements cannot be readily identified during dry periods.

Despite vegetation throughout the area being highly modified by agriculture, there are significant biodiversity values associated with Hanna Swamp, primarily in the southern portion of the wetland with Plains Grassy Wetland EVC 125 (see below) and wetland plant species detected in the north also. These biodiversity values are summarised below, with brief comments on connected values downstream and with the broader Wallan Wetlands area.

Further information for Hanna Swamp and brief summaries for Herne and Meade Swamps can be found in Appendix B that are drawn from the Stage 1 to 4 report for the Wallan-Beveridge Waterway's Assessment (Alluvium 2021).

Desktop findings – vegetation

Model-based vegetation mapping provides background information on what vegetation may occur at a site. The mapping referred to must be verified in the field. Results of previous field surveys are presented in the next section.

Hanna Swamp and the surrounding area fall within the Victorian Volcanic Plain (VVP) bioregion. Pre-1750 EVC mapping (DELWP, 2020) shows Hannah Swamp modelled as EVC 125 Plains Grassy Wetlands, which is classed as Endangered in the VVP bioregion. The pre-1750 EVC mapping is at a coarse scale and these modelled EVCs need to be coupled with interpretation and field investigation.

One federally listed threatened community that is recorded as likely to occur at Hanna Swamp is Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains, Critically Endangered (EPBC Act 1999) (EPBC Protected Matters Report). This community is considered equivalent to EVC 125: Plains Grassy Wetland (Endangered Conservation Status in the Victorian Volcanic Plains bioregion).

Field survey findings (Alluvium 2021) – vegetation

The redirection and channelisation of Strathaird Creek and drain construction through the floodplain, has modified the hydrology of the water-dependent vegetation zones throughout the Hanna Swamp and Strathaird Creek area. However, significant remnant vegetation still exists, and Hanna Swamp holds species and a vegetation community protected under state and federal legislation.

Starkly different values occur to the north and south of the property boundary which bisects the swamp (as per Figure 1 above and Figure 6 below). Field surveys conducted by Alluvium (October 2020) confirmed the presence of EVC 125 / Seasonal Herbaceous Wetlands (SHW) at Hanna Swamp in the southern portion, and degraded EVC 125 vegetation in the northern portion. Note that further investigation as to the way in which vegetation condition might vary across the site have not yet been undertaken. Further assessment would provide valuable additional information.

Hanna Swamp North: The limited native vegetation values that remain in the north comprise robust, disturbance tolerant species derived from degraded EVC 125 Plains Grassy Wetland and does not meet the criteria for SHW (Alluvium 2021).

It is dominated by exotic plant species, with robust common indigenous plants currently restricted to drainage lines (i.e. *Amphibromus nervosus*, *Eleocharis acuta*, *Myriophyllum* spp. and *Juncus spp.)* and a patch dominated by the native grass *Poa labillardierei* occurring to the east of Hanna Swamp. At the time of assessment, 19 plant species were identified in total, comprising 11 exotic and 8 indigenous species.

This confirms findings of a prior vegetation survey conducted by Biosis on the eastern 2/3 of Hanna Swamp north in 2016 when the wetland had been wet but was drying (Biosis 2018). They found small areas of Plains Grassy Wetland (EVC 125) of poor quality (weed cover >50%) in the drainage lines and patches in the SE corner of Hanna Swamp North that did not meet the criteria for SHW (four patches, total 2.32 hectares).

The north portion is currently managed for intensive agriculture (Alluvium 2021) and has been deep ripped to ~600mm and sprayed out with selective and non-selective herbicides 4-5 times over the past 14-15 years. It receives annual fertiliser top ups and is intensively grazed. The history of cultivation, intensive pasture management and grazing reduces the current suitability of this area to sustain a diverse range of indigenous species. This area would require much higher inputs than the southern portion for rehabilitation to occur. Hanna Swamp north is now largely a very well managed pasture of high quality and agriculture productivity.

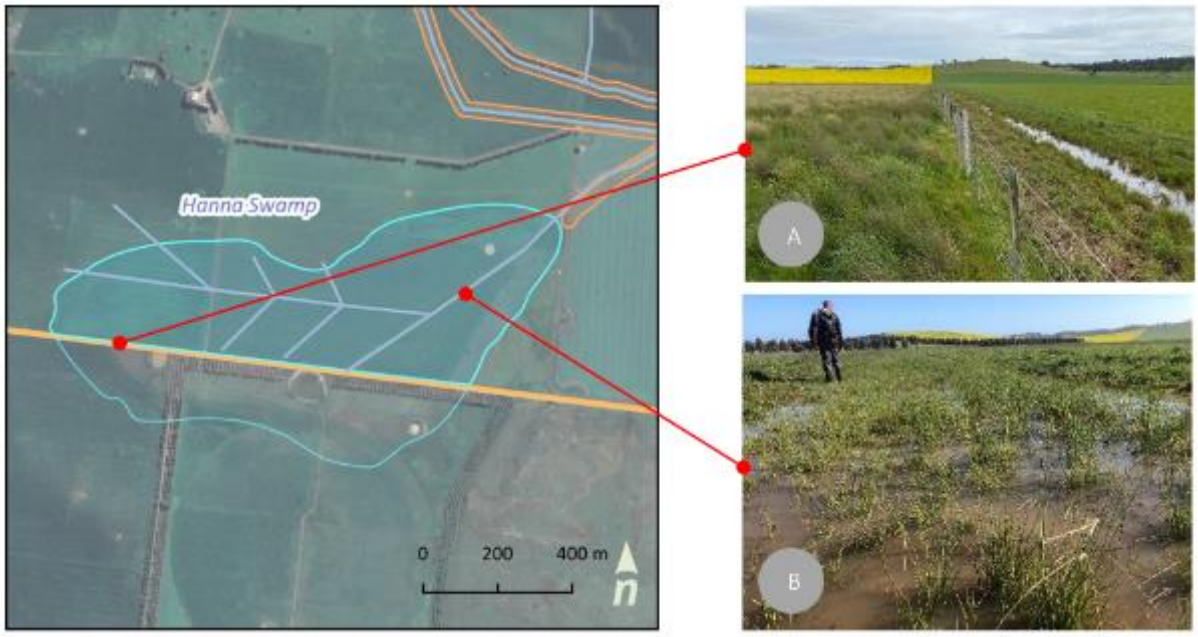

Figure 6. *Hanna Swamp north showing drainage lines and site images*

Hanna Swamp South: The south side maintains a portion of remnant wetland vegetation EVC 125 which qualifies as a very high quality SHW and provides habitat for a number of important wetland plant species. Indigenous wetland flora is evident throughout the south side co-occurring with exotic species.

This vegetation has much higher species diversity than the north, with 67 species found (33 indigenous species, 1 planted i.e. *Eucalyptus camaldulenis* Red Gum, and 33 exotic species). *Coronidium gunnianum* Pale swamp everlasting, a threatened species in Victoria (vulnerable under the FFG Act) was observed in the portion not subject to pasture renovation.

The very high quality SHW benchmark is met because the site contains more than three diagnostic species in the federal advice for this threatened ecological community (TSSC 2012). In this case six species were identified including *Calocephalus lacteus* Milky Beauty-heads, *Coronidium gunnianum* Pale Swamp Everlasting, *Eryngium vesiculosum* Prickfoot, *Lobelia pratioides* Poison Lobelia, *Montia australasica* White Purslane and *Ranunculus inundatus* River Buttercup.

The long term trajectory potential for Hanna Swamp south is positive, and is likely to maintain its values if hydrology is suitable and threats are managed appropriately.

Figure 7. *Hanna Swamp south location and site images*

Fauna and fauna habitat

To the best of our knowledge, a comprehensive fauna survey of the full extent of Hanna Swamp has not been conducted, with surveys lacking in the southern high value vegetation areas. A flora and fauna assessment of the Strathaird/Taylors Creeks area in 2016 included only the northern part of Hanna Swamp, and did not identify significant fauna species or habitat within this part of the wetland footprint (Biosis 2018). The field survey conducted by Alluvium in 2020 included only incidental fauna observations (Alluvium 2021).

Incidental fauna observations at Hanna Swamp south included seven common species of birds and the crustacean Tadpole Shrimp, Family Triopsidae (Alluvium 2021). This crustacean is typical of ephemeral wetlands and indicates the importance of hydrological function for transient fauna that rely on ephemeral and seasonal wetlands. This is an example of contemporary wetland process occurring at Hanna Swamp.

Given the limited fauna information specific to Hanna Swamp, fauna habitat information in the listing advice for SHW (TSSC 2012) gives an indication of the potential importance of this wetland type for fauna. The types of fauna present in SHWs vary depending on site history and local conditions and includes species that use other habitat types as well as species that are temporary water specialists (TSSC 2012). The main fauna groups found in this ecological community include frogs, invertebrates, reptiles and waterbirds (aquatic mammals and native fish tend to need more permanent inundation). Wetting and drying of these wetlands supports high productivity with large numbers of invertebrates supporting wetland species that feed on them. The invertebrate species composition tends to be different to that of permanent wetlands. Seasonal herbaceous wetlands are noted to be important feeding and breeding habitat for frogs such as the Growling Grass Frog (TSSC 2012).

Growling Grass Frog: Although Hanna Swamp is unlikely to currently provide habitat directly for the Growling Grass Frog (GGF), it is connected to and upstream of areas that are important for this threatened species. The GGF is listed as 'Vulnerable' under the EPBC Act (Department of Environment, 2021)

A 2017 assessment including most of Strathaird and Taylors Creeks and only the northern part of Hanna Swamp, did not find Growling Grass Frogs or suitable habitat (Biosis 2018). Biosis conducted GGF surveys at waterholes along Strathaird Creek, including at the point where Hanna Swamp drains to the creek. GGF was not detected during the survey and based on this and the presence of introduced predatory fish in the waterways, it was concluded they were unlikely to occur in the study area.

Alluvium (2021) notes that Hernes Swamp and parts of Merri Creek are areas of strategic importance to the Growling Grass Frog. The designated Growling Grass Frog Conservation Area (GGF CA) along Merri Creek (to the SE of Hanna Swamp extends as far north as Hadfield Road in Beveridge and is considered Category 1 Habitat and classified as 'medium' priority in the GGF Master Plan for Melbourne. Although this corridor terminates at the edge of the Melbourne Strategic Assessment (MSA) boundary, the complex of swamps to the north and west (Hanna, Meade and Hernes Swamps) are still considered suitable habitat for Growling Grass Frog. (Category 2 – Other Suitable Habitat requiring offset if cleared).

High sediment load inflow events are a potential threat for this species, requiring careful management of upstream disturbances. Improving and maintaining the natural function of Hanna Swamp as part of a connected network of wetlands and waterways at the landscape scale could help support benefits to downstream water quality and biodiversity values like the GGF.

The outcomes of water cycle planning in the swamp system immediately upstream will have direct impacts on habitat quality and GGF populations within the GGF CA. This is because instream habitat quality is typically degraded by flashy stormwater flows and poor water quality typical of urbanised catchments. It is therefore recommended that the Wallan / Beveridge growth corridor adopt an integrated water management (IWM) approach in consultation with DELWP, Melbourne Water (MW), Council and the Victorian Planning Authority (VPA) so that future development is able to sustain and support the ecological health of the upper Merri Creek system such that is more suitable habitat for Growling Grass Frogs (Alluvium 2021). This is not asserting that Hanna Swamp will become GGF habitat, rathe that the corridor as a whole, that Hanna Swamp is a part of, will become more suitable for GGF.

Golden Sun Moth: A review of the Victorian Biodiversity shows one threatened fauna species record near the eastern edge of Hanna Swamp – *Synemon plana* (Golden Sun Moth) - listed as Critically endangered under the national EPBC Act (last record 2019). This species was also observed in 2016 in small grassland remnants immediately to the east and approximately 1km to the west of Hanna Swamp (Biosis 2018). However, Hanna Swamp in its current state is unlikely to provide substantial areas of suitable habitat for this species (Alluvium 2021) as the Golden Sun Moth prefers Native Temperate Grasslands with a dominance of Wallaby Grasses as habitat.

The subregional strategy for the Golden Sun Moth requires retention of habitat in native vegetation in a development area if these conditions are met:

- At least 100 ha of contiguous, native high-quality grassland habitat in or around the precinct
- These areas comprise native habitat patches less than 200 m apart
- Each habitat patch contains less than 25 per cent cover of high threat perennial grassy weeds (DEPI 2013).

The general effect of the prescription is to allow for clearing of Golden Sun Moth habitat within the growth corridors conditional on these habitat areas being offset (typically to the Western Grassland Reserves). Vegetation of wetland and waterway assessments by Alluvium in 2020, including Hanna Swamp, was considered unlikely to meet 'prescription for maintenance' thresholds (Alluvium 2021).

During site inspections limited to wetland and waterway features including Hanna Swamp in October 2020, habitat for the golden sun moth meeting this 'prescription for maintenance' was not found within the swamp footprint (Alluvium 2021).

Providing seasonal hydrology and suitable water quality

Changes to hydrology from urbanisation will not be suitably managed by a buffer unless it includes a controlled inflow and wetland treatment system. The system will need to deliver adequate water quality and flow regimes delivering seasonal wetting and drying. Surface runoff would need to be diverted to prevent flooding of the SHW during the drier part of the year. Preventing release of untreated runoff from the surrounding areas during construction (DELWP 2012) is especially important due to the highly erosive and dispersive sodic soils of the area. Ideally such an asset would be defined within the relevant Developer Services Scheme (DSS) as prepared by Melbourne Water for the catchment.

The system would need to treat the polluted 'first flush' of runoff while volumes from the later part of large rain events could be diverted to the swamp with minimal treatment, thereby maximising the flood mitigation and infiltration/evaporation benefits of retaining the wetland.

Summary

- From an ecological perspective, protecting the SHW values that are present within Hanna Swamp South is considered highly desirable. The southern portion of the site has the highest values and greatest long term capacity for rehabilitation.
- Incorporating an area to the norther (i.e. within Wallan South PSP) to act as a stormwater treatment and flow moderation asset is also desi5rable, and likely to be fundamental to the protection of the SHW in the south.
- Development of a restoration plan is recommended to ensure that all stakeholders have a shared understanding of the objectives relating to the future direction of the area of Hanna Swamp that is retained (and for other significant natural assets in the region). This includes outlining expected ecological outcomes and how this may change over time, as well as the potential for community amenity and liveability outcomes. Additional data and/or modelling of Hanna Swamp's rehabilitation potential based on what is known about current ecological values and historical data would be needed to inform restoration planning.

Table 1. Preliminary recommendations for Hanna Swamp from Alluvium (2021).

Location	Current habitat quality	Recoverability of ecological processes	Indicative resourcing to maintain and improve	Priority to retain and protect existing values and to rehabilitate.	Key issues for retention and rehabilitation
Hanna south (Plains Grassy Wetland; very high value Seasonal Herbaceous Wetland)	High	Recoverable with careful attention to biomass, watering and monitoring of response.	Medium level to be sustained for the long term.	Very high	The preference is to retain the SHW notwithstanding the evaluation made under the BCS Modelling to determine appropriate hydrological regime, ensuring an appropriate wetting and drying regime (timing, depth and duration) while still allowing for natural variability. Stormwater entering the system must have some form of primary treatment as water chemistry will be critical to future restoration. Invasive species that can alter composition and values of the site for both flora and fauna. Biomass of indigenous and exotic flora, removal of planted Eucalypt trees. Future land use impacts associated with urbanisation including unauthorized access. Preference would be for meaningful community interaction to be supported via boardwalks, walkways etc.
Hanna north (Plains grassy wetland)	Low	Substantial resources required for current and ongoing management if significant improvement is desired.	Resourcing will depend on objectives, which are not sufficiently clear.	Low	Appropriate hydrology/stormwater treatment depends on management objectives Clear and measurable objectives needed Invasive species and biomass reduction Further understanding of recovery potential needed Passive rehydration without sophisticated long-term management could risk a relatively low standard of indigenous vegetation recovery that may come at high cost depending on land ownership implications. Investigation of the seed bank would help predict expected balance of exotic and indigenous species and help determine the management actions and long term cost of rehabilitation. Cost benefit analysis required to understand full costs and likely benefits involved in different potential rehabilitation options. Other ecological processes benefits including for water quality, fauna habitat (including for birds, frogs, fish and macroinvertebrates) refuge habitat and amenity benefits need to be clear established and described.

3.2 Cultural and heritage values

Biosis Pty Ltd conducted a cultural heritage due diligence assessment as part of an environmental assessment for the broader area surrounding Hanna Swamp in 2020. This involved a desktop search of the Victorian State register to identify Aboriginal and historical heritage. While no specific heritage sites of European origin were identified, a brick hut just north of the swamp was identified as an area of archaeological potential.

Wetlands in the area have Aboriginal cultural significance (see Figure 8) and the absence of mapped Aboriginal places around Hanna and Herne Swamps is likely due to a lack of investigation, and not a good indicator of Aboriginal places not being present (Biosis 2020)[1].

Aboriginal people have a strong connection to the broader area around Hanna Swamp and evidence of their presence prior to and after European settlement has been identified across the surrounding region (Biosis 2020). A review of previous archaeological investigations within the vicinity of the study area provides indication that lesser waterways and swamps in the area are sensitive for the presence of Aboriginal cultural heritage material. Places of significance in the surrounding region include artefact scatters and a scarred tree, which demonstrates that the area was used by, and is significant to, Aboriginal people. Any waterway within the study area has been shown to also hold high significance and sensitivity (Biosis 2020).

Any high impact activity within defined areas of sensitivity requires a mandatory Cultural Heritage Management Plan, under the Aboriginal Heritage Act 2006 (Biosis 2020).

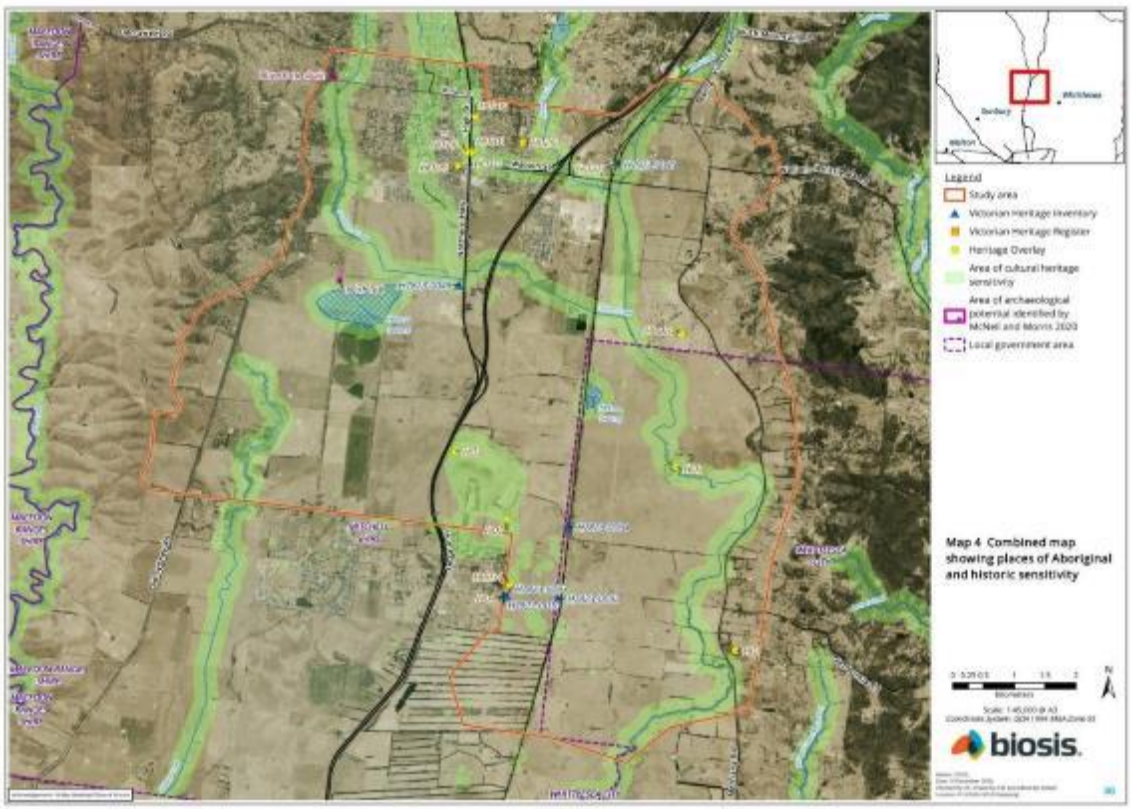

Figure 8. *Combined map of aboriginal and historic sensitivity within the broader Wallan-Beveridge area, showing Hanna Swamp as an area of cultural significance (Biosis 2020).*

[1] "*A notable absence is the lack of Aboriginal places in the vicinity of Herne and Hanna Swamps. It is likely that this is not a good indicator Aboriginal places not being present, rather the lack of investigation of these areas. These wetlands, although not ideal camping places, would have provided an abundance of game and other resources. It is likely that material culture was deposited and may be impacted by construction or drainage works.*" Biosis 2020 p27

4 The potential to rehabilitate Hanna Swamp

4.1 Restoration versus Rehabilitation

In a strict sense, restoration implies return to a prior (pre-damage) condition. While aspects or components of ecosystems can be restored, their comprehensive restoration is generally unrealistic. A more useful approach is one of rehabilitation, which involves re-establishment of some ecological components and functions. While only a word, use of the term 'restoration' can create unrealistic expectations for the outcomes of ecological interventions, whereas 'rehabilitation' allows for a staged recovery of some of the ecological attributes and species composition, depending on the resources available.

The following section considers the potential to rehabilitate Hanna Swamp based on the current condition of the northern and southern sections of the swamp and the values that are present. This section begins by reviewing the Nature Glenelg Trust (NGT) submission to the Beveridge North West Planning Panel (NGT 2020, Appendix C).

4.2 Nature Glenelg Trust panel submission – Peer review

Alluvium with the assistance of wetland ecologist Doug Frood, undertook a review of NGT's submission to the Beveridge North West Planning Panel in relation to the potential and proposal for 'rehabilitation' of Hanna Swamp (NGT 2020, referred to as 'the proposal' in this section). In NGT's submission while the term restoration is used, the document appears to argue for rehabilitation of ecological process. As such, this document will use the term restoration.

This review focuses solely on ecological considerations relating to the potential restoration of this wetland and does not address other considerations such as economic or planning related issues. There are a number of points raised in the proposal that are beyond argument, for example, wetlands provide benefits such as habitat for a range of fauna, opportunities for recreation, and potential amelioration of flooding events if they are acting as holding areas on floodplains. The primary focus of this review however, is on how 'restoration' is interpreted, and any included assumptions.

In many ways, the outcomes of interventions will depend on the strategic approach used. For instance, while blocking drainage channels in highly modified wetlands is unlikely to be an ecologically controversial approach, interventions involving construction of 'sills' (i.e. a low earthen barrier) to retain water can have negative consequences for aspects of biodiversity, with the Koorangie/Avoca Marshes being one of the most dramatic examples. At this wetland system, it was assumed that construction of a sill across the outlet to the system of shallow lakes would restore the historical hydrology, but instead resulted in the death of many thousands of mature red gums and increased salinity issues.

It is clearly desirable to avoid situations where well-intentioned but inadequately understood interventions can simply be another major disturbance adding to the impacts of previous modifications.

From an ecological perspective, it would be difficult to argue against the attempted restoration of a wetland, the moot point purely being to define what this would mean, the strategy to achieve this, and the acceptance of realistic potential outcomes.

The comment that the deeper parts of the wetland would be inundated to around 45-50 cm before experiencing seasonal drying seems reasonable and consistent with the remnant flora.

The proposal reports that inundation events have occurred at a frequency of around one in three years, however specific information on the duration of these inundation events appears to be lacking. While not an important issue, ephemeral does not directly equate to episodic. Ephemeral implies a brief period of inundation, whereas episodic refers to a lower frequency of inundation events. The extent to which contemporary inundation events are driven by flooding from the realigned stream or from run-off from the upstream and adjacent catchment the wetland basin is not specified.

One of the key assumptions of the NGT proposal appears to be that there will be a substantial seedbank of wetland flora at the site, and that restoration of hydrological levels is all that is required to 'restore' a wetland. While the drains within the northern portion of Hanna Swamp support some species indicative of Plains Grassy Wetland, this is a very species-poor assemblage. The native wetland plant species recorded from these drains are *Amphibromus nervosus*, *Eleocharis acuta*, a couple of *Myriophyllum* spp. and some species of *Juncus*.

This vegetation lacks the diverse herbaceous flora indicative of more intact examples of the EPBC listed ecological community Seasonal Herbaceous Wetland (SHW). The eastern flank of this section of the wetland retains an area of grassland with a substantial component of the tussock grass *Poa labillardierei*, characteristic of damp grasslands on the fringes of some variants of SHW, but otherwise extremely poor in native plant species.

It would be easy to over-emphasise the importance of the persistence of a few more resilient/opportunistic species in the drains and on the margins of this area in relation to the potential for recovery of the prior wetland vegetation community.

It is agreed that historical hydrological changes have shifted the wetland towards more ephemeral and more episodic inundation, but care is needed to ensure that any hydrological modifications allow the persistence and flourishing of the remnant SHW flora present in the southern section of the wetland, not just opportunistic taxa which can persist in highly disturbed sites. In this sense a progressive and monitored approach to restoring any sustained deeper inundation would be desirable.

The proposal documentation includes the following statement: 'cannot meaningfully assess a quarter of a single wetland feature and simply ignore the values of the rest'. It is obvious that fragments of wetlands do not stand alone from their catchment, water supply and adjacent land-uses. However, taking the concept of 'restoration' literally, there is a need to understand what vegetation patterns the restoration is intended to restore, and not just lose representative species from the system that are highly unlikely to return without active intervention, i.e. to not drown out remnant taxa from their current position in the ecological profile. Prior to interventions, inventory should be undertaken to identify high value 'core' areas and management plans should address their protection and ideally enhancement.

There is no argument with the potential values provided by a restored wetland, merely questions relating to some of the assumptions and a requirement for greater detail of potential outcomes and strategies for effective restoration to support the case for such a large-scale project.

Some of these questions are as follows:

- What will future water quality be like in Strathaird Creek post-development and can suitable water quality be ensured?
- Is a treatment strategy required (e.g. engineered treatment pond, as for storm water)?
- What would the future frequency, timing, duration and depth of inundation be at Hanna Swamp under any given management intervention and is this likely to support the remnant SHW flora?

The potential quality and characteristics of the wetland cannot be considered separately from the condition of the catchment especially with planned urbanisation. In the proposal, Scale Swamp is used as an example of the outcome of the restoration of hydrology. However, no data is provided and it is not clear that this is a comparable ecosystem/vegetation type. Questions including

- What species were in the seedbank?
- What is the composition of the vegetation – has there been species-based monitoring of the vegetation?

It appears to be suggested that all ecological values recovered at Scale Swamp. There are many examples elsewhere where this is simply not the case in the short to medium term (e.g. Winton Swamp, a number of DELWP WetMAP monitoring sites). There is no data-supported basis to predict that Hanna Swamp has the same potential for recovery as Scale Swamp simply because it is a wetland on the Victorian Volcanic Plain – there is a wide range of EVCs represented in the wetlands of this region, some of which are species-poor and other which are extremely species-rich.

It is clear that some responses would occur if the water supply to Hanna Swamp and its water holding capacity were restored to a more natural state. Some more resilient or mobile wetland flora would become established and the wetland would provide enhanced habitat value for a range of fauna. It is however important to be clear about what 'restoration' means, and to be able to outline the details of what is an acceptable outcome. Based on observations of a wide range of modified wetlands, a number of values will not automatically return without active management.

For instance, as an extreme case, it can be assumed that the orchid *Prasophyllum diversiflorum*, eliminated by works along the rail reserve near Beveridge prior to the mid 1980s, will not be a component of the vegetation. It can also be assumed that other disturbance sensitive species such as *Microseris scapigera* will not automatically return and may be difficult if not impossible to re-establish. This does not mean that a range of the prior SHW species cannot be successfully re-introduced, even if the likelihood of their unassisted recolonisation is low to negligible.

There would also be a need to ensure the protection of the existing SHW flora and build from this. If there is to be a genuine attempt at restoration, this is a critical starting consideration. If 'restoration' is a genuine objective, then this implies reference to the prior species composition. The redevelopment of broad-acre SHW vegetation has to be a key component: SHW vegetation is not just a passing phase of temporal variation in natural wetlands - while clearly not the only included wetland value, SHW vegetation cannot be dismissed as a peripheral or minor consideration.

There is no mention in the proposal of weeds and management strategies for these during restoration of the wetland. Grassy weeds such as *Phalaris aquatica* can be predicted to flourish around the wetland margins. Depending on water quality and water regime, other introduced species have the potential to colonize the regenerated wetlands. It may or may not be feasible to manage some of these, particularly around the periphery of the wetland; however it is hoped that a restoration plan would consider the relevant issues.

Further detail in relation to this peer review is provided in Appendices. Appendix D includes a description of the different floristic components of Seasonal Herbaceous Wetland. Appendix E includes evaluation of the NGT proposal against criteria for ecological interventions and questions to ask for wetland restoration, as well as a comparison of Scale Swamp with Hanna Swamp in more detail.

4.3 Factors influencing rehabilitation and restoration potential

If there are efforts to retain or rehabilitate high quality SHW at Hanna Swamp, some considerations will be critical in determining a successful outcome. These include:

- Ensuring a sufficient buffer between the swamp and residential development.
- A water supply of sufficiently high quality, presumably treated in a designed wetland area prior to it flowing into areas supporting SHW.
- Regulated inflows to prevent urban runoff reaching the wetland at inappropriate times and in inappropriate volumes.
- Resources for on-going maintenance including weed control.
- A strategy for ecologically appropriate biomass management if this becomes necessary.
- Monitoring to determine any required adaptive management responses.
- Expertise in reintroducing SHW flora and if necessary relocating remnant flora to the new wetland shallows, to ensure its survival under the changed hydrological conditions.

An assessment of the impact of Melbourne's urban growth on SHW undertaken by DSE (2012) lists rules of thumb for the protection of SHW in an urbanised landscape. It is noted that where planning is already at an advanced stage, some may be difficult to implement (i.e. planning needs to commence as soon as possible).

In relation to timeframes for Wallan South and Beveridge North West PSPs, discussions with land owners in both Wallan South and Beveridge North West PSP suggest that urban development is unlikely to occur in the area for another 15 – 20 years.

The following should also be considered and would need to be specified within relevant planning documents should the SHW be retained.

- Prioritise the protection of existing sites and use restoration as a last resort.
- Preference larger sites.
- Preference larger buffers. Preserve existing native vegetation around the wetlands as much as possible, as far as possible.
- Control weeds, with a nuanced approach that recognises the differing levels of threat posed by weeds (weeds which may transform the system vs. weeds which may be merely unsightly), the differing degrees of tractability (established vs. emerging weeds) and the different reasons for pursuing weed control (ecological vs. public acceptance).
- Prevent soil disturbance (particularly during development).
- Prevent vehicle and foot access to the wetland.
- Prevent stormwater inputs.
- Resist the temptation to convert seasonal wetlands into permanent lakes (including when apparently justified by other conservation programs, such as frog conservation).
- Be prepared to accept SHW in their dry phases. Communicate to the public that drying is a natural part of the SHW cycle, and that dry wetlands are neither 'failed', nor 'degraded'.
- Engineer surrounding land use change in ways which minimise hydrological change. This will require a detailed hydrological assessment. It is unknown how much change SHW can tolerate.
- Consider enrichment planting with site-appropriate species, but only after the natural former species composition of the individual wetland had been investigated in detail.

The many negative impacts of these threats are shown in Table 2 (Papas et al 2016). In particular, cultivation of the soil and application of herbicides and fertiliser, as has occurred in Hanna Swamp north, can lead to reduced germination and diversity of plants from the seedbank. Grazing can lead to invasion by pest plants, loss of grazing sensitive species, and changes to soil and water conditions. Urbanisation can lead to loss of wetlands, alterations to hydrology, nutrient enrichment and reduction in water quality from polluted urban runoff.

Table 2. Impacts of relevant land use types on seasonal herbaceous wetlands (Papas et al 2016)

Land use	Activity/processes	Impacts on seasonal herbaceous wetlands
Cropping in wetlands	Cultivation of the soil Application of pesticides (insecticide, herbicide, fungicide) Application of fertilizer Drains Raised beds	• Reduced germination of plants from the seed bank and reduced diversity of plants that establish • Invertebrate diversity and abundance can be impacted by cultivation and other physical changes • Changes in hydrology that occur when wetlands are modified to enhance their value as cropland • Chemical and physical disturbances associated with cropping wetlands can modify food availability and reduce the numbers of amphibians, reptiles and mammals that use wetlands as a refuge • Cropped wetlands support fewer waterbirds which rely on a mosaic of wetlands for feeding and breeding (Casanova and Casanova 2016)
Livestock grazing in wetlands	Removal of palatable biomass Treading in the wetland leading to pugging Transport of plant seeds into the wetland Deposition of urine and faeces in the wetland	• Usually detrimental changes in water quality, water regime, soil properties, physical form, invasive flora and vegetation health, structure and composition (Morris and Reich 2013, Peters et al. 2015) • Species that are very sensitive to grazing mostly absent or only exist in small numbers (DEPI 2013) • Invasion by pest plants
Plantation forestry near wetlands	Water extraction (uptake by pine and blue-gum forest)	• Altered water regime (less water) (Dickson et al. 2014)
Urbanisation	Levelling/filling Drainage Stormwater runoff Runoff from surrounding land	• Complete loss of wetlands • Altered water regime (reduced or excess water) • Nutrient enrichment that can lead to changes in vegetation (DEPI 2013) • Input of toxicants which can affect some aquatic invertebrates (Mackintosh et al. 2015)

Buffer requirements

Provision of an adequate buffer adjacent and additional to the protected community is strongly recommended in the commonwealth listing advice for SHW (TSSC 2012). A notional buffer width has been included in this report's consideration of a future Hanna Swamp for the purposes of information (i.e. that a buffer will be required), however detailed analysis as to the area and performance requirements of that buffer have not been undertaken. It is also worth noting that a buffer will only be as effective as the quality of maintenance it receives, which in turn requires appropriate monitoring.

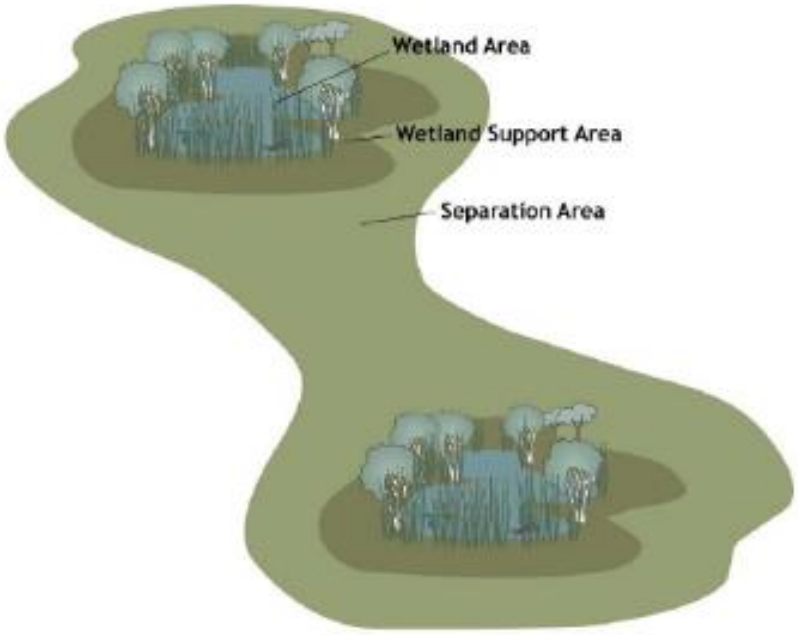

Figure 9. *Illustration of some key principles of wetland buffer design (Figure 5 in DERM 2011) - including both an inner wetland support area and outer wetland separation area and providing connectivity between wetlands.*

The presence of a seedbank in Hanna Swamp North

Research has shown that agricultural cropping decreases diversity and density of wetland plants in reflooded swamps, shown in seedbank testing and field surveys after reflooding of cropped areas (Casanova 2012). If the seed bank is severely impacted and no longer contains amphibious/wetland species, then the recovery capacity of a site will be impaired and intervention would likely be needed for regeneration (TSSC 2012). Data is currently not available on the state of the seedbank in the northern portion of Hanna Swamp, but it is reasonable to assume the seedbank is no longer fully intact in this area. The degree to which plant species could return is unclear and would depend on reinstated seasonal hydrology and appropriate water quality, connectivity with the southern high values area and other local wetlands, and management of other threats such as invasive weeds, grazing, and elevated nutrient levels (Casanova 2012) [2].

While degraded examples of the nationally ecological community are not protected under the EPBC Act, they may still have conservation value through landscape connectivity (TSSC 2012) [3] and could play an important role in the future viability of the ecological community.

[2] "The degree to which cropping is a threatening process to swamp plant communities and their dependent fauna will depend on whether vulnerable elements can return to swamps, which in turn depends on swamp management, connectivity and landscape level processes" (Casanova 2012, p54)

[3] Some wetlands may have additional conservation value through being connected in the landscape (either directly or as 'stepping stones') to other native vegetation remnants and wetland types, including wetlands that may not, in their current state, meet the description or condition thresholds." P16 TSSC 2012

4.4 Case studies

The use of case studies can help to establish restoration feasibility and increase confidence in decision-making (Hopfensperger et al 2006). We chose a range of relevant case studies which are similar to Hanna Swamp, being from southern Victoria and including restoration of SHW in an urban context. Although there are cases where previously cropped SHW have recovered after reflooding in a non-urban context (e.g. Scale Swamp, GTN 2020), restoration may be more complicated in an urbanised landscape.

Barnbam Swamp

Barnbam Swamp, also known as Cranbourne Swamp, provides an example of the management issues associated with conservation of SHW in an urban environment in south-east Melbourne. Substantial effort has gone into management and restoration of this area, guided by a management and ecological restoration plan (Rakali 2010) and it is now included in Melbourne Water's Wetlands Monitoring and Evaluation Plan (MW 2020).

Details of its current state, current trajectory, and target trajectory across different ecological values and waterway conditions are reported in the Catchment Program (Melbourne Water 2018b). Managed by Parks Victoria, the wetland includes a core of high-quality vegetation surrounded by a lower quality, 50m wide buffer. Water quality to the wetland is maintained using water sensitive urban design (WSUD) infrastructure and ongoing management includes maintaining WSUD assets and controlling pest plants and animals, revegetating as needed, and investigating ways of improving the wetland water regime. Despite efforts over the past 10 years, the current trajectory for vegetation value is very low, with 10-50 year target trajectory of moderate.

One of the key issues is closure of the vegetation, with a thick mat of dead and living *Glyceria australis* providing serious challenges for the persistence of forb species associated with SHW. This dense mat would appear to be a consequence of some combination of altered water regimes, urban nutrient fallout and lack of herbivory. Due to its direct proximity to urban development on one side and a rail line on the other, implementing biomass reduction through burning would be a very difficult prospect. Perennial grass weeds are also problematic within this wetland. The lack of a wider buffer and limitations on the supply of available high quality water provide challenges for the management of this wetland.

Lesson learned: providing an appropriate wetland water regime and improving SHW vegetation in an urbanised context is very challenging, requires ongoing maintenance, a sufficient buffer and appropriate high quality water supply. Only modest improvements may be feasible in a 10-50 year timeframe where urban development has already compromised seasonal hydrology.

Waterways (Braeside)

"The Waterways" in Melbourne's south-eastern suburbs is a large scale (48 ha) site on Mordialloc Creek where a housing development was combined with innovative ecological restoration, including SHW/Plains Grassy Wetland (EVC 125). This award-winning restoration project successfully transformed former grazing paddocks into a mosaic of constructed wetland and terrestrial vegetation to reflect 9 different Ecological Vegetation Classes originally occurring in the region in the vast wetland complex known as Carrum Swamp (Australian Ecosystems, no date). Examples of establishing SHW where former wetland vegetation has been completely removed seem particularly rare, and this is the only example found.

Plantings comprised 223 Indigenous vascular plant species including 14 rare or threatened species, and the site had attracted 19 threatened fauna species by 2016. The Waterways also removes a substantial proportion of nitrogen and phosphorous from Mordialloc Creek. Seasonal Herbaceous Wetlands (or EVC 125) form a small but important part of the site, occupying only half a hectare in small patches within tussock grassland (another EVC). These small seasonal rain-filled wetlands form important habitat for rare plant species (e.g. Swamp Everlasting) and breeding areas for frogs and invertebrates that do not occur in the more permanent stormwater treatment wetlands (e.g. Shield Shrimp). This demonstrates that a range of aquatic and semi-aquatic herbs can be established in the shallows of constructed wetlands provided there is a suitable hydrological regime and the water quality is adequate.

The success of the project is attributed to appropriate funding, willingness by the developer to innovate, and management by staff experienced in ecological restoration. Innovative techniques were successfully used, including spreading propagules to establish cryptogrammic crust and ecological burning, as well as established best practices including: careful site investigation, planning (including the use of local benchmarks), preliminary weed control, introduction of flora species, maintenance and monitoring. Consequently this approach was resource intensive per area involved.

Lesson learned: establishment of small, high value areas of SHW is possible within larger constructed areas of native vegetation in an urbanising context, but this requires substantial funding and willingness by developers and land managers to invest in innovative development and restoration. It is unlikely that resources would be available to support work of this level of detail over a large area. However connectivity of the restored SHW patches to other SHW sites at the landscape scale is still a challenge.

Gisborne Racecourse Marshlands Reserve

Another example of impacts of urban development on SHW occurs at the very high quality and significant sedge-dominated wetlands at Gisborne Racecourse Marshlands Reserve. While extensive areas maintain substantial populations of some of the extinction-prone daisy species, a portion of the wetlands is impacted by stormwater run-off from adjacent urban development. In this area, the sedge dominants have been replaced by Juncus spp. (rushes) and most of the forbs representative of SHW have been displaced. This effect is due to some combination of poor water quality and an altered water regime due to run-off from the hard surfaces creating wetness at unsuitable times.

Lesson learned: SHW flora will likely be degraded by poor water quality and/or wetting at unsuitable times from urban runoff unless adequate water pre-treatment and control of seasonal timing of wetting is in place.

4.5 Summary

- The review of NGT work, while generally supportive of the high level proposition that swamps like Hanna Swamp have the potential to be rehabilitated, raises a number of questions including defining the objective of the restoration and the method that would be adopted to achieve that objective.
- The northern section of Hanna Swamp has limited existing ecological values and the persistence of a seed bank that could recover in the presence of suitable hydrology is questionable or at best, unknown. Restoration of the northern section to a functioning SHW would require significant effort and resources without certainty as to the quality of the outcome. It is not recommended that the north of Hanna Swamp be restored to a SHW, rather that it be used, at least in part to protect those values in the south.
- There are two time frames to consider: between now and urbanisation, and post urbanisation. It is expected that urbanisation in this catchment will take 15 to 20 years (as per stakeholders communications). Therefore there is a period of time between now and development where existing SHW values will require protection and management.
- Urbanisation will introduce a number of risks associated with changed hydrology and poor stormwater quality requiring flow management and pre-treatment. This implies that protecting Hanna Swamp South will require additional land as a buffer and / or stormwater treatment and regulation asset. Any reconnection to Strathaird Creek would need to be designed to ensure appropriate water quality and frequency, timing, duration and depth of inundation to the SHW vegetation.
- Case studies illustrate that rehabilitation of Hanna Swamp is achievable, however this will require dedicated and sophisticated management (as well as the buffer described above) to be successful. Ongoing improvements in native vegetation management approaches are likely for SHW as they have been for other specialised vegetation communities such as Plains Grasslands.

5 What are the options for Hanna Swamp?

The following section examines possible options for the protection of Hanna Swamp that have been referred to as 'ecological futures'. Four have been considered:

- Future 1#: No future swamp i.e. the PSPs are delivered as planned
- Future 2#: Retain the SHW within Hanna Swamp South with minimal buffer
- Future 3#: Retain the SHW within Hanna Swamp South and retain an area within Hanna Swamp North to act as a buffer and stormwater regulation and treatment asset
- Future 4#: Retain the full boundary Hanna Swamp South and North, retaining the SHW values in the south and considering the restoration objective for the north (e.g. strive to restore to a SHW, or allow that area to act as an ecological buffer to the south).

The options are conceptual in nature and have been developed for the purposes of discussion, comparison and to consider the pros and cons of each approach in the context of both retention of Hanna Swamp and the impacts upon current precinct structure plans. The following section presents:

- a map or plan of each ecological future
- a qualitative discussion and assessment on the social and ecological impacts of that approach.
- a summary of the implications of each approach.

Comment is also provided on the impacts of urbanisation on each future, including consideration of the infrastructure planned as part of the two PSPs and how this overlaps with the proposed boundary of each Hanna Swamp ecological future.

Values considered
A number of criteria have been taken into account when comparing these futures. A comment is provided for each as appropriate with a summary of the overall implications for the ecology of the site under each approach.

Table 3. *Values descriptions*

Values	Definition
Ecology (SHW)	Refers to the protection of unique values within Hanna Swamp and specifically those that respond to the definition of a Seasonal Herbaceous Wetland (SHW). A principle here is that fragmentation of the swamp will result in poor ecological outcomes.
Waterway health and water quality	The potential for the swamp / wetland to contribute to improved water management both pre and post urbanisation. This will respond to the stormwater performance objectives of the Healthy Waterways Strategy, specifically whether the swamp can contribute to evaporation, infiltration and harvesting of stormwater.
Cultural	This refers to opportunities for recognising and practicing connection to Country and specifically with regard to wetlands that are known to be places of cultural significance.
Amenity / Liveability	The extent to which the swamp / wetland landform can contribute to a healthy and varied urban landscape, providing a location for recreation, relaxation and interaction with nature for future residents.
Affordability and cost	The impact of the option on affordability and this is assumed to align with land take (i.e. the more developable land removed increases the cost of retaining the swamp.
Planning / PSP implications	To what extent does the option align with the current PSP layouts and what would need to be reconsidered should the swamp be retained.
Ongoing management	The likely ongoing maintenance requirements particularly considering the specialist ecological skills that may be required to maintain a unique ecological community.

Other considerations
In developing the options, the following is noted as some of the rationale for the assessments below:

- **Stakeholder engagement:** Engagement with Wurundjeri Woi-wurrung traditional owners would be undertaken as any part of developing an 'ecological future' for Hanna Swamp to better understand how cultural values can be supported.
- **Buffer areas**: As discussed above, a buffer area is likely to be necessary to protect any area of SHW that is to be retained. A notional buffer width has been included in plans below, however the actual width and function of the buffer would need to be considered according to the final management objectives of the swamp.
- **Ecohydrology of an SHW:** Seasonal wetting of the SHW (i.e. shallow inundation for several months of the year, dry rest of year and potentially all year during drought) is required and therefore should the SHW be retained, then surrounding urban catchments and drainage infrastructure will need to be designed to support the SHWs hydrologic requirements.
- **Transport arterials**: the major road arterials are assumed to be required as per the current PSP plans. Comment is made where these alignments would need to altered under a particular future. It is not within the remit of this consultancy to identify alternative road alignments, only to comment where they impact swamp values.
- **Offsets:** The application of offsets to Hanna Swamp needs to account for the differing application of offsetting rules to each portion of Hanna Swamp. The recent removal by DELWP of the state wetland layer for the northern portion of Hanna Swamp for native vegetation removal regulation purposes has been authorised as there is insufficient evidence of the presence of native vegetation requiring an offset. Offsetting is therefore not required for the north portion.

  Offsetting is likely to be required for portions of the south side of Hanna Swamp due to its qualification as a Seasonal Herbaceous Wetland of high quality. Given that the southern portion of Hanna Swamp is within the area covered by the MSA it is assumed that any offsetting would not require Commonwealth referral under the EPBC Act.

5.1 Summary

In summary, the SHW wetland is protected to some degree within Futures 2, 3 and 4.

- In Future 1, the swamp has been removed as per current PSP plans as per the BCS. If this were the case offsets would be required. At this stage the location for offsetting has been identified as Hernes Swamp (DEWLP, pers comms).
- In Future 2 only that section of the swamp within Beveridge North West is retained. In consultation this has raised questions about the feasibility of this approach given the relatively limited potential for a buffer to the north and / or the ability to provide a stormwater pre-treatment asset to manage incoming flows. Further, the hard interface with the road along the northern boundary will significantly impact ecological values as well as the perceived naturalness of the wetland form and opportunities for the community to interact with the swamp. Proposed north south road alignments would also impact current extent and function.
- In Future 3 some land to the north is set aside to accommodate an appropriate ecological and hydrologic buffer that ensures the SHW has a reasonable chance of protection. The exact area proposed is yet to be determined and would need to be with a clear understanding of the objectives for both the north and south.
- Future 4 encompasses the full area of what is understood to be the perimeter of Hanna Swamp. This future would be recommended if more of a concerted effort were being made to restore hydrologic assets into the landscape and there was certainty about ongoing management responsibility.

Overall, it is suggested that Future 3 represents a reasonable approach that combines protection of the SHW and scope for a meaningful recreation and natural asset. Providing for connectivity of Hanna Swamp to waterways and other wetlands at a landscape scale also requires consideration to allow for ecological processes such as the dispersal of aquatic organisms.

5.2 Future 1# – No swamp

The ‘no swamp’ option reflects the outcome if the PSPs are implemented as planned, with the removal of the Seasonal Herbaceous Wetland, to be replaced by a combination of open space, residential development and roadways.

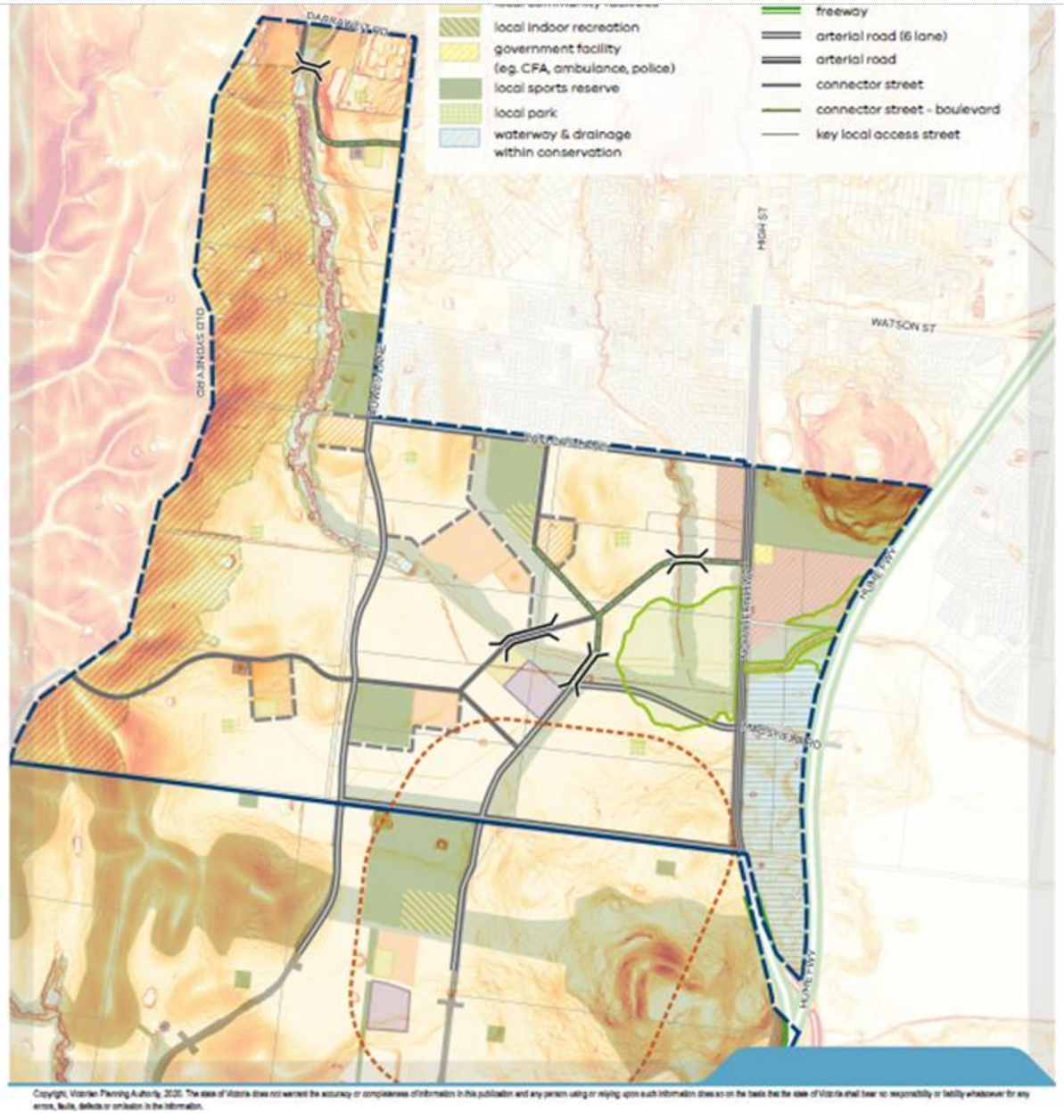

Figure 10. *Option 1 - No swamp*

Value	Description and impact
Ecology	No ecological values associated with the SHW will be retained. This future is as per the BCS and would require offsets at Hernes Swamp as per advice from DELWP
Waterway health and water quality	The removal of the swamp will eliminate the stormwater removal potential benefits of the swamp through evaporation and infiltration
Cultural	All cultural values associated with the swamp, including vegetation and connection to water will be removed
Amenity / Liveability	Given the swamp may be replaced with open spaces, there may be some residual amenity and liveability benefit associated with planned open spaces in the south (Beveridge North West PSP)
Affordability and cost	With no land take, presents greater development yields and the least impact from a development cost perspective
Planning / PSP implications	No implications for the PSP planning process, other than communication risk associated with the removal of an EPBC protected landscape
Ongoing rehabilitation, restoration and ongoing management	Little to no unique ongoing maintenance requirements

5.3 Future 2# - Retain SHW values in Hanna South

This option proposes retaining the high value SHW identified within the southern section of Hanna Swamp (in Beveridge North West PSP), while the northern section will be developed as per the PSP. A buffer area (in green) has been assumed and is presented below. A buffer would be required to protect the SHW values in the south and the width and area of the buffer would need to be determined if this option was progressed. In this plan, the swamp is bisected by a west – east arterial.

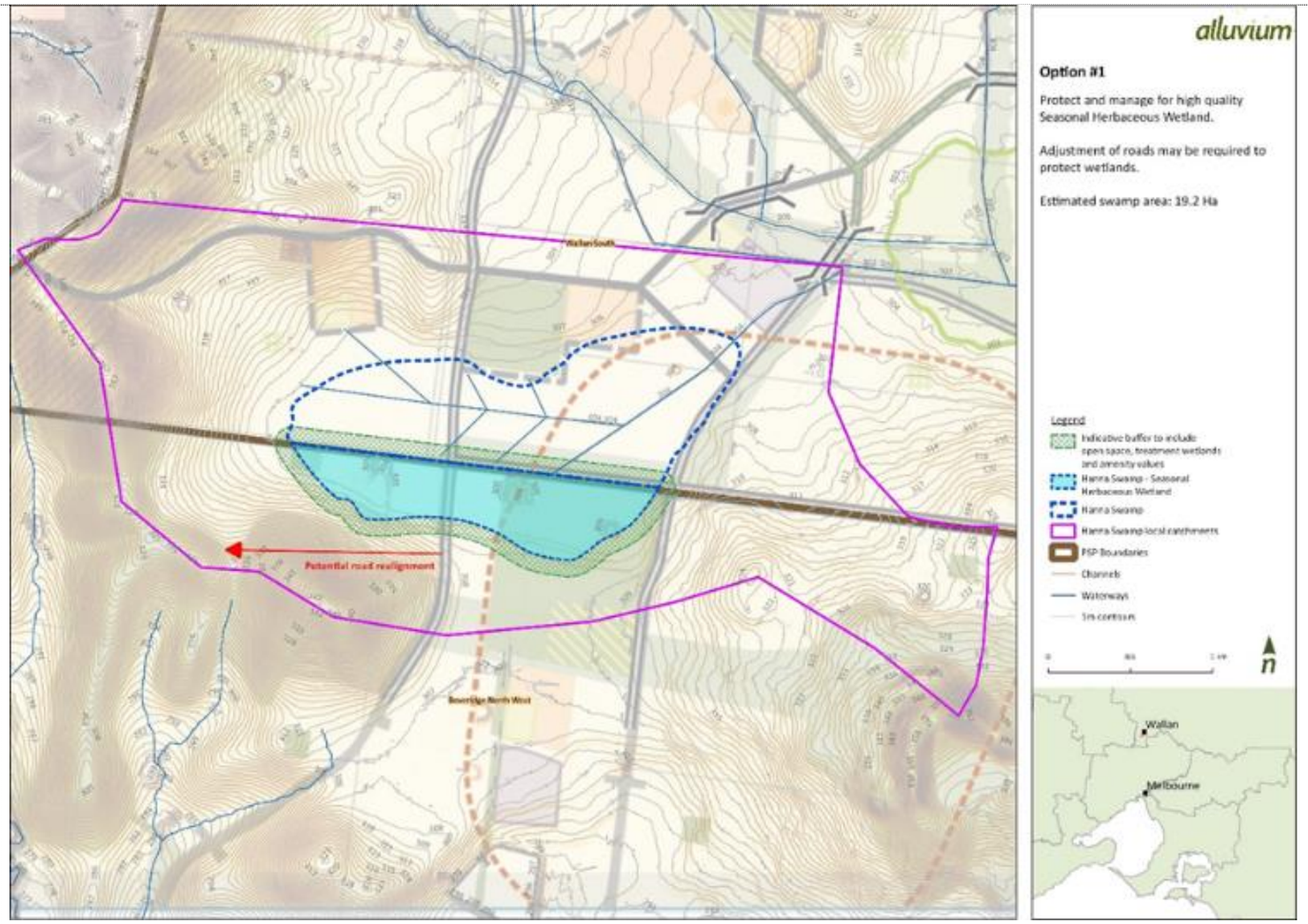

Figure 11. *Option 2 - Retain SHW values in Hanna South*

Value	Description and impact
Ecology	The high value SHW is retained in theory however bisecting the swamp with a roadway without consideration of resident landforms, will make the ongoing management and retention of those values into the future challenging, particularly as there is limited space or allowance for an area to provide stormwater pre-treatment to improve water quality reaching the SHW. The wetland is isolated from the broader waterway system limiting opportunities for dispersal of aquatic organisms.
Waterway health and water quality	From a Healthy Waterways Strategy perspective there will be some infiltration and evaporation benefit, however the limited surface area will reduce that benefit proportionately.
Cultural	Retention of SHW vegetation is seen as being a positive cultural outcome, however the risks to retaining those values long term (due to limited stormwater pre-treatment) may diminish the long term cultural importance of the swamp.
Amenity / Liveability	Retaining the SHW in the south is seen as a partially positive amenity outcome, however having a hard infrastructure roadway as the northern boundary with limited access will reduce perceived 'naturalness' and community interactions with the swamp.
Affordability and cost	The main impact is to the potential for reduced developable land to the south (within Beveridge NW). It is also assumed that the planned north-south arterial would need to be realigned to avoid bisecting the swamp
Planning / PSP implications	The two main impacts will be the need to realign the north-south arterial away from the swamp to ensure it does not bisect it and to design the west-east arterial to protect the northern boundary of the retained SHW to the south.
Ongoing rehabilitation, restoration and ongoing management	The form as presented will present challenges for ongoing maintenance given the limited scope for connection to other waterways/wetlands, stormwater pre-treatment, the hard northern border and the interface with a major roadway and the need for a surrounding buffer.

5.4 Future 3# - Retain SHW (HS South) and restore a portion of the northern wetland

In this future, high value SHW will be retained in the south as per Future 2#. A section of the northern wetland is retained to help support the southern portion, including by acting as an urban stormwater treatment and flow regulation asset. The perimeter buffer is retained around the swamp boundary.

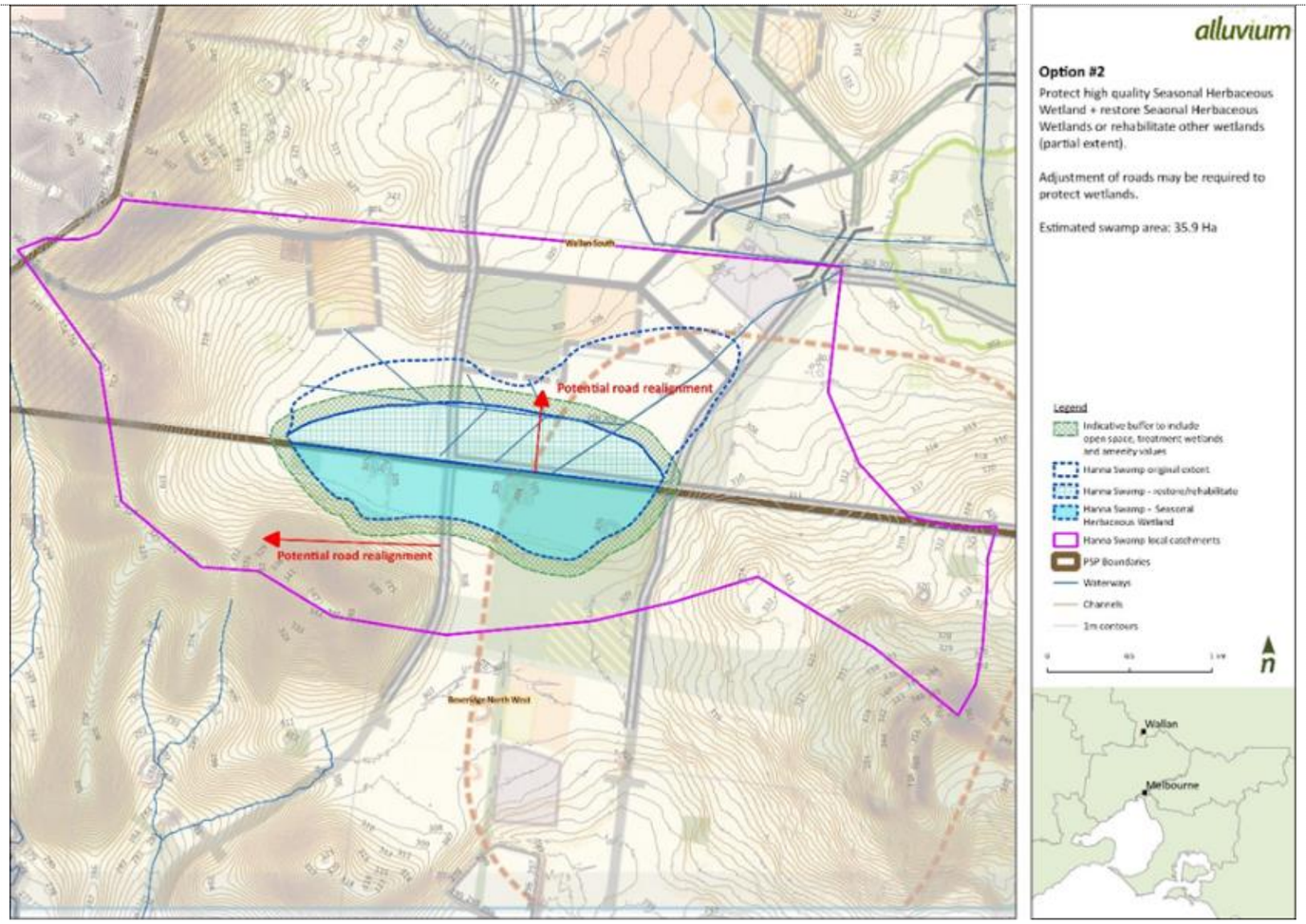

Figure 12. *Option 3 - Retain SHW (HS South) and restore a portion of the northern wetland*

Value	Description and impact
Ecology	The high SHW values in the south are retained. There is additional protection afforded in the north with a more conventional urban stormwater wetland proposed to improve water quality entering the SHW and to regulate flow. The required area of the northern wetland would need to be estimated to ensure it fulfils that role sufficiently. Connectivity to other waterways/wetlands for dispersal of aquatic organisms not addressed, although this may be more feasible than Future #2 given closer proximity of the wetland edge to Strathaird Creek.
Waterway health and water quality	This is an improved waterway and wetland result given that there is increasing potential for stormwater infiltration and evaporation from both the SHW and the conventional urban stormwater wetland section. Including the pre-treatment wetland opens the opportunity for stormwater harvesting.
Cultural	A more positive cultural outcome with the retention of high value SHW, improved stormwater quality and an increased likelihood of long term protection of resident flora. Assumes Traditional Owners are actively engaged in management.
Amenity / Liveability	The additional wetland footprint is seen as a positive amenity outcome for the local community. In this form, there will be two distinct wetland communities providing a varied landscape and greater opportunity for interaction and education as to the different ecological communities that are present.
Affordability and cost	There is a greater land take associated with this option across both PSP areas. There is therefore a greater cost associated with the reduction in developable land. The realignment of roadways and other planned community services will also have an associated planning related cost.
Planning / PSP implications	Extending the wetland to the north will have implications for planning across both PSPs. This will include the removal or realignment of east-west and north–south road arterials. This is likely to also require the relocation of necessary community assets if they are displaced by the extension of this wetland area.
Ongoing rehabilitation, restoration and ongoing management	This layout affords greater protection to the SHW and therefore greater likelihood that the values can be protected long term. This will require specialist skills and education of ground staff as to what is required to manage these landscapes – both the SHW and the conventional stormwater wetland portion.

5.5 Future 4# – Retain full extent of HS South and North

This option reinstates the Swamp footprint as best as possible within an urban landscape. The option includes the full known extent of Hanna Swamp and includes a buffer area. This has the maximum impact on land take and planned infrastructure while benefits include the potential retention of resident values with additional landscape values being introduced within Wallan South PSP. However, as the commentary and case studies above suggest, this is not a definite outcome and will require investment in specialist maintenance.

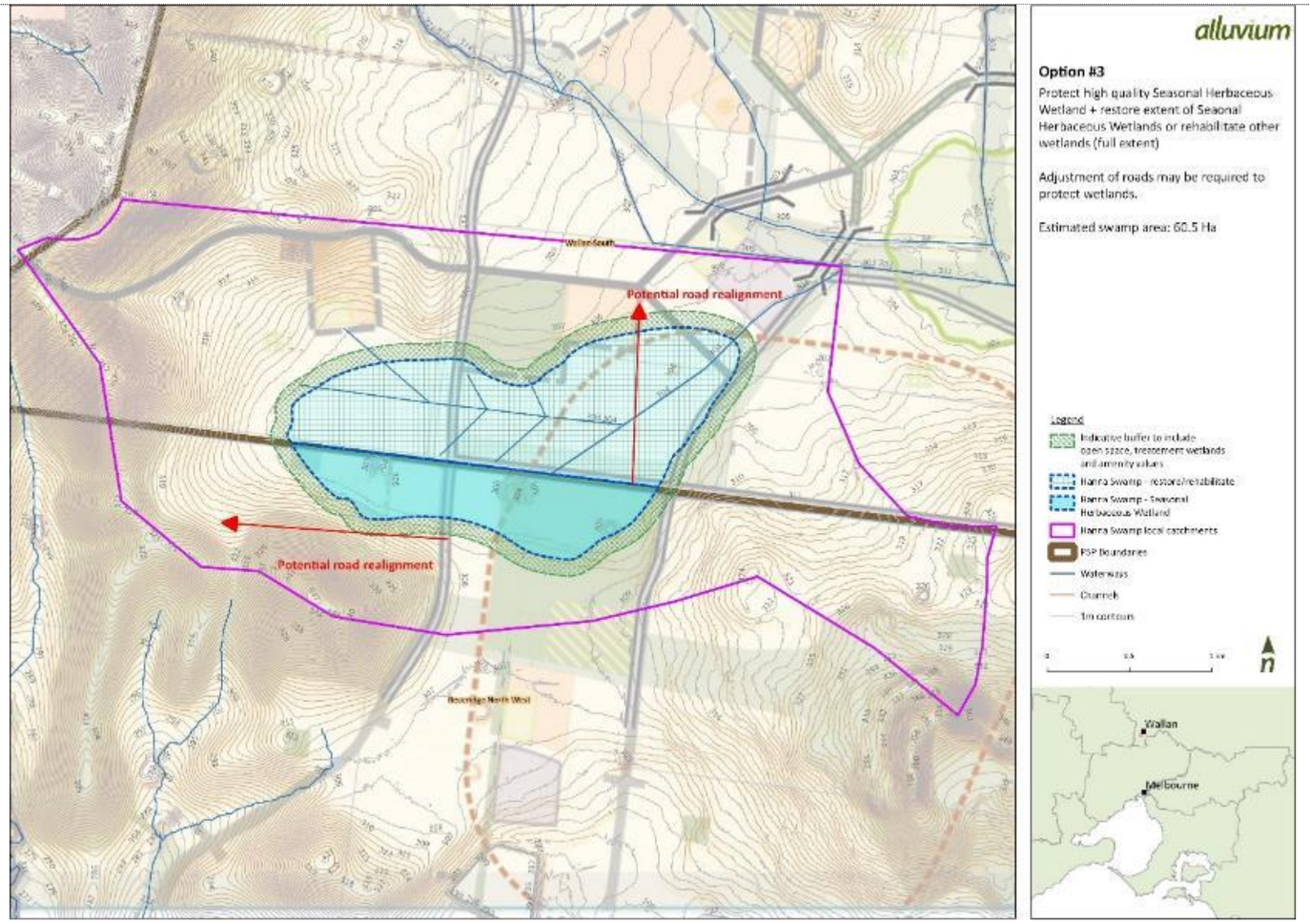

Figure 13. *Option 4 - Retain full extent of HS South and North*

Value	Description and impact
Ecology	As per Future 3#, this provides protection and a buffer to the values in the south as well as an extended area to house a conventional stormwater treatment asset. The area that is required to achieve stormwater treatment requirements for this catchment would need to be calculated in collaboration with Melbourne Water as part of their Developer Services Scheme for the area. Connectivity to the Strathaird Creek corridor to maximise dispersal of aquatic organisms and ecological processes is likely to be most feasible under this scenario given the closer proximity to Strathaird Creek in the north-east.
Waterway health and water quality	The larger wetland to the north opens up greater capacity of stormwater infiltration and evaporation. There may also be greater potential (when compared to other options to reconnect to Strathaird Creek and therefore treat or harvest a greater volume of stormwater for local uses.
Cultural	Reinstatement of the full swamp footprint and the increased capacity to treat stormwater and improve waterway health is seen as a positive cultural outcome. Of the options this may provide greater opportunity for maintaining Aboriginal cultural values and involving Traditional Owners in wetland/water management. It is noted that the full footprint is not intended to be returned to a SHW standard of vegetation.
Amenity / Liveability	Creating a 60ha wetland is seen as potentially providing a significant natural asset to the future Wallan community. Combined with other swamp and ecological value sin the area, this could form part of a regional feature offering the greatest potential connection to nature and sense of space. In this case the footprint is assumed to be proportionate to amenity, and hence of the futures presented, this is deemed to provide the greatest community amenity. It is assumed that other community assets, like schools and open space would need to be relocated.
Affordability and cost	This will have the greatest impact on cost and affordability as this is seen largely as a function of footprint and therefore reduction of developable land. There will also be costs associated with realigning assets within the PSP including major roadways and community facilities.
Planning / PSP implications	This footprint would result in significant implications for both the Beveridge North West PSP and Wallan South PSPs in terms of realigning linear assets and relocating other community facilities.
Ongoing rehabilitation, restoration and ongoing management	This is a larger area which will require greater resources than other futures to both protect the SHW section and manage a larger, stormwater treatment type asset.

6 Site ownership and future management

In considering possible futures for the swamp, there is a question as to how Hanna Swamp would be managed and who (or which organisation) would undertake that role to protect existing and future values. The resources and skills required to manage the swamp will be a function of the ultimate objective of the plans for the swamp, which at a minimum would be to protect the SHW, as well as the aspirations of Traditional Owners and other physical factors like area.

Therefore in the absence of a detailed understanding of which future will eventuate, some of the issues, opportunities and likely responsibilities are set out below.

6.1 Challenges

The first challenge is the process by which Hanna Swamp transfers into public hands, particularly considering any northern section under Futures 3 and 4.

If retained as a SHW, which organisation would manage and maintain the swamp, assuming a transfer to public land is negotiated? Candidates include Melbourne Water as Metropolitan Melbourne's waterway manager and Local Government, in this case the Mitchell Shire Council (Council). Influencing this may be whether Hanna Swamp is in fact defined as a waterway under the Water Act. Advice from Melbourne Water suggests this is likely to be the case however this needs to be formally confirmed. The area is defined as a 'floodplain' as per the definition that it is covered by the 1% average exceedance probability (AEP) flood level. Wetland dependant vegetation has been mapped and recorded on both sides of the swamp indicating elements of hydrology/soil typology is intact. The hydrology is modified but intact with the ability to return hydrology to the required regimes if designed appropriately. The swamp is also connected to Strathaird Creek via its outlet (i.e. swamp outflows drain to Strathaird Creek).

Further consultation with DELWP and Parks Victoria is also recommended as part of resolving the question of ongoing maintenance and management.

An additional challenge will be to ensure that whichever organisation/agency assumes responsibility for the swamp sufficiently understands the ecological community that exists there and how to maintain it. In discussions with Council we appreciate that those skills do not currently sit within Council and there would need to be additional resources and/or training of staff to gain that capacity. Dedicated conservation staff are required as grounds maintenance and facility management staff are currently unlikely to have the specialist ecological skills required to manage SHW. It is proposed that this is a reasonable and achievable extension of skills for those who are already adept at wetland management and maintenance tasks. We draw the VPAs attention to the parallel management issues faced by local government entities who manage Plains Grassland areas. Some decades ago, the subtlety of management and knowledge of plant ecology of Plains Grasslands was considered too sophisticated for local government to be able to reasonably conduct. However, this knowledge has built over time to the point where local government land managers are now recognised as leaders in the management of biodiversity conservation particularly for Plains Grasslands. These skills are also broadly shared across specialist contractors who are dedicated to the management of remnant vegetation. We see no reason why upskilling of council staff and contractors is not possible for SHWs. Indeed, this is a new area and there may be some losses as lessons are learnt. But the management of Grasslands across Melbourne stands testament to the potential for local government and specialist contractors to effectively manage challenging biodiversity assets.

As noted above, a key challenge will be to incorporate suitable ecohydrology principles into Melbourne Water's conventional drainage services scheme process. This is likely to require a bespoke approach that responds to the unique hydrological needs of the swamp. Upon urbanisation Local Government and / or Melbourne Water may need to manage the designed drainage infrastructure to ensure it delivers suitable flow and quality to the SHW section of the swamp. This will require specific understanding of the drainage network and how it needs to be maintained with collaboration between hydrologists and ecologists at the planning and delivery phase.

Realisation of Traditional Owner aspirations to play an active role in wetland and water management may require culturally sensitive capacity building and support. Finally, if the swamp is retained to maintain and/or improve ecological values then connectivity to the wider waterway/wetland network needs to be addressed to maximise ecological processes such as dispersal.

6.2 Opportunities

There is an opportunity for organisations who manage and maintain the site to realise multiple benefits that are set out in numerous water industry strategy documents summarised above including Water for Victoria and the Healthy Waterway Strategy, including improved waterway and catchment health, improved resilience and liveability of Victoria's cities and towns and an opportunity to use the site to meet stormwater performance objectives in the sub-catchment.

There may be an opportunity for Traditional Owner or community involvement in the maintenance of both the southern SHW and northern sites. Friends groups or similar may also be able to contribute to Council or Melbourne Water maintenance requirements.

7 Conclusion and recommendations for Hannah Swamp

There is a clear difference in the values that are present when comparing the northern and southern sections of Hanna Swamp (i.e. the areas delineated by the boundary of the Beveridge North West and Wallan South PSPs), with the southern section retaining high value SHW community.

Hanna Swamp north has degraded remnants of Plains Grassy Wetland EVC 125 and does not qualify as a SHW. Further, the northern section would require substantial resources and inputs if the objective for that area was to be rehabilitated to a point where it exhibited SHW characteristics and values. That is not the recommendation of this report. However, the retention of an area of the northern swamp may be critical to the protection of the values in the south. This can be achieved if the area to the north is designed as more of a conventional urban wetland that regulates flows and treats stormwater entering the SHW. This asset would also act to remove the hard northern border that is illustrated as part of Future 2#. While that border could be modified, the point is that a suitable wetland area is required to protect the south and this area would logically be located in the north.

While this approach would best protect the existing values in the southern section of Hanna Swamp, it is recognised that the swamp was not identified as a conservation area under the BCS and is therefore not afforded protection under the MSA. The implications of this are that while it could be preserved, if it was to be removed payment of environmental mitigation levies would be required under the Melbourne Strategic Assessment (Environmental Mitigation Levy) Act 2020 (MSA Act). Advice from DELWP suggests that these offset contributions would be applied to ecological improvements at Hernes Swamp.

In this report, the background, context and strategic drivers behind the protection of natural assets and also urban land development have been presented. There are competing objectives at play and a need to, according to the Planning Panel report, to investigate how Hanna Swamp might be protected. This report seeks to respond to that question, providing context as to how the values of Hanna Swamp could be retained, what that might look like and how that could be managed.

In summary

- From an ecological perspective, and understanding the ruling under the BCS, it is the recommendation of this report that as much of the SHW in the southern section of the swamp (within Beveridge North West PSP) be protected and retained.
- A suitable buffer is critical to protecting the SHW ecological community on an ongoing basis. It is recommended that this include a buffer around the perimeter of the southern section and an allowance, potentially within Wallan South PSP, for a wetland asset to regulate flow and improve stormwater quality prior to flowing to the southern section.
- The area that is to be set aside in the north, should that advice be followed, would be defined based on the objectives of the asset as a whole e.g. to protect the SHW in the south or potentially fulfil a broader role that meets some of the HWS performance objectives for the sub-catchment such as stormwater harvesting.
- A suitable urban drainage network would need to be designed that meets defined stormwater quality, duration, timing and volume (inundation) requirements for a SHW. Ecological skills in SHW management and hydrological skills need to be applied early in the design phase. This may be incorporated into Melbourne Water's developer services scheme, or another appropriate process.
- Maintenance of the SHW should be the responsibility of a suitably qualified organisation. This is not to say that Council or Melbourne Water could not meet this requirement, only that capacity building within the responsible organisation is likely to be required to ensure the SHW is managed appropriately. Other organisations such as Parks Victoria and community groups like the Friends of Merri Creek could also be invited to be involved.

- The integration of Hanna Swamp into the surrounding landscape should not occur in isolation of the rest of the Upper Merri Creek catchment. Landscape scale planning across multiple wetlands and waterways is recommended (including consideration of Hearne and Meade Swamps). In particular, connectivity to other waterways/wetlands is a high priority to support important ecological processes such as dispersal.
- Further investigation, analysis and stakeholder consultation will be required should a rehabilitation and management plan for Hanna Swamp be developed. Should some of Hanna Swamp be retained, a more detailed investigation into the feasibility of restoring Hanna Swamp and similar local wetlands could be conducted. This study could refer to the wetland recovery feasibility decision making tool produced by DELWP in 2017 (Roberts et al 2017).
- The issue of willingness to pay has not been addressed in this review. It is suggested that this is a broader issue for the water and development industries to address in consideration of this and other examples within Melbourne's Growth corridors.

The discussion above highlights the interactions between ecological, cultural and waterway values and urban development and as such Hanna Swamp represents something of a test case. There are planning mechanisms in place that enable existing ecological values can be offset, however the reality is that much of the unique value associated with Hanna Swamp will be lost, with offsetting not ensuring an equivalence of ecological function. As a result a unique and protected ecosystem will become further endangered.

Strategic documents over many years have called for the protection of waterways and wetlands for their ecological value, their community benefit and in more recent years through an emphasis on the cultural values associated with these spaces that connect people to country. The intent of these strategic documents has been clear, noting the need for water to be prominent in the landscape and for diverse urban landscapes reflecting local conditions and waterway health to be maintained and improved. The conclusion of this report is consistent with that strategic advice, that unique environments like those observed within Hanna Swamp, be protected.

7.1 Future work and next steps

- Further detailed work is required to identify the restoration potential and long-term feasibility of retaining Hanna Swamp. This additional work needs to:
    - Address the impacts of agriculture, grazing and urban development (existing and future)
    - Develop a shared stakeholder understanding of what the objectives of any intervention are, such as what the future Hanna Swamp looks like and its form and function in the landscape
    - Identify if a more detailed "Rehabilitation and Management Plan" is required and who should undertake this work
    - Identify who will have the future responsibility for management and maintenance of the swamp
    - Identify the interaction of the swamp with current and future development
    - Identify swamp buffer and urban structure requirements
    - Identify controls needed during the construction of urban development to protect Hannah Swamp and the downstream environment, particularly in light of the potential existence of sodic soils (i.e. preventing the release of untreated runoff and suspended sediments from construction activities in the surrounding areas)
- Consider the broader IWM context, including the findings of the "Upper Merri Creek IWM Project" and in particular the "Cultural Flows Assessment Report" (when this is finalised and made available)
- Identify hydrological requirements for a SHW including:
    - Method of connection and interaction with the local drainage network and the area in the north that would be required for detention and treatment of stormwater flows including an understanding of the duration, timing and episodic nature of inundation in SHW.
    - Investigate the urban catchment and how Hanna Swamp would interact with that catchment and Strathaird Creek (including flood mitigation and infiltration/evaporation)
    - Identify a water balance and how the local swamps can potentially be used as storage ponds, factoring in evapotranspiration and downstream water requirements, while ensuring their ecological values are retained and improved.
    - Identify how to manage decommissioning of existing informal drainage lines within the swamp.
- Potentially include additional consultant support
- As a first step, undertake a comprehensive flora and fauna survey of the full extent of Hanna Swamp is needed to inform further work and consideration about the restoration potential and future management of the swamp.
- A communication strategy is needed outlining the nature of Seasonal Herbaceous Wetlands to enable the community to engage with and value this unique type of wetland.

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Yarra Valley Water - Upper Merri Creek Sub-catchment Cultural Flows Assessment (in progress)

Attachment A
Strategic context detail

Strategic drivers for management

The protection and enhancement of the values identified through the desktop and field assessments are driven by both legislative requirements and stakeholder strategic objectives and targets. Objectives and targets for the Wallan-Beveridge growth corridor are covered through several strategic plans, strategies and guidelines developed by the key project stakeholders. There are a large number of stakeholders involved in the planning and management of this region. These stakeholders include:

- Melbourne Water
- Victorian Planning Authority (VPA)
- Department of Environment, Land, Water and Planning
- Yarra Valley Water
- Mitchell Shire Council
- Aboriginal groups
- Upper Merri Catchment IWM Project Steering Committee and Working Groups
- Merri Creek Management Committee
- Nature Glenelg Trust

These organisations and groups have developed documents that provide strategic guidance for the management of the catchment and or waterways of the study area. Relevant elements from these strategic documents (identified values, issues, opportunities and vision) have been incorporated into this report.

Melbourne Water - Development Service Schemes
Melbourne Water Development Service Schemes (DSS) comprise a catchment-based drainage strategy setting out the functional designs of waterway related infrastructure required to service urban growth. Each scheme consists of an infrastructure plan, which takes into account environmental considerations, and an estimate of the cost of works to control the quality and quantity of stormwater run-off. Typically, the scheme concept design outlines work that are optimal in terms of cost and performance, while protecting environmental and other waterway values. These works typically include:

- Pipelines
- Overland flow paths
- Retarding basins
- Water quality treatment facilities such as wetlands
- Floodways
- Other drainage and water quality treatment measures

Within the study area the Taylors Creek, Taylors Creek East and Kalkallo DSSs cover the majority of the area (Figure 14). These schemes are currently subject to review by Melbourne Water to ensure that the scheme infrastructure proposed is still effective and functional within the existing site constraints, whilst considering its alignment with current best practice targets and the latest Melbourne Water guidelines. While these measures and guidelines can generally be accommodated in new greenfield schemes, there are a range of challenges with existing schemes, and therefore the review needs to consider these impacts carefully. The challenges are related to the highly erodible soils; implementation of the HWS; engineering challenges in the design of drainage infrastructure due to the constraints of the physical form of the area; and the large body of relevant work that has already been completed.

VPA - Precinct Structure Plans

Precinct Structure Plans (PSPs) developed by the VPA in consultation with the key stakeholders are high level master plans for whole communities. PSPs layout roads, shopping centre, schools, parks, housing, employment, connections to transport and generally resolve the complex issues of biodiversity, cultural heritage, drainage infrastructure provision and Council charges. Together with the framework planning, precinct structure planning is an important part of the State Government's strategy to address population growth and the housing and employment demands that flow from this growth.

The following PSPs fall within the study area and are at different status levels in their development at the time of writing this report (Figure 14):

- Beveridge North West PSP (exhibited – panel hearing currently being undertaken)
- Wallan South PSP (early planning phase)
- Wallan East PSP (Part 1 and 2) (early planning phase)
- Northern Freight PSP (not yet commenced)
- Beveridge North East PSP (not yet commenced)
- A portion of the Lockerbie North PSP (completed)

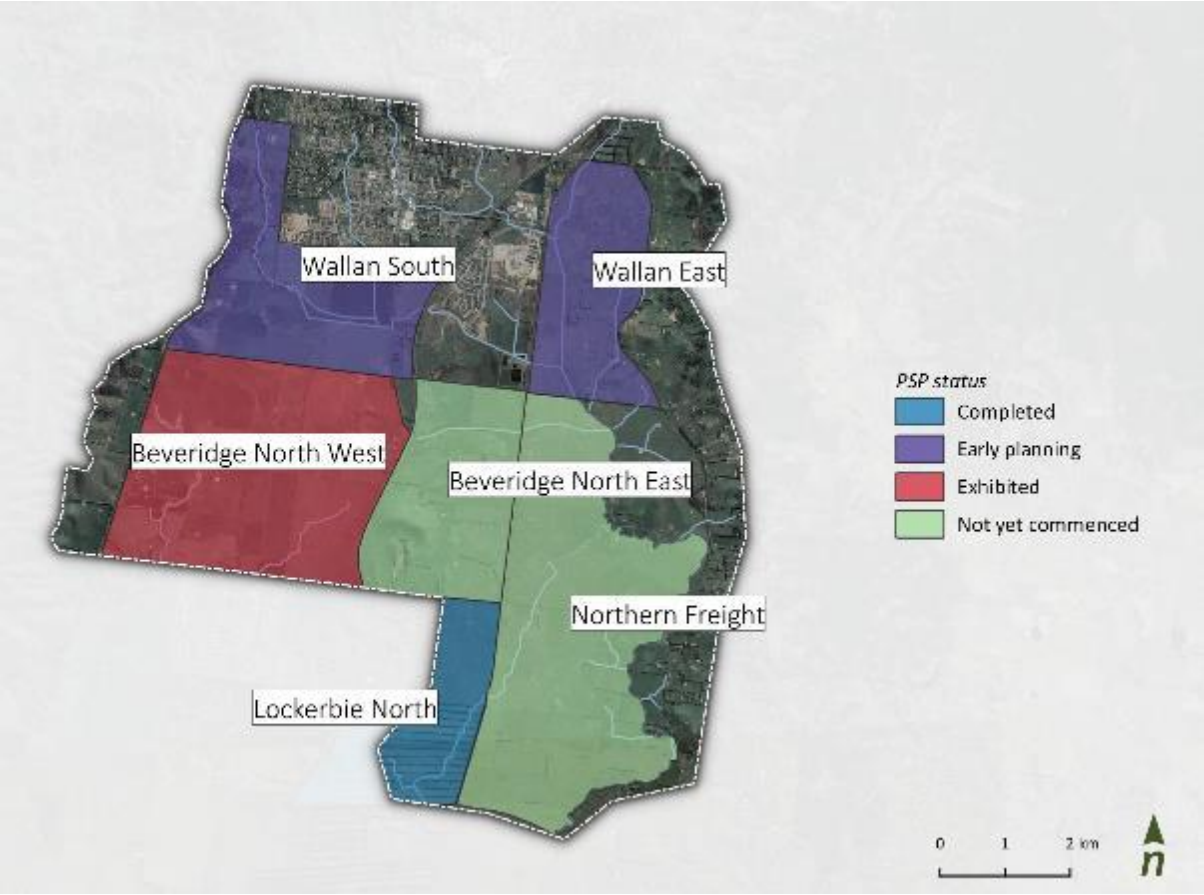


Figure 14. *Progress of PSPs within the Stage 1 study area.*

VPA – North Growth Corridor Plan

The North Growth Corridor Plan (NGCP) is one of a series of Growth Corridor Plans developed by the VPA to provide high level integrated land use and transport plans that provide a strategy for the development of Melbourne's growth corridors. The NGCP seeks to ensure that the corridor is an attractive location for a wide range of businesses, and a wide diversity of households. Of note to the management of waterways and wetland one its key challenges are:

- Preserving and enhancing the natural features of the Growth corridor, including the significant landscape and biodiversity values. New communities will benefit from an integrated open space network that provides a distinctive character and amenity, and existing biodiversity values will be preserved and enhanced.

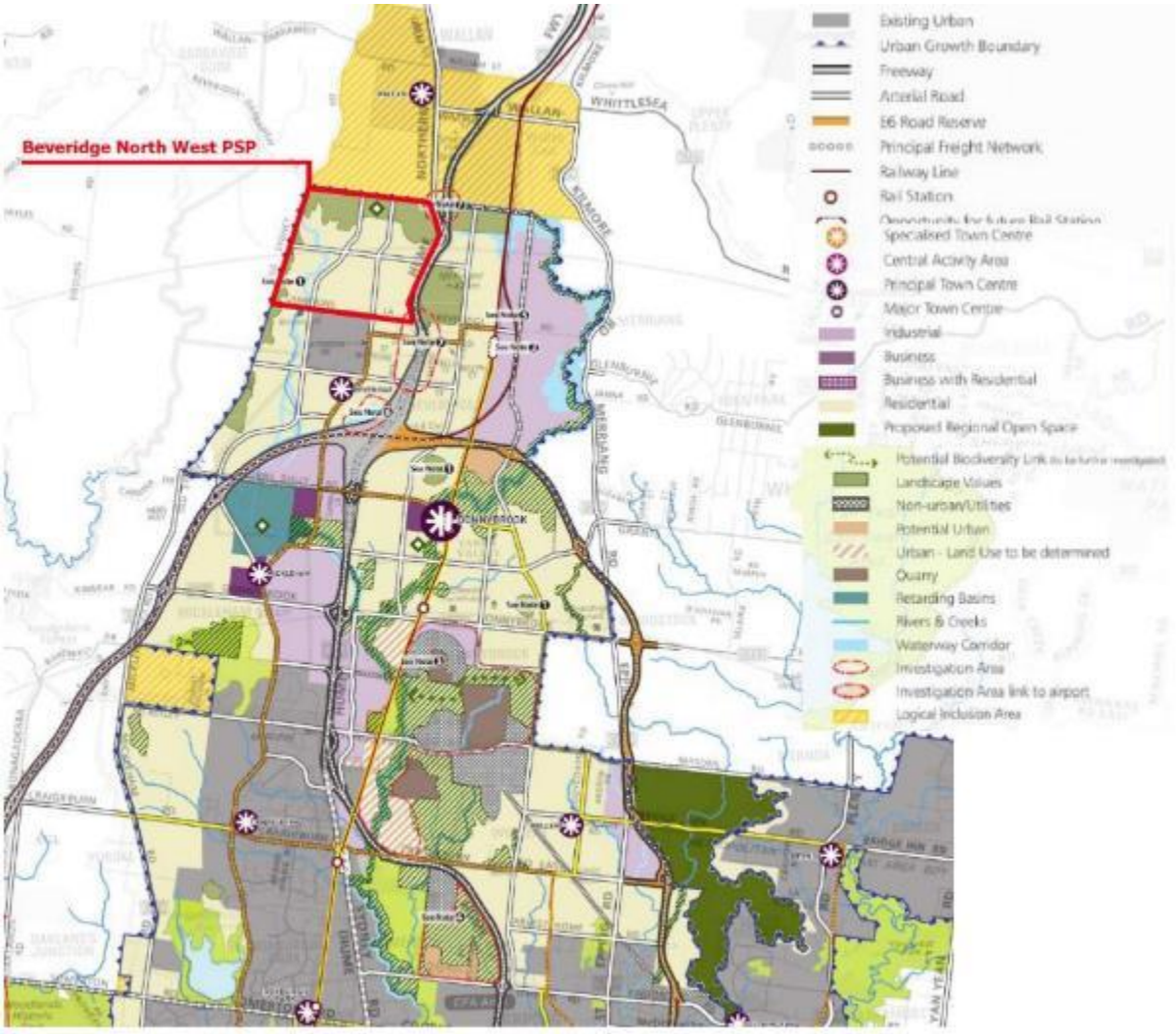


Figure 15. *North Growth Corridor Plan*

Under the vision for the NGCP - *Each community will have a distinctive character, defined by its natural setting – the foothills, grasslands, woodlands, creeks and waterways – and well designed, accessible town centres. And specifically, it looks to enhance key landscape features that form part of the broader setting for urban development*:

- Utilisation of the natural drainage system across the Growth Corridor to create a network of open spaces which connect different parts of the corridor in both visual and landscape terms.

- Retention of an inter-urban break between the northern edge of the Growth Corridor and Wallan. The edge of urban development has been identified as just south of the saddle that commences at the intersection of Old Sydney Road and Beveridge Darraweit Road, and links south-east to Mt Fraser.

The plans vison for Character & Identity also refers to waterway and wetland features:

- The sense of place for each of these communities will be created from natural features, particularly the hills that frame the Growth Corridor, volcanic cones and the creeks and woodland reserves within and adjacent to it.

Planning principles outlined within the corridor plan relevant to waterway and wetland planning include:

- Under Principle 4
    - Planning of each corridor should maximise the contribution that these landscape features make to the local character and amenity of the Growth Corridor
    - The protection and enhancement of existing landscapes within and adjoining Melbourne's Growth Corridors will provide the basis for creating new communities of high amenity and a strong local identity. The ridgelines, hilltops, waterway corridors, and areas of special environmental and heritage significance
- Under Principle 5
    - Precinct Structure Planning will respond in greater detail to local waterway values ensuring that Melbourne's waterways continue to provide a network of flora and fauna habitats, flood protection and natural open spaces that make a major contribution to the liveability of the Growth Corridors

The background study *Analysis of Opportunities & Priorities for Open Space Network Planning for Melbourne's Growth Areas (Tract 2011)* includes underpinned many of the recommendations in the approved NGCP and the approach included the following principle:

> **Waterways** and other large areas of open land required primarily for other purposes (such as flood plains or wetlands required for water quality purposes), are potentially able to contribute to conservation, recreation and amenity outcomes for the growth area

Water for Victoria Plan: Chapter 5 – Resilient and liveable cities and towns (2016)
Victorian State government plan for managing water into the future. Chapter 5 summarises the five key outcomes to achieve 'Resilient and Liveable Cities and Towns' including efficient and affordable water and sewerage services, effective stormwater management to protect the urban environment, healthy and valued landscapes and community values reflected in place-based planning.

Yarra Strategic Directions Statement (IWM Forum, September 2018)
Strategic Directions Statements (SDS) have been prepared for Metropolitan Melbourne's five sub-catchments, including the Yarra River, of which the Merri Creek is a tributary. The vision of this document is: *Working together, Yarra is a world-leading water sensitive catchment and our communities are healthy and thriving. We honour the land and the water of the Birrarung and its tributaries as the lifeblood of the catchment.* The desired outcomes for the SDS are summarised in Figure 16 below, highlighting the range of considerations in planning for water management within the corridor.

Figure 16. *Yarra catchment SDS outcomes*

Three of the actions identified within the SDS are highly relevant to the corridor and by extension these PSPs. The text below is lifted directly from the SDS:

- **IWM Sub-catchment plan**: This project will develop place based IWM Sub-Catchment Plans to clearly convey planning requirements and infrastructure investment sequencing information. It will provide a coordinated, consistent and proactive approach from water authorities, catchment managers and local governments in relation to water resources planning and management for specified areas across Metropolitan Melbourne.
- **Merri Creek Upper IWM Sub-Catchment Plan Pilot**: The Merri Creek Upper sub-catchment will be a pilot site for the implementation of IWM Sub-catchment Plans in a predominantly greenfield development setting.
- **Wallan Restorative Project**: The Wallan Sewage Treatment Plant (STP) will be connected to the metropolitan sewer network by 2021. At this time, the STP will become a sewer mining plant. There is an opportunity to repurpose the existing irrigation land and 165 ML winter storage lagoons for other benefits Including for the storage and reuse of harvested stormwater. While the volume of stormwater that this facility can harvest and store in an average year is unknown, it is a significant storage asset that should be incorporated into any precinct scale IWM planning analysis.

Stormwater Ministerial Advisory Council (MAC) (2018)
The stormwater MAC reviewed the regulation of stormwater management in Victoria and delivered a series of recommendations in September of 2018. The first stage (planning reforms) has been gazetted and is embedded into the Victorian Planning Policy Framework. The recommendations and planning reforms extend the range of developments that are required to meet Clause 56 best practice environmental management (BPEM) pollution reduction targets. The developments covered extend beyond residential subdivisions to include commercial subdivisions and developments, industrial subdivisions and developments, public-use developments and multi-dwelling residential subdivisions and developments. Further recommendations cover future policy directions and supporting actions and are not gazetted at this stage.

Metropolitan Open Space Strategy (DELWP)
The Metropolitan Open Space Strategy will provide a strategic framework for publicly owned land and waters that are accessible to the public, as well as making use of other types of public land for open space where possible. It will set the:

- vision for Melbourne's open space network for the 30-year horizon
- goals to give us the focus for action
- principles to guide how we will plan and work as land managers to deliver the vision
- short-term investment priorities,
- enabling actions that will support the longer-term sustainability of the network; and

- new governance arrangements to collectively oversee delivery of the strategy and investment priorities and maximise the public good unlocked from public open space.

The geographic scope of the strategy is metropolitan Melbourne, inclusive of the 32 Local government areas.

The strategy is currently in draft and at this stage it has not been released for formal comment.

Integrated Water Management Framework for Victoria (2017) / Yarra Strategic Directions Statement (2018)
The IWM Framework for Victoria is designed to help local governments, water corporations, Catchment Management Authorities, Traditional Owners and other organisations work together to ensure the water cycle efficiently contributes to the urban liveability of the region, with communities at the centre of decision making.

Healthy Waterways Strategy (2018)
Melbourne Water's 2018 Healthy Waterways Strategy sets out the direction and approach for Melbourne Water's role in protecting and improving waterways and waterway values in the Port Phillip and Westernport region. The strategy guides investment in waterway health, defines a vision for the region, identifies priority areas and management actions, and sets out targets to measure the effectiveness of these actions and a framework for delivering the strategy. The regional 50-year HWS vision for waterways and wetlands is:

Healthy and valued waterways are integrated with the broader landscape and enhance life and liveability. They connect diverse and thriving communities of plants and animals; provide amenity to urban and rural areas and engage communities with their environment; and are managed sustainably to enhance environmental, social, cultural and economic values.

The strategy uses a framework of nine key values that waterways (and wetlands) can support, and waterway conditions. The strategy identifies current states, future trajectories, and target trajectories for each waterway condition. Of relevance to this project is the Merri Creek Upper sub-catchment, detailed within the Co-Design Catchment Program for the Yarra Catchment (Figure 17). The following target summaries represent an average across the Yarra catchment for wetlands:

Table 4. Target summaries across the Yarra catchment

Key Values	**Current State**	**Current Trajectory**	**Target**
Birds	Very low	Low	Low
Fish	Low	High	High
Frogs	High	Moderate	High
Vegetation	Low	Low	Moderate
Waterway Conditions	**Current State**	**Current Trajectory**	**Target**
Water regime	Low	High	High
Wetland habitat form	Low	Low	Low
Wetland buffer condition	Very low	Low	High
Vegetation condition	Low	Moderate	High
Wetland water quality	Low	Very low	Moderate

A summary of the 10-year performance objectives for wetlands in the *Co-Designed Catchment Program* for the Yarra catchment is outlined below.

- Reduce the threat of invasive plant species.
- Deliver environmental water to key billabongs on the Yarra floodplain.
- Investigate opportunities to re-engage natural floodplain wetlands in key locations to meet ecological watering objectives, improve ecosystem services, cultural and social values.

- Reduce the threat of invasive animals such as dogs, cats and foxes to protect key wetland bird habitats.
- Develop understanding of the amenity, community connection and recreation values of wetlands and develop performance objectives to enhance these values.

The following table provides a summary of the long-term outcomes for *Co-Designed Catchment Program* for the Yarra catchment.

Table 5. Summary of long-term key value outcomes Yarra catchment

	**Wetland bird** score in the Yarra catchment is on average currently very low. However, some wetlands such as Cockatoo Swamp have high bird values. Environmental watering of key billabongs in the Yarra catchment is predicted to improve the bird value of many billabong wetlands. The target is to improve from very low to low. **Locations where a decline or very low score is expected:** Donnybrook Road Lake, Hernes Swamp, Kalkallo Commons Grassland and Kalkallo Creek Wetlands, Growling Grass Frog Reserve Wetlands, Ringwood Lake, Lilydale Lake, Stormwater Wetlands, Anderson Creek East Retarding Basin
	**Fish** score is currently low overall. However, environmental watering of key billabongs and re-engagement of floodplain wetlands in the long term is predicted to significantly improve the fish score up to high.
	**Frogs** score is high. Actions to reduce the threats of changed water regimes, altered wetland form, lack of wetland buffers and poor wetland vegetation condition will maintain the score at high, particularly in the Yarra billabongs. Many Yarra wetlands provide habitat for significant frog species such as growling grass frog. It is predicted that these habitats will continue to support these species.
	**Vegetation** score is currently low. Actions to reduce the threats of changed water regimes, improve vegetation condition and wetland habitat form will improve the wetland vegetation score to a potential trajectory of moderate.

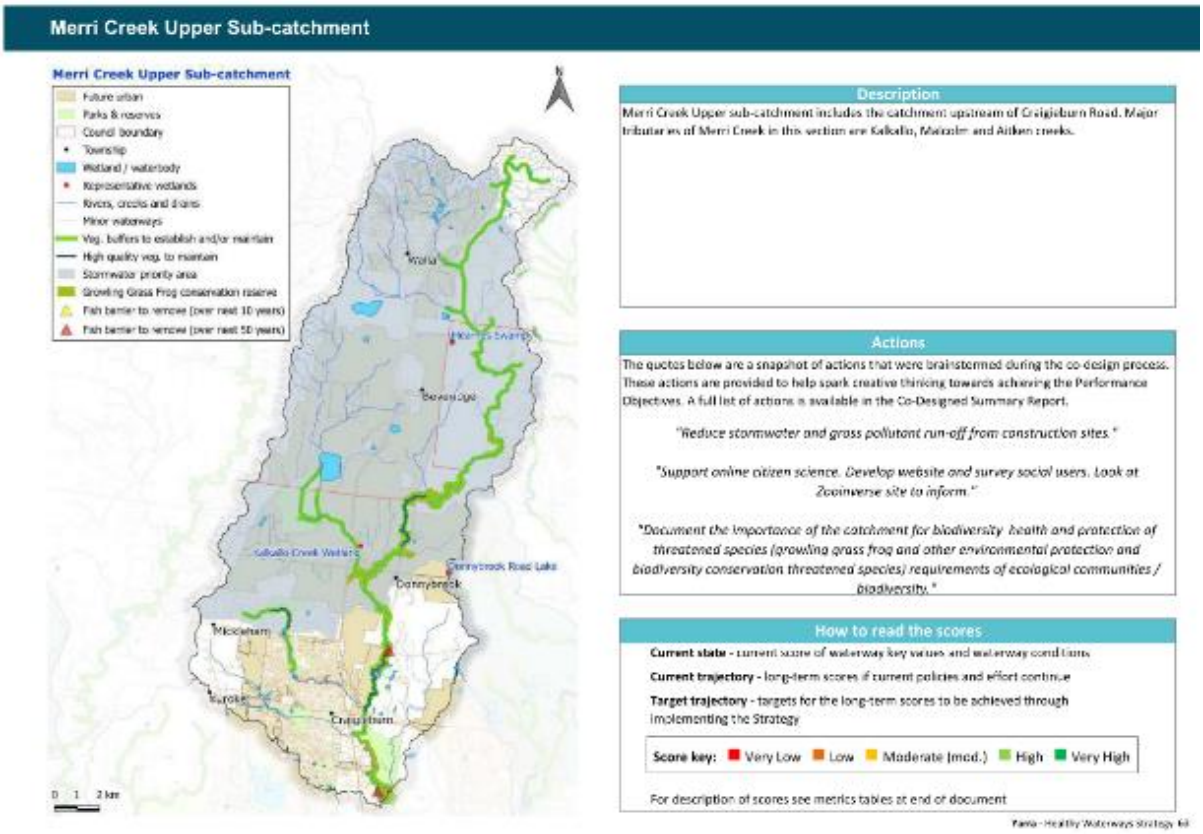


Figure 17. *Merri Creek Upper sub-catchment (Co-Design Catchment Program for the Yarra Catchment)*

This document identifies 11 specific performance objectives. Objectives relevant to the waterway and wetland management within the study area include:

- Identify and implement opportunities to maintain or improve the flow regime in refuge reaches to support instream values.
- To prevent decline in stormwater condition, treat urban development so directly connected imperviousness (DCI) remains below 2% on the Merri Creek at Summerhill Road (Wollert). For every hectare of new impervious area, this requires harvesting around 4.5 ML/y and infiltrating 1.1 ML/y, which is about 21.4 GL/y and 5.2 GL/y for full development to the urban growth boundary.
- Investigate and mitigate threats to physical form and other high values (including impacts of urbanisation).

The document additionally identifies Hernes Swamp near Wallan as a freshwater meadow and is also a nationally listed Seasonally Herbaceous Wetland (Figure 18). Performance objectives include:

- Investigate opportunities to further re-engage the natural wetlands in this area and to improve wetland water regime to meet ecological watering objectives, improve ecosystem services, cultural and social value.
- Identify opportunities to improve the wetland habitat.

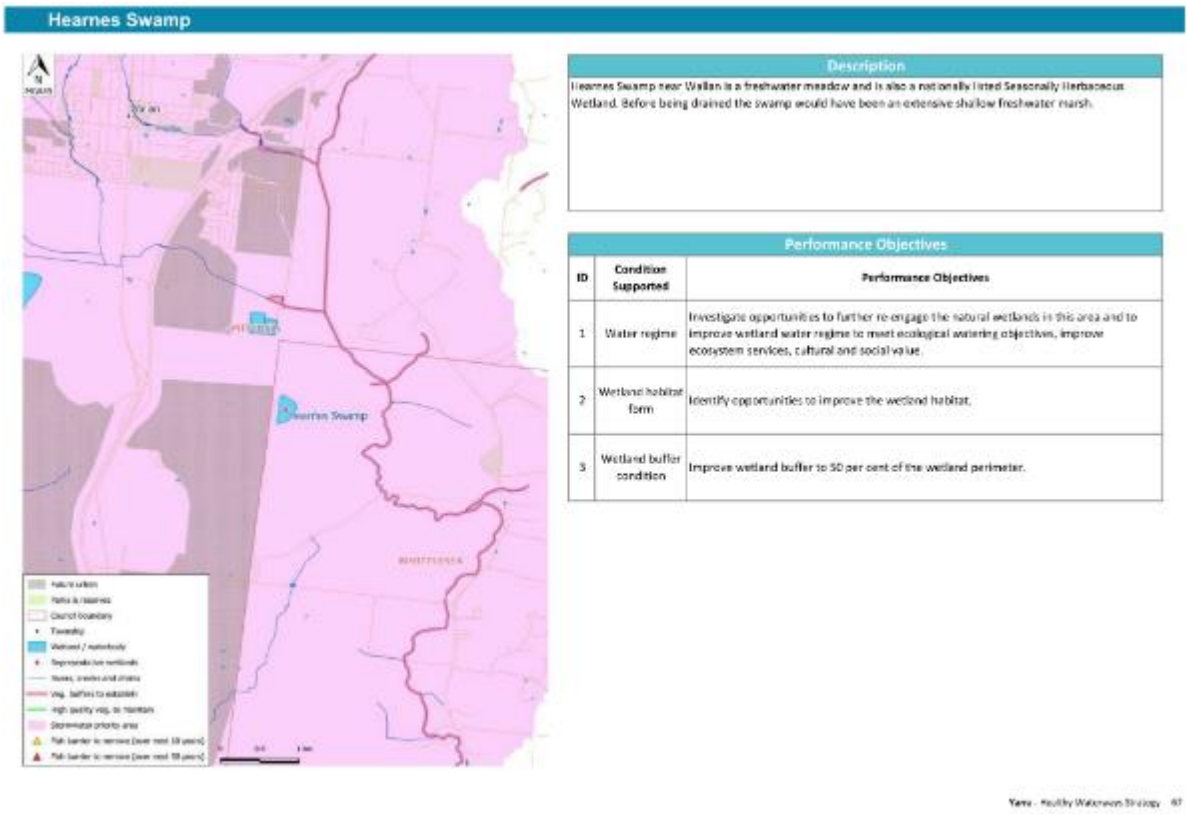


Figure 18. *Hernes Swamp (Co-Design Catchment Program for the Yarra Catchment)*

Upper Merri Creek IWM Project (2019 onwards)
The Upper Merri Creek IWM Project is a collaborative effort across Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation, Hume City Council, City of Whittlesea, Mitchell Shire Council, Yarra Valley Water, Melbourne Water and the Victorian Planning Authority. The aim of the stakeholder engagement elements of this project is to bring community and industrial stakeholders along the journey of developing an IWM plan. The community indicated that they strongly valued the Merri Creek, biodiversity, and connection to healthy open space.

These values have been mapped out as part of the Upper Merri Creek Issues Paper (October 2019, Foundry Associates 2019). This document introduces the Upper Merri Creek sub catchment, and the opportunities to create communities and places where people want to live through the planning decisions about water. Key objectives and questions contained within this paper that is relevant to this project include:

- Without sufficient flows, local waterways and wetlands such as Hernes Swamp will struggle to maintain viable habitats for birds, fish and frogs, including the threatened Growling Grass Frog.
- Recreating the waterway systems which were pre-historically and historically important and remain important features of the Merri Creek and its tributaries
- Conducting comprehensive terrestrial and aquatic flora and fauna assessments across the sub-catchment to identify opportunities to reintroduce and restore native plants, birds and animals into the Upper Merri Creek sub-catchment, including species that are important to Wurundjeri Woi Wurrung people as totems, seasonal indicators and resources required for ceremony
- Urbanisation affects local and regional biodiversity, and policy frameworks attempt to compensate for the impacts of development on biodiversity through vegetation offset schemes. How could we protect or regenerate biodiversity through integrated water management?
- Water planning also needs to recognise the rights of First Nations people, and the unique role that Traditional Owners can play in looking after water and land. We expect that the planning authorities

will incorporate Aboriginal perspectives and visions for the catchment into their own planning documents.

The Upper Merri Creek IWM project team are currently working on a shortlist of high priority topics and actions and seeking endorsement from upper management of the partner organisations. This will form the basis of the Upper Merri Creek IWM Plan and guide the development of IWM servicing plans for smaller catchments within Upper Merri Creek.

Northern Growth Corridor - Integrated Water Management Study (AECOM 2015)
Northern Growth Corridor - Integrated Water Management Study for the northern growth areas of Melbourne, comprising the local government areas of Whittlesea, Mitchell and Hume, was prepared for Yarra Valley Water, Department of Environment Land Water and Planning, Melbourne Water and the former Office of Living Victoria. The report assesses IWM servicing options that aim to achieve desired future outcomes identified by key stakeholders. These outcomes are shown Figure 19.

Outcome	Indicator
A place-based approach to planning for whole-of-water-cycle management	Integration of whole-of-water-cycle management into urban planning, in both established and growth areas Identification of regional water cycle initiatives and strategies for their implementation that could contribute to a sustainable, productive, and liveable North in the future
Resilience and affordability	Creation of resilient water systems that accommodate changes in climate and water demand Long-term affordability of water services through providing the right water to the right places at the right time, and at the right cost
Protection and enhancement of natural water systems	Improvement of natural water systems Sustainable management of extractions from and discharges into natural water systems
Enhancement of liveability	Provision of adequate water supply for significant vegetation, including tree cover, playing fields and open space Contribution to improved public health and liveability through making water a feature in the community (e.g. by easy access to connected open spaces and reduction of urban heat due to increased tree cover) Improved management of urban flooding
Acceptance and ownership by stakeholders and the community	Creation of ownership through regular collaboration with stakeholders and a clear implementation plan and funding arrangements A community that is informed and able to provide input at key stages

Figure 19. *Desired IWM Outcomes of the Water Futures North project (Water Futures North 2015)*

Any IWM solutions which incorporate Hernes Swamp or other key sites need to be considered carefully in line with the ecohydrology required to sustain the seasonal herbaceous vegetation communities as too much water will be detrimental to these systems.

Upper Merri Creek Sub-catchment Cultural Flows Assessment
While not complete at the time of this assessment the future Upper Merri Creek Sub-catchment Cultural Flows Assessment will identify opportunities for cultural flows to be integrated into development planning and enhance IWM based on traditional owners' knowledge of the country. Ways for water planning and management to support Wurundjeri Woi Wurrung's objectives were outlined in the Upper Merri Creek Issues Paper (October 2019) and include:

- Preference being given to Wurundjeri Woi Wurrung's Narrap Team to undertake a range of land and natural resource management services

- Exploring native produce enterprise (and other business) opportunities within the Upper Merri Creek sub-catchment
- Incorporating signage for geographical features and public spaces in Woi Wurrung language incorporating clan acknowledgements of place and historical custodianship
- Recreating the waterway systems which were pre-historically and historically important and remain important features of the Merri Creek and its tributaries
- Developing strategies to establish cultural and environmental corridors within the Upper Merri Creek sub-catchment that provide connectivity within this area and to the broader Birrarung system
- Conducting comprehensive terrestrial and aquatic flora and fauna assessments across the sub-catchment to identify opportunities to reintroduce and restore native plants, birds and animals into the Upper Merri Creek sub-catchment, including species that are important to Wurundjeri Woi Wurrung people as totems, seasonal indicators and resources required for ceremony
- Incorporating Wurundjeri Woi Wurrung flora and fauna assessments as critical planning tools for future management of the sub-catchment

Melbourne Strategic Assessment

The Melbourne Strategic Assessment (MSA) is a strategic assessment by the Victorian Government of the urban development program, including development in the urban growth corridors. As part of the MSA conservation strategies were developed for the growth corridors, including a Biodiversity Conservation Strategy and Sub-regional species strategies.

The Wallan-Beveridge corridor abuts conservation areas designated under the MSA, with land set aside for Growling Grass Frog (GGF) habitat. This project will need to incorporate the findings and data from the MSA and describe the process for protecting native vegetation that is within the MSA, but outside the designated conservation areas.

Of note, the MSA does not cover the entire northern growth corridor, as it does not extend into the logical inclusion areas beyond the old UGZ boundary. Hence these areas, including a large part of the study area around Wallan, are a significant gap that is currently overlooked by the Biodiversity Conservation Strategy and Sub-regional species strategies.

Hanna Swamp

Approximately 15 ha of Hanna Swamp is within the Melbourne Strategic Assessment (MSA) program area (the section within the Beveridge North West precinct) with the majority (approx. 60ha) outside the program area. DELWP has not considered the conservation value of the areas outside the MSA.

The section of Hanna Swamp within the MSA, was not included as a Conservation Area within Biodiversity Conservation Strategy for Melbourne's Growth Corridors 2013 (BCS) because it was identified as not strategically important for Matters of National Environmental Significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Specifically, it was assessed as:

- not strategically important habitat Growling Grass Frog in the context of achieving functional and connected populations of Growling Grass Frog through the MSA program.
- not comprising of the Seasonal Herbaceous Wetland.

Wallan Regional Park and the Upper Merri Creek Regional Parklands

DELWP is in the process of developing the boundaries of a regional park that will link across several of the PSPs within the study area. This piece of work will help DELWP understand the potential opportunities and constraints for this park.

The feasibility study for the Wallan Regional Park and the Upper Merri Creek Regional Parklands will include a corridor-wide assessment of open space within the North Growth Corridor. The assessment will inform the location, opportunities and challenges for creating a regional park in Wallan. The assessment will also inform potential linkages with the proposed Upper Merri Creek Parkland and proposed landscape in the precinct structure plans. The study will be informed by contemporary approaches to the planning and management of open space, environmental planning (including biodiversity and green infrastructure), land use planning, mapping, and stakeholder and community engagement.

The study will consist three components:

- Part A - Assessment of strategic need
- Part B - Identification of available and suitable land
- Part C - Recommendations for any proposed park

The regional park assessment has potential to integrate outcomes from the waterways and wetlands assessment (this investigation) into the regional park planning. However, timing and sequencing of this task currently proposes an issue for an integrated outcome as the PSPs develop ahead of this project.

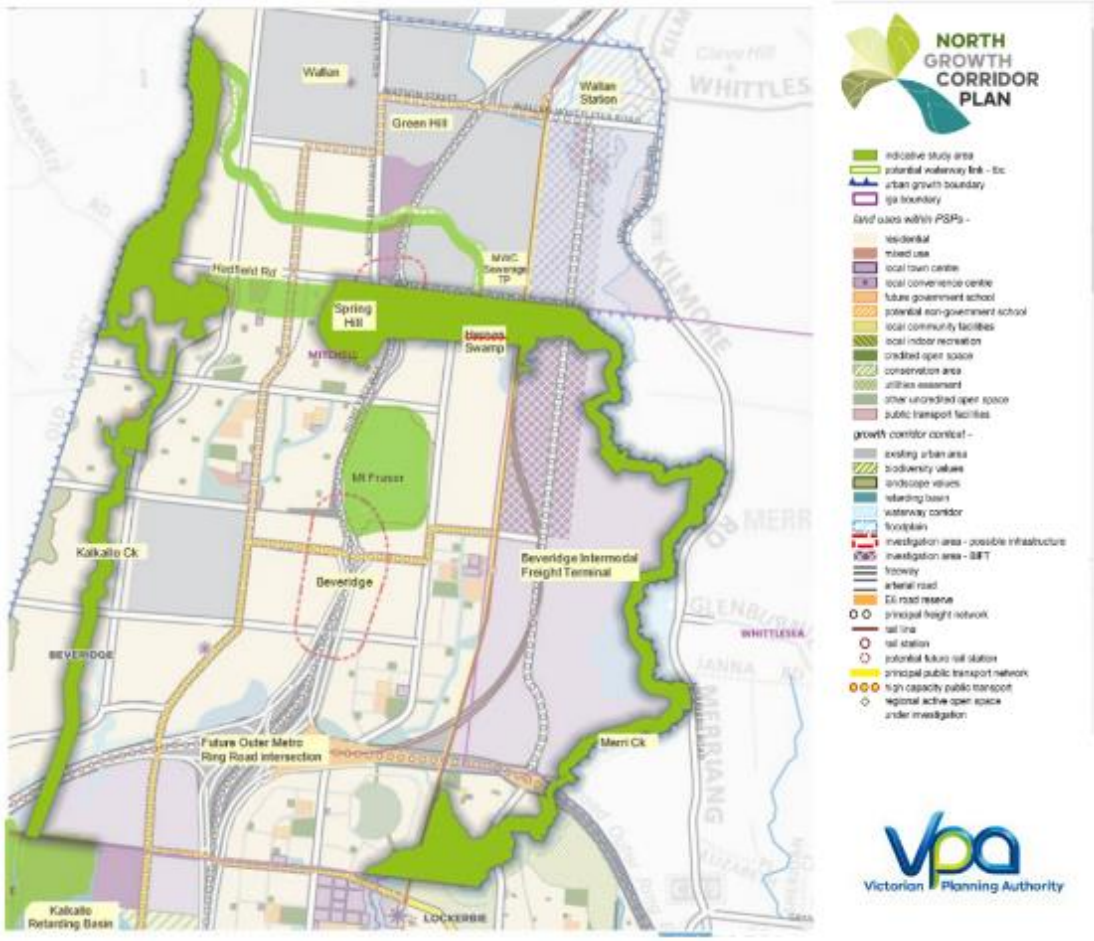


Figure 20. *Wallan Regional Park study area (DELWP)*

Mitchell Shire Council – Open Space Strategy (2013 – 2023)
The Mitchell Open Space Strategy provides a planning and development framework for the provision of open space and off-road trails in the Shire to 2023. The Strategy seeks to achieve a balance in the equitable distribution of a diverse range of open space and off-road trails for people that live, work and visit the Shire.

Within the strategy the eight principles are outlined which underpin the strategy. Of these one directly relates to the management of waterways and wetlands within the study area:

- Protection and enhancement of natural and cultural heritage
    - Council acknowledges the value of the natural and cultural heritage to the Mitchell Shire, for the purposes of biodiversity, identity, education and recreation. Council will seek to utilise open space to enhance the protection of the natural environment and features, landscape character and cultural heritage for future generations. Opportunities will be sought to allow residents and visitors to explore and interact with this heritage in a manner that also supports and encourages its conservation.

This is also reflected in the six strategic goals, specifically:

- Amenity
    - High environmental quality in parks, and landscape character of the Shire, that enhances amenity, restorative values, recreation experiences, civic pride and connection with nature.

Mitchell Shire Council - Environmnetal Stategy (2014 - 2024)
The Mitchell Shire Council Environment Strategy is focused around five priority areas including Biodiversity, Waterways and Wetlands, Rural land use and management, Urban land use planning and development and Resilient communities.

Of these five priority areas, three directly relate to the management of waterways and wetlands within the study area:

- Biodiversity
    - Vision: Protect, enhance and connect landscapes by increasing the extent and quality of native habitat
- Waterways and Wetlands
    - Vision: Improve water quality, riparian condition and in-stream habitat of waterways and wetlands.
- Urban land use, planning and development
    - Vision: Enable land use planning and development that respects and conserves Mitchell Shire's natural environment by anticipating, avoiding and reducing potential adverse impacts from increased population, economic and settlement growth.

Actions within the plan that relate to the management of waterways and wetlands include:

- Investigate the feasibility of creating new Flora Reserves for areas of high biodiversity value
- Protect and enhance the environmental values of waterways, wetlands and water bodies on Council managed land
- Commit to improving water quality in waterways, wetlands and water bodies throughout the Shire through regulations, strategies and programs
- Prepare Development Guidelines for the protection of waterways and incorporate into the planning scheme
- Embed custodianship of natural environmental values within structure planning processes so that growth is managed, and natural assets are protected simultaneously
- Investigate opportunities to advocate for reform of regulations and controls drafted by State and Federal governments so that ESD outcomes can be achieved and demonstrated more easily in new developments

Mitchell Shire Council – Environmental Policy (2020)
The Mitchell Shire Council Environment Policy is underpinned by six (6) strategic aims to assist in guiding Council's activities planning and business decisions which support best practice environmental management now diverse and rapidly growing community. These are:

- Energy,
- Climate Change,
- Land and Biodiversity,
- Water,
- Urban Ecology, and
- Resource Use and Waste Management.

Specifically, in relation to the management of waterways and wetlands, the Land and Biodiversity strategic aim states that:

- We will practice, promote and encourage sustainable, innovative and adaptive land management that responds to climate change.
- We will protect, restore and connect landscapes by increasing the extent and quality of native habitat.

2050 Goals for Land and Biodiversity management as specified in the policy include:

- Mitchell Shire is known for supporting innovative, sustainable and adaptable land management and agricultural business.
- Mitchell Shire's biodiversity values and natural environment are embedded within and protected by the planning scheme and local policy.
- The majority of our population is connected to nature.
- Prevent new high-risk invasive plants and animals from establishing in the Shire
- Indigenous land management practices are recognised and respected
- No vulnerable or near threatened species will have become endangered.
- Net gain of the overall extent and condition of habitats across Council managed land.

Mitchell Shire Council - Wallan Structure Plan (2015)
The Wallan Structure Plan developed by Mitchell Shire Council (2015) sets a framework for the future growth of Wallan township outlining twelve directions, with the aim to achieve its vision:

> *Wallan is a thriving township with a distinctive country town feel. Residents have the best of both worlds benefiting from a range of services whilst living in a place that is welcoming and green.*
>
> *The lifestyle qualities of Wallan are enriched by a strong connection to the open space networks that extend across the town taking in the natural creeks, wetlands, hillsides and areas of native vegetation.*
>
> *The town centre and public spaces are places of pride for all residents. The streets are green, inviting, full of people and prosperous places for businesses.*
>
> *Wallan is a great place to live with a range of housing choices. Everything is close by and residents have the choice of walking, cycling or using public transport for their* daily needs.

Of the twelve directions to achieve this vision two directly relate to the management of waterways and wetlands within the study area:

- Direction B2 - The Structure Plan supports planned drainage infrastructure established by Melbourne Water and ensures the drainage corridors and wetlands form a cohesive open space network across Wallan, providing drainage, ecological and recreational functions.
- Direction B5 - An integrated open space network across the town which follows waterways and connects residents to the town centre, schools, community facilities, major open space and sporting reserves is identified.

The Urban Framework Plan developed based on the key directions, objectives, strategies and actions outlined within Part B and Part C of the Structure Plan is shown below (Figure 21).

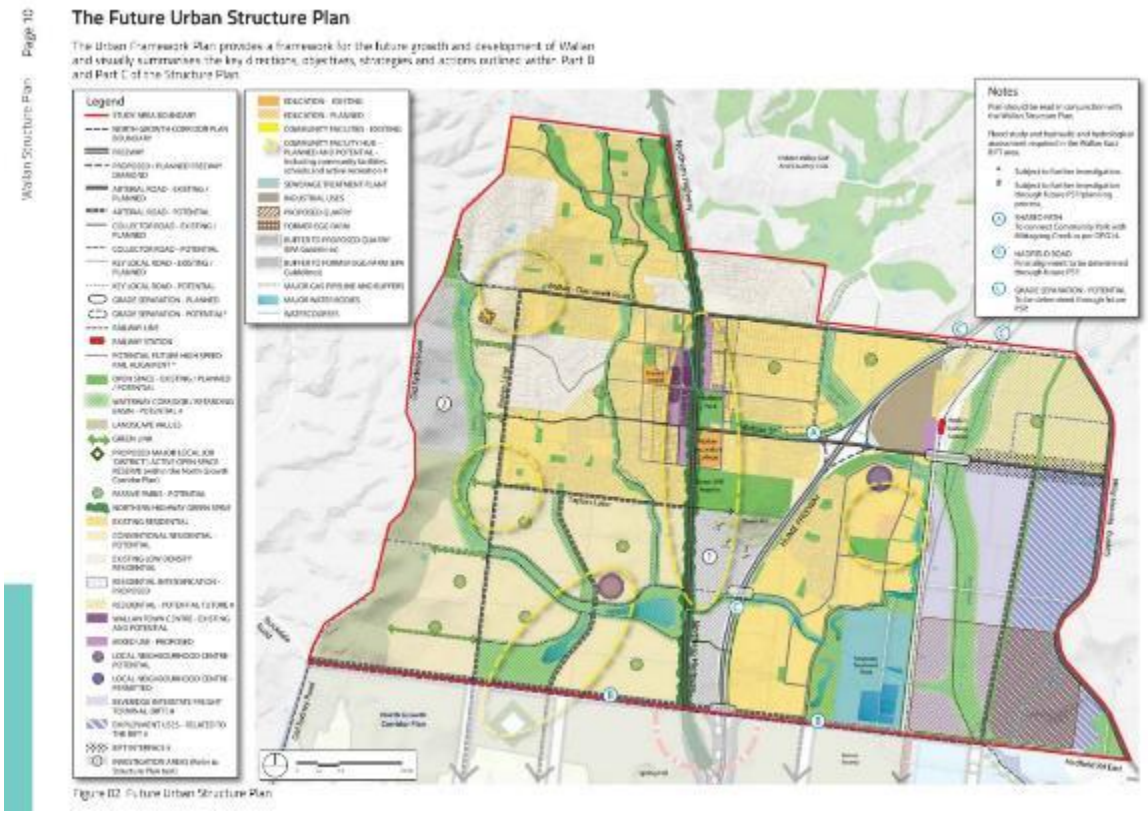


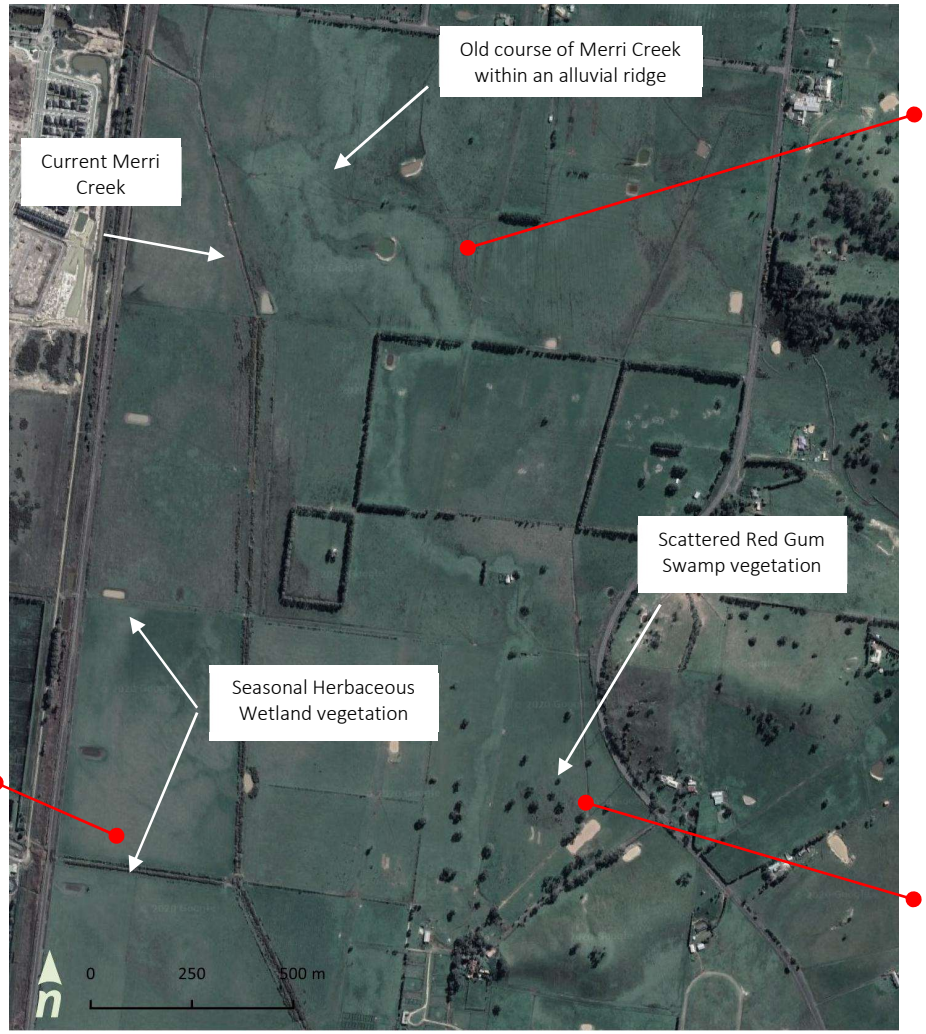
Figure 21. *Wallan Structure Plan including links to Hanna and Meade swamps (Mitchell Shire Council, 2015)*

Attachment B
Excerpts from Alluvium (2021) relating to Hanna Swamp, Meade Swamp and Hernes Swamp

Hernes Swamp

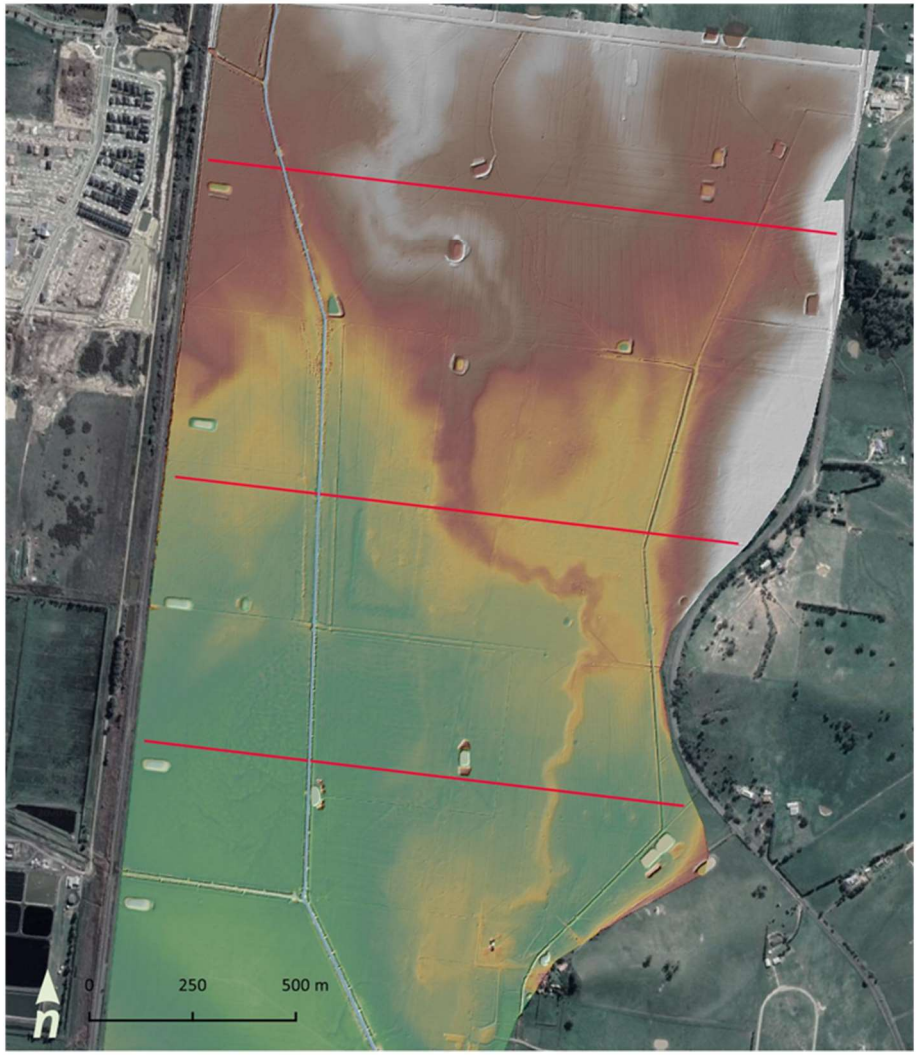
The alluvial ridge of the old Merri Creek channel appears to be playing a significant role in the hydrology and vegetation characteristics of the floodplain.

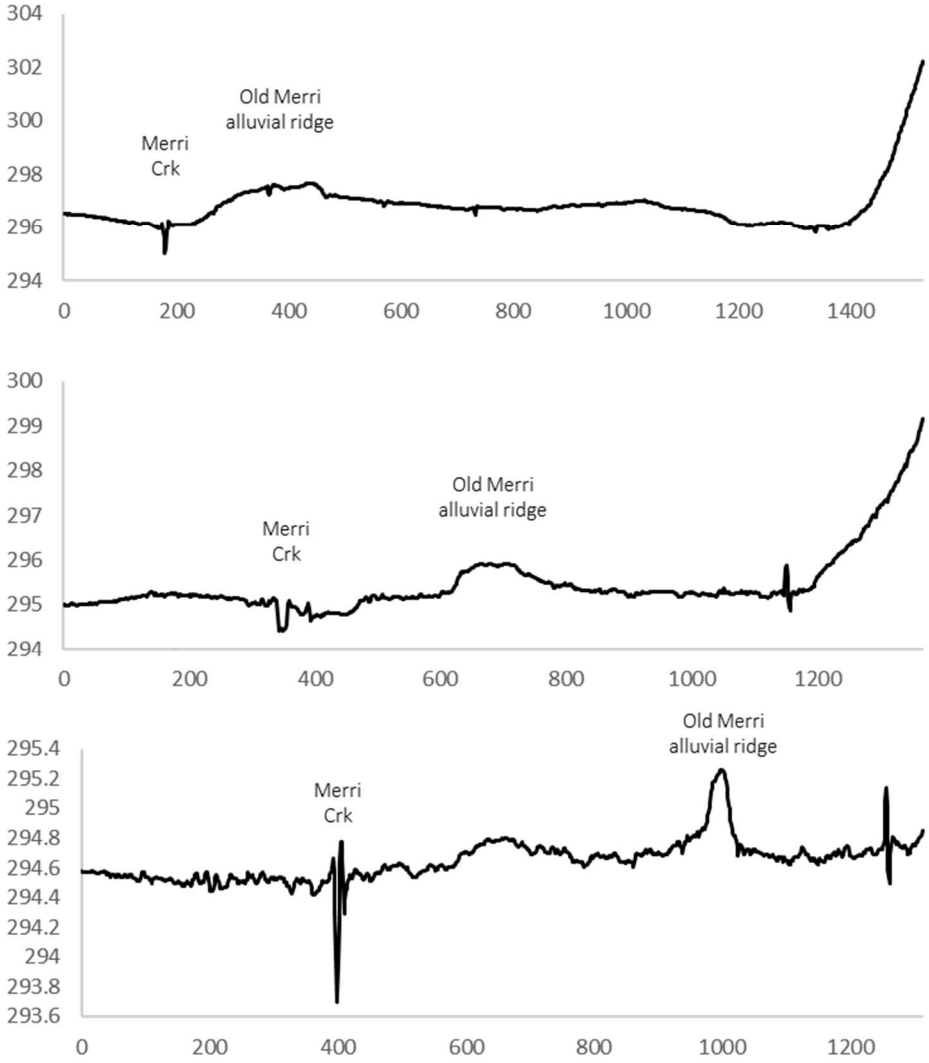
The alluvial ridge appears to be acting to hold water on the eastern side of the floodplain. This side of the ridge is slightly higher in elevation than the western side of the alluvial ridge as well. This difference in elevation and its impact on hydrology has led to different vegetation types being present on each side of the ridge. Scattered Red Gum Swamp can be found on the eastern side of the alluvial ridge while Seasonal Herbaceous Wetland is found at lower elevations on the western side of the alluvial ridge.



The old Merri Creek channel and alluvial ridge are indistinct features on the ground but appear to be having a major influence on the hydrology and vegetation of the area. The old reach could be classified as an intact valley fill according to the RiverStyles framework which is a rare geomorphic form. While this is of interest the fact that it is a discontinuous channel that does not convey the majority of flow any more does not warrant protection in its own right. However, the hydrologic and vegetation characteristics of the floodplain may be altered if the topographic form of the alluvial ridge is not maintained.

Hernes Swamp



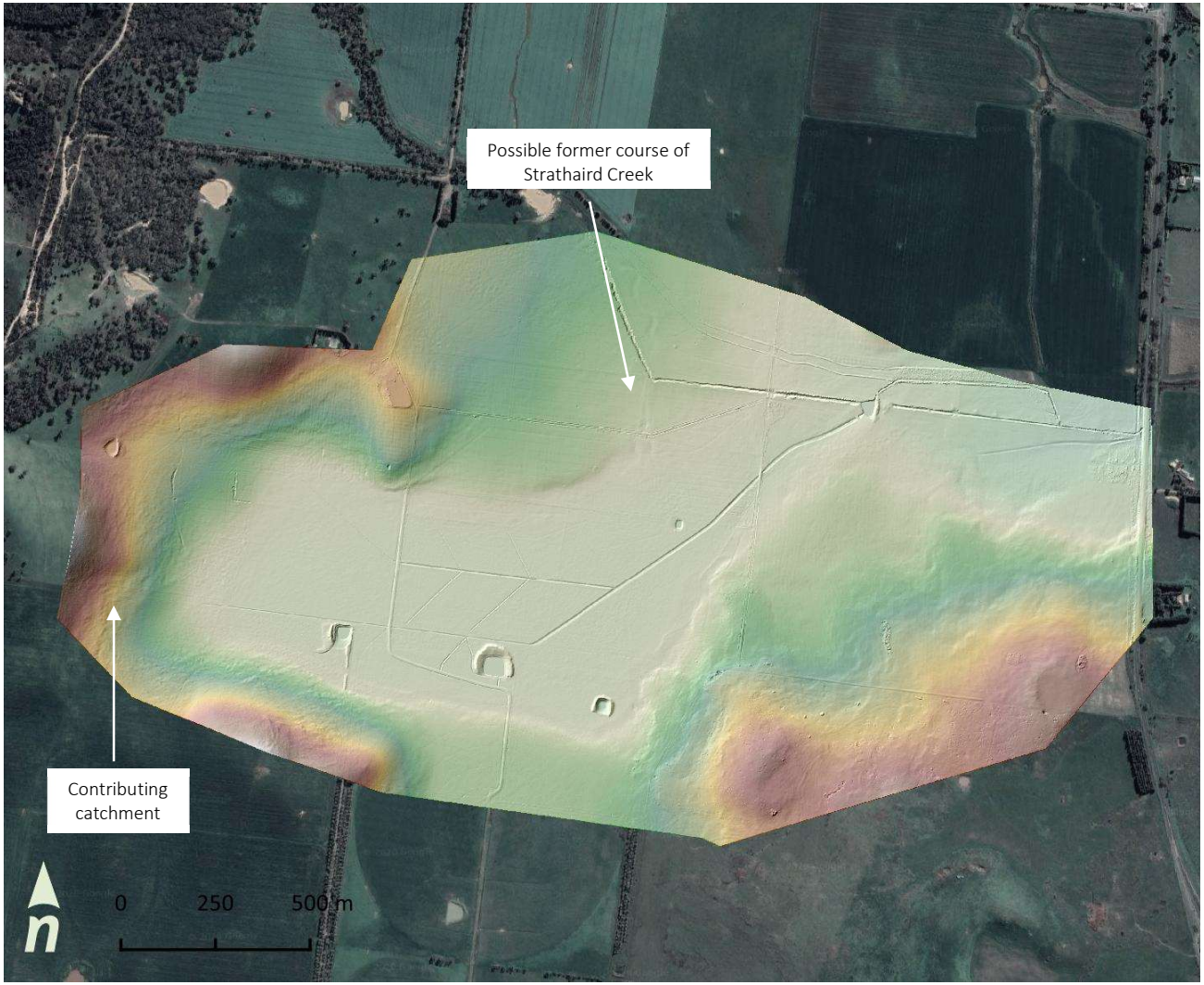


Hanna Swamp

The hydrology of Hanna Swamp has been altered with the construction of diversions and drains through the wetland area. Nature Glenelg Trust have indicated the former channel alignment of Strathaird Creek that flowed into Hanna Swamp. An examination of the LiDAR for the swamp area appears to support this suggestion. The construction of the Strathaird Creek diversion channels and the subsequent loss of hydrologic inputs from the Strathaird catchment will have had a significant impact on the hydrology of Hanna Swamp.

While the diversion of Strathaird Creek is an important factor in the current hydrology of the swamp, it is important to recognise that the surrounding hills above Hanna Swamp provide a substantial catchment area that still drains into the swamp.

The final factor that has impacted on the former functioning of the swamp is the construction of a network of drains that cover the swamp area. These drains are efficient means of moving water away from the area.



Wallan South- Meade Swamp

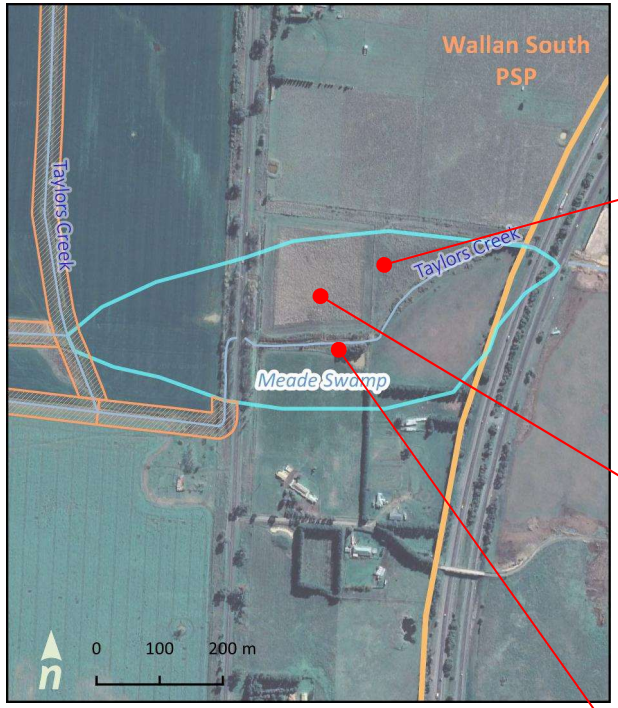
Meade Swamp and drainage lines

Meade swamp occurs between the Northern Hwy and Hume Hwy. It is currently approximately 7 hectares in area. Early maps indicate that this swamp may have been somewhat larger with an upper estimate of 10 ha. Meade Swamp comprises of a constructed channel and a broad flat vegetated portion that is the former base of the swamp. The current vegetation is largely dominated by *Carex appressa* Common Sedge in the wetland portion of Meade Swamp. The channelised section comprises of mostly exotic species including *Ulex europaeus* Gorse and *Phalaris aquatica* Toowoomba Canary-grass

Lathams Snipe was observed at Meade Swamp (October 2020). This species is listed as near threatened and indicates the importance of tussock dominated areas for foraging.

13 species were identified in the wetland component comprising 10 indigenous and 3 exotic species. *Carex appressa* Common Sedge dominated the wetland component. 49 species were identified in the channelised section comprising 37 exotic species, 2 non-indigenous native species and 10 indigenous species. The bulk of biomass in the channel comprised of the native species *Typha domingensis* Narrow-leaf Cumbungi. On the overburden portion of the cut channel *Ulex europaeu*s Gorse was dominant.

Meade Swamp appears to be receiving regular wetting sufficient to maintain a reasonably



resilient cover of native species. This supply may be coming from either the upstream urban catchment or potentially subterrain flow. A spring is identified in historical mapping.

Local threats to the condition and long-term function of this ecosystem include changes to the hydrological regime beyond the tolerance of dominant species, further encroachment of exotic species, further urban development and the influence of climate which will alter the availability of water.

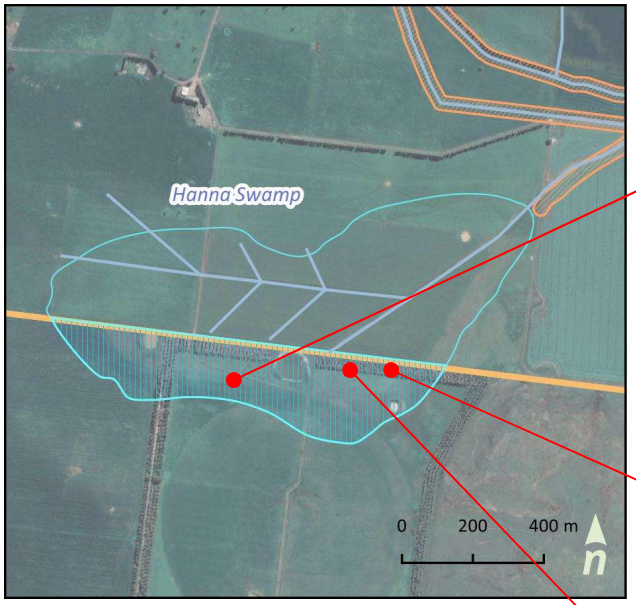
Future wetland and stormwater design must pay careful attention to current ecological value and maintain or improve the ecological function of Meade Swamp.

Wallan South – Hanna Swamp South

Hanna Swamp; a highly variable conservation asset with both high value and low value components. Hanna Swamp is a low lying landscape feature with varying values and quality, portions of Hanna Swamp are identified as Plains Grassy Wetland (EVC 125) (A). This community is listed as endangered.

For the purpose of this assessment Hanna Swamp will be described in two sections, Hanna South and Hanna North. Values and trajectory differ sharply across Hanna Swamp. Future management will need to consider the site as a single unit and determine more specific priorities for each side in consideration of current values and long term trajectory.

Hanna South is habitat for number of important species including one of State Significance. *Coronidium gunnianum* Pale Swamp Everlasting (B) which is listed as vulnerable. The southern section qualifies as a Seasonal Herbaceous Wetland of **very high quality**. This benchmark is met because the site contains more than three species as described in *Key Diagnostic Characteristics and Condition Thresholds* advice from the Federal Environment Department. In this case six species were identified including *Calocephalus lacteus* Milky Beauty-heads, *Coronidium gunnianum* Pale Swamp Everlasting, *Eryngium vesiculosum* Prickfoot, *Lobelia pratioides* Poison Lobelia. *Montia australasica* White Purslane and *Ranunculus inundatus* River Buttercup.



Summary vegetation values; Hanna South

67 species comprising; 33 indigenous species, (1 planted i.e. *Eucalyptus camaldulenis* Red Gum (C)) and 33 exotic species. Notably *Coronidium gunnianum* a listed threatened species, numerous patches observed. Indigenous wetland flora is evident throughout, co-occurring with exotic species.

Hanna South is of very high conservation significance. Ecological values and hydrological function are a **very high priority to retain, protect and improve. Its long term trajectory is positive, it will maintain its values if hydrology is maintained and ecological threats are managed appropriately.**

Wallan South – Hanna Swamp South

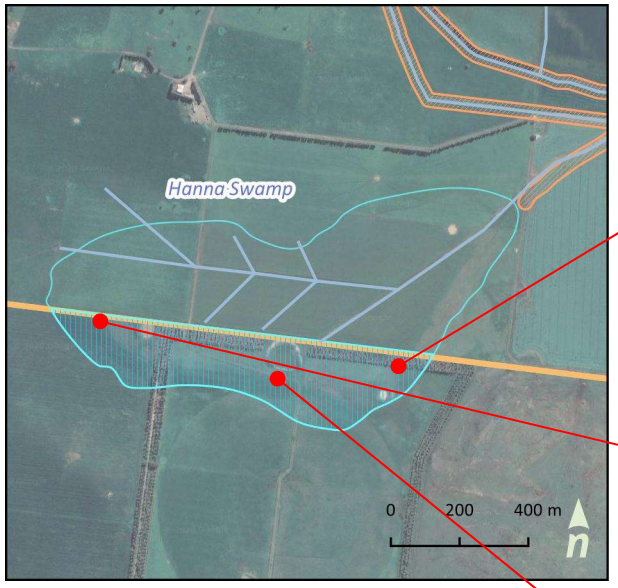
Hanna Swamp; fauna values observed, recorded and potential.

This assessment focused largely on extant flora with a review of previous records and other survey data. A detailed and comprehensive assessment of fauna was beyond the scope of this assessment. Fauna surveys have been undertaken in other assessments for the VPA.

Incidental records were made and we reviewed previous records for fauna within a 5km radius of Hanna Swamp. No species of high significance were identified during our assessment however previous data from the VBA identifies Growling Grass Frog and Golden Sun Moth within a 5 km radius.

Observed fauna; Hanna South

Seven common species of birds were observed during our assessment. Tadpole Shrimps Family Triopsidae (C) were observed indicating importance of hydrological function for ecological processes. Incidental observations were made of this crustacean with a single individual identified in an ephemeral pond. The site likely contains many more of these transient crustaceans. Furthermore, it suggests functioning ecological processes for the site with some capacity to influence adjacent sites. Further work is required to determine the extent to which fauna at Hanna South would have the capacity to improve Hanna North.



Current and future threats; Hanna South

- Cattle pugging and grazing (B)
- Exotic species, especially flora such as *Phalaris aquatica* (Toowoomba Canary-grass) and *Alopecurus pratensis* (Meadow Fox-tail)
- Disconnection from catchment
- Hydrological changes due to drainage of Hanna Swamp (impacting north and south (B))
- Competition from planted Eucalypts
- Urbanisation (potential filling, roads, subdivision)
- Climate

Hanna South is of very high conservation significance. Ecological values and hydrological function are a very high priority to retain, protect and improve. Positive long-term trajectory is if hydrological function can be maintained.

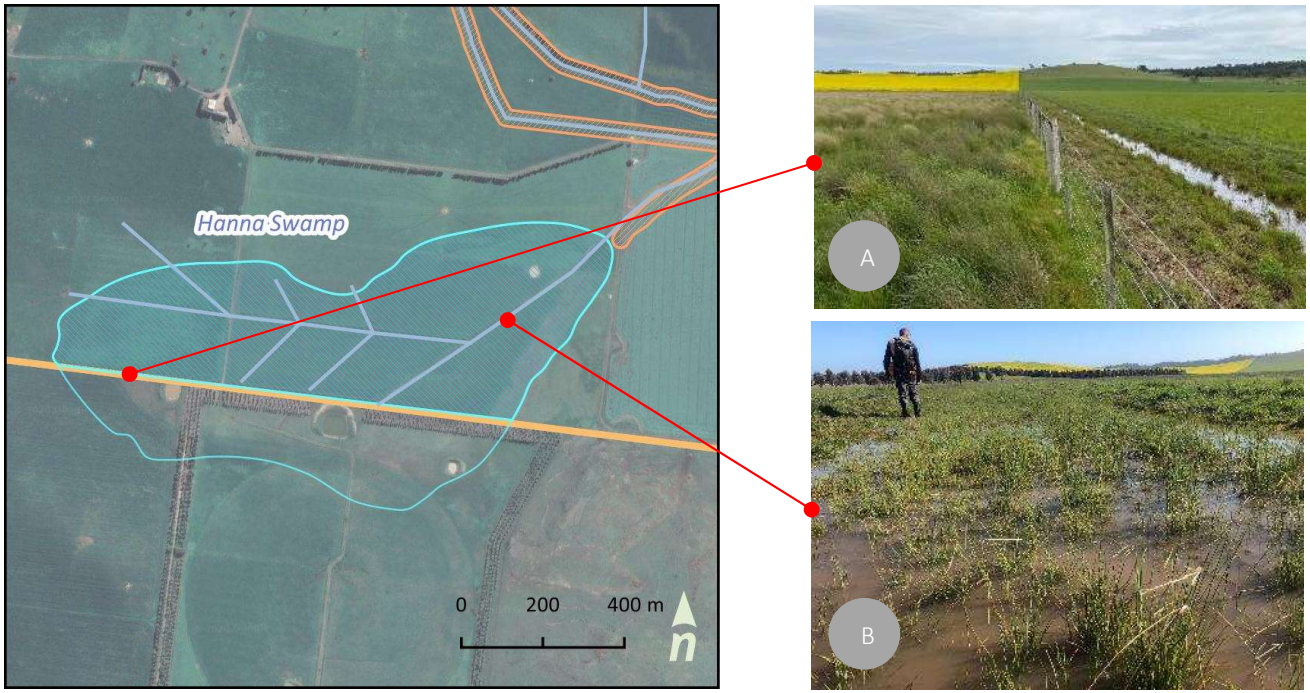
Wallan South – Hanna Swamp North

Hanna Swamp is highly variable

Values and trajectory differ sharply when comparing Hanna North with the very high significance of Hanna South. Hanna South currently contains little of the diversity of Hanna South. At the time of assessment, we identified 19 species in total, comprising 11 exotic and 8 indigenous species. Portions of Hanna North are currently identified as Plains Grassy Wetland (EVC 125) in DELWP mapping.

An important consideration is the management that has occurred in order to establish the current pasture crop. The process for establishing this crop has included the repeated application of herbicide and reshowing with pasture species over a period of approximately 15 years. Hanna North has been deep ripped to ~600 mm and re-seeded approximately 4-5 times over that period. It has been sprayed with broadleaf selective herbicides and glyphosate in preparation for sowing there has substantial inputs of fertiliser after sowing. It receives liquid fertiliser annually with several applications depending on the productivity of a season. It has also been comprehensively grazed during this time. These factors will influence the recovery of flora which will in-turn influence the extent of recovery of other ecological processes.

Current vegetation comprises largely of *Amphibromus nervosus* (Common Swamp Wallaby-grass), *Juncus amabilis* (Hollow Rush), *Juncus holishoenus* Joint-leaf Rush, *Juncus semisolidus* Rush and *Myriophyllum crispatum* (Upright Water-milfoil) observed only in the major channels of Hanna North.



These channels were inundated to ~300 mm (B) at the deepest point. *Calocephalus lacteus* (Milky Beauty heads) was observed at a single point on the fence-line with Hanna South. A patch of *Poa labillardierei* (Common Tussock-grass) was observed within the margins of the wetland and has since been approved for clearance. *Poa labillardierei* (Common Tussock-grass) *and Veronica gracilis* (Slender Speedwell) were observed beyond the margins of the wetland.

In its current form Hanna North does not meet criteria for determination as a Seasonal Herbaceous Wetland. The extensive channel network has effectively drained Hanna North resulting in the confinement of indigenous species to theses wet niches. Intensive pasture management and grazing further reduces the suitability of Hanna North to sustain a diverse range of indigenous species via natural recruitment. Those that remain are adapted to the current hydrological regime and intensive pasture management. The extent to which Hanna North can be recovered requires a detailed evaluation of latent values in the context of a highly modified future landscape and the feasibility of management which will require a high degree of organisational capacity.

Wallan South – Recommendations Hanna Swamp

Hanna Swamp; Long term management

A range of strategic, resourcing and technical considerations need to be resolved by Melbourne Water or other agencies for Hanna Swamp before decisions can be made about its future rehabilitation. Our recent assessment will help inform these decisions and future prospects.

Our assessment identified that Hanna South is a very high value SHW (based on the definitions outlined in the Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains EPBC Listing advice). This area should be protected, maintained and improved. The above average rainfall early in 2020 allowed for many of the SHW with the study area to be inundated and express during this wet phase. Long term management of the following key issues are required;

- hydrology, ensuring an appropriate wetting and drying regime (timing, depth and duration) while still allowing for natural variability
- storm water entering the system must have some form of primary treatment as water chemistry will be critical to future restoration
- invasive species that can alter composition and values of the site for both flora and fauna,
- biomass of indigenous and exotic flora
- future land use impacts associated with urbanisation including recreational use and potential degradation by unauthorized access

Considerations for rehabilitating Hanna North are more complicated owing to current land management and intensive pasture management history. Issues that need to be properly evaluated and detailed include but are not limited to the;

- Establishment of objectives that are measurable and provide clear and achievable ecological outcomes. The current HWS targets are broad. Without clearly defined targets any ecological response would be deemed a success. A range of outcomes can be interpreted from the existing objectives. A relatively low cover of indigenous vegetation (mostly opportunistic species such as *Juncus spp*. (Rush) and *Lachnagrostis filiformis* (Common Blown-grass) with a high proportion of exotic species tolerant of the inundation levels might be considered a success under the current HWS but this is a low standard of recovery (from a vegetation perspective) that would come at high cost.

At this time it is not clear as to what standard the proposed wetland will/is being managed to and therefore at what cost this might come. Given the landscape context and associated costs of this proposed restoration project more effort needs to go to defining what successful rehabilitation might look like.

- Testing of objectives with a comprehensive understanding of the ecology of individual significant species and the system as a whole, with particular focus on the wetland in an urbanised landscape and associated management issues.

- Cost/benefit analysis, suggestions to reinstate the hydrology of the site to allow more natural filling as a means for triggering ecological process are potentially feasible at face value depending on what objectives are set. However, these do not consider the potential initial cost of the site if Melbourne Water were to purchase it or the ongoing management cost for a system that needs a high degree of management sophistication. Some consideration of who will be the responsible authority to manage this infrastructure and at what cost needs to be made.

- Quality and extent of vegetation restoration expected and whether this is feasible given the current soil stored seedbank. Hydrochory evaluation and the expected balance between exotic and indigenous species would provide a basis for predicting future vegetation composition which would in turn provided a basis to determine the management actions and long term cost of rehabilitation.

- Other ecological processes benefits including for water quality, fauna habitat (including for birds, frogs, fish and macroinvertebrates) refuge habitat and amenity benefits need to be clear established and described.

Wallan South – Recommendations Hanna Swamp

To advance the discussion consideration needs to be made as to what resources Melbourne Water or other agencies are willing to commit to the rehabilitation of Hanna Swamp. The current ecological value of Hanna North is low due to hydrological modifications and the intensive management of pasture. With almost all other wetland features in the study area being inundated to some capacity, Hanna Swamp North remained largely dry with only a low level of indigenous vegetation cover in the wettest parts of the drain. Given this it is difficult to determine the future potential of Hanna North. A comprehensive evaluation of potential response informed by site-based data has not been made and objectives are not sufficiently defined.

Three resourcing scenarios could be considered, all would need to factor in initial set up costs and future management. Resourcing scenarios could include;

1. Full rehabilitation; where a decision is made to rehabilitate the full extent of Hanna North accepting that results may not be able to be defined at the beginning of the project and that outcomes may lead to a range of results from very positive to minimal (in terms of vegetation).

2. Moderate rehabilitation; some subset of restoration might be achieved either with reduced spatial extent for management, reduced diversity and quality of response or a combination of both. Rehabilitation in this instance might comprise of a range of ecological outcomes which provide some improvements to the existing condition but do not aim to fully restore the function, diversity, extent and condition of the site.

3. Limited rehabilitation; aiming for a further reduced subset of 2 with a focus on maintaining, protecting and rehabilitating Hanna South and allow the remainder of Hanna North to be maintained for other ecological purposes that are less management intensive than the rehabilitation of Hanna North as a functioning wetland.

Determining the future potential of Hanna Swamp particularly the north portion is fundamental in developing a comprehensive response that Melbourne Water can be confident is achievable. How Hanna will respond to rehabilitation-based modifications to the existing drains, changes in hydrology from future development and reinstating what is perceived to be the systems ancestral level is not known. Data needs to be relied upon before making decisions about what is achievable.

What we do know is that with any restoration project the intention needs to be clearly outlined. There must be an expectation that basic criteria for indigenous vegetation cover are met. This must be representative of standards outlined IWC Wetland Benchmarks. If there is lack of adequate natural recruitment of character species that these will need to be planted back into the site. Large scale wetland restoration projects have been undertaken widely by Melbourne Water over the last few decades that provide a base line for the cost and long-term management of these systems. Objectives and future management actions may take into account the value of recovering this asset from a social and amenity perspectives. Future functions may also support additional stormwater retardation or even treatment asset if this was modelling to be feasible.

A primary recommendation for Hanna Swamp is to collect data about its rehabilitation potential or model its rehabilitation potential and extent based on what is known about current ecological values and historical data. From this a restoration plan needs to be developed which outlines the expected ecological outcomes in terms of indigenous species cover and diversity to ensure that all stakeholders have a clear understanding of their objectives relating to the future direction of Hanna Swamp

Protecting the current values of Hanna South is essential, future managers have an obligation to prioritise this part of Hanna Swamp as it qualifies as the EPBC listed ecological community Seasonal Herbaceous Wetland of very high quality.

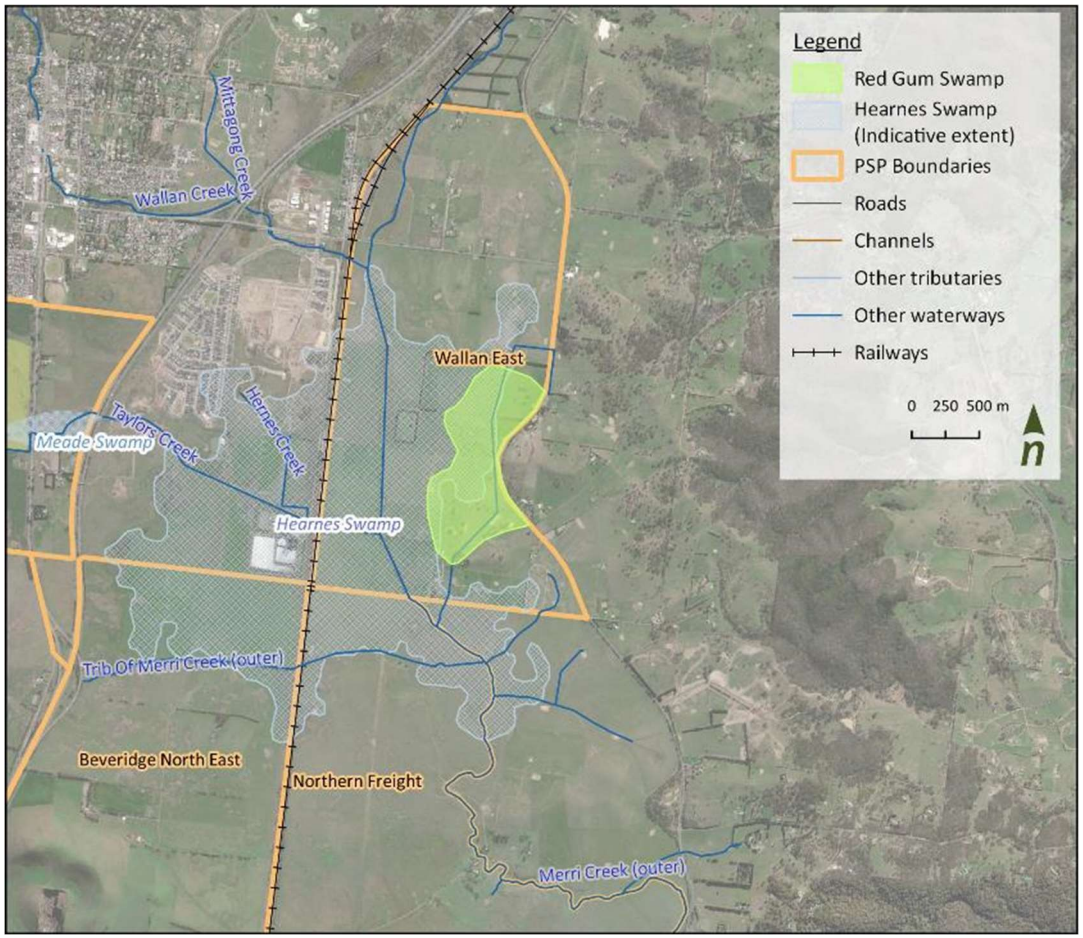
Wallan East – Vegetation community overview

The dominate feature driving vegetation communities of interest in the Wallan East PSP area is Hernes Swamp. This swamp once covered approximately 300 ha (NEROC 1997), its extent would vary depending on seasonal rainfall. The swamp is feed from surrounding foothills and has developed as a result of basalt flows restricting the flow of water through this portion of the upper Merri. This swampy vegetation is generally considered to have comprised of Plains Grassy Wetland (EVC 125) across the entire Hernes Swamp. Vegetation expression would have varied considerably between seasons with some years seeing a substantial display of wildflowers and herbs.

Limited insight is provided by DELWP pre-1750 vegetation mapping with the majority of the study are mapped as Swampy Riparian Complex (EVC 126), this community is highly variable and applying to the study area offers limited insight and was not validated in field assessments. Our assessment provides greater clarity and provide justification to apply Plains Grassy Wetland (EVC 125) across the site. Grassy Woodland is mapped by DELWP in some areas, this was not evident in field assessment.

Remnant Red Gum vegetation to the east of the site is mapped as Plains Grassy Woodland (EVC 55) by DELWP, however the species observed on site more closely align to Red Gum Swamp (EVC 292), although it is of low quality and highly modified.

The lower portion of the study area on the Merri Creek currently has limited vegetation values. Mapped by DELWP as *Riparian Scrub/Swampy Riparian Woodland Complex* it is now dominated by exotic species. The community as currently mapped is a broad 'catch all' description applied when there is some uncertainty about the composition and distribution of species resulting in an imprecise determination of community.



Our assessment applies *Riparian Woodland/Streambank Shrubland complex* as the likely vegetation community for the lower Merri on account of the few remnants that could be observed in this degraded agricultural landscape.

Wallan East – Vegetation community overview

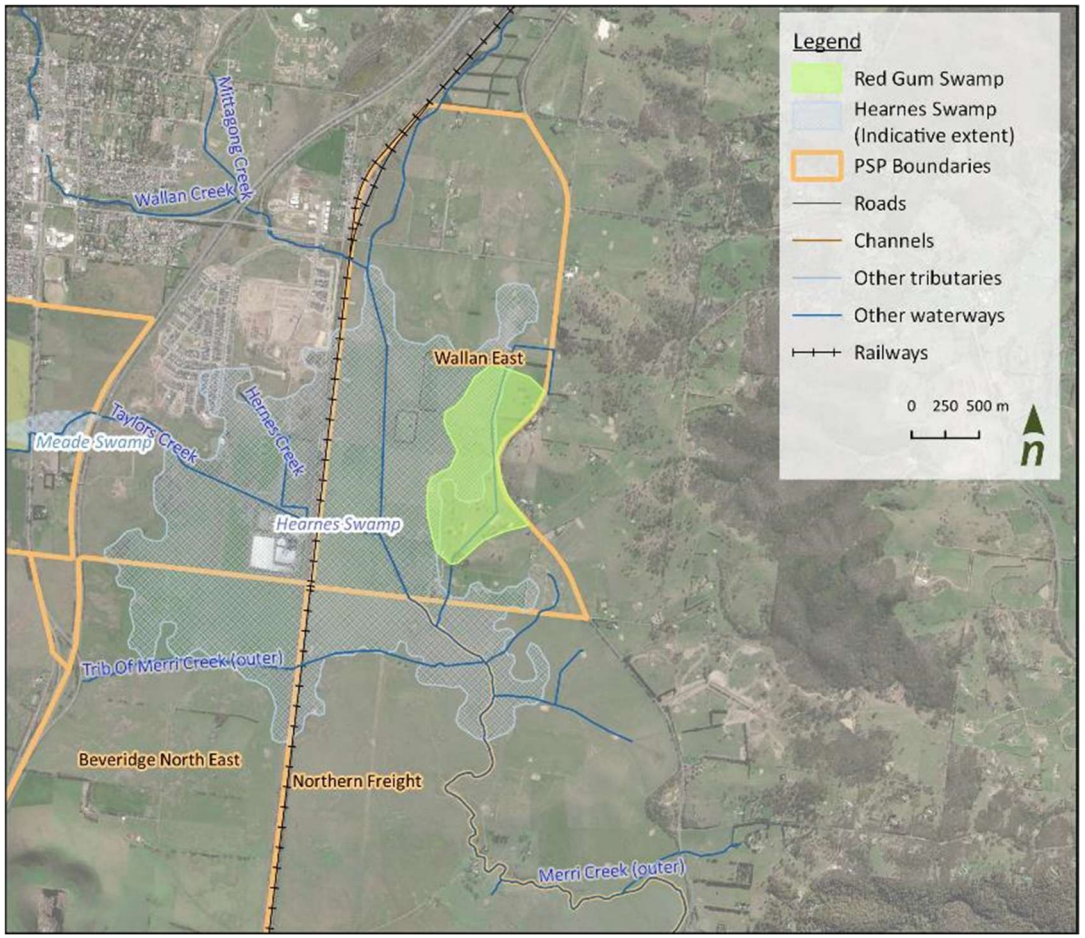
Other significant vegetation consideration

Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains are a national listed wetland community which captures a range of finer resolution ecological vegetation classes and species diversity.

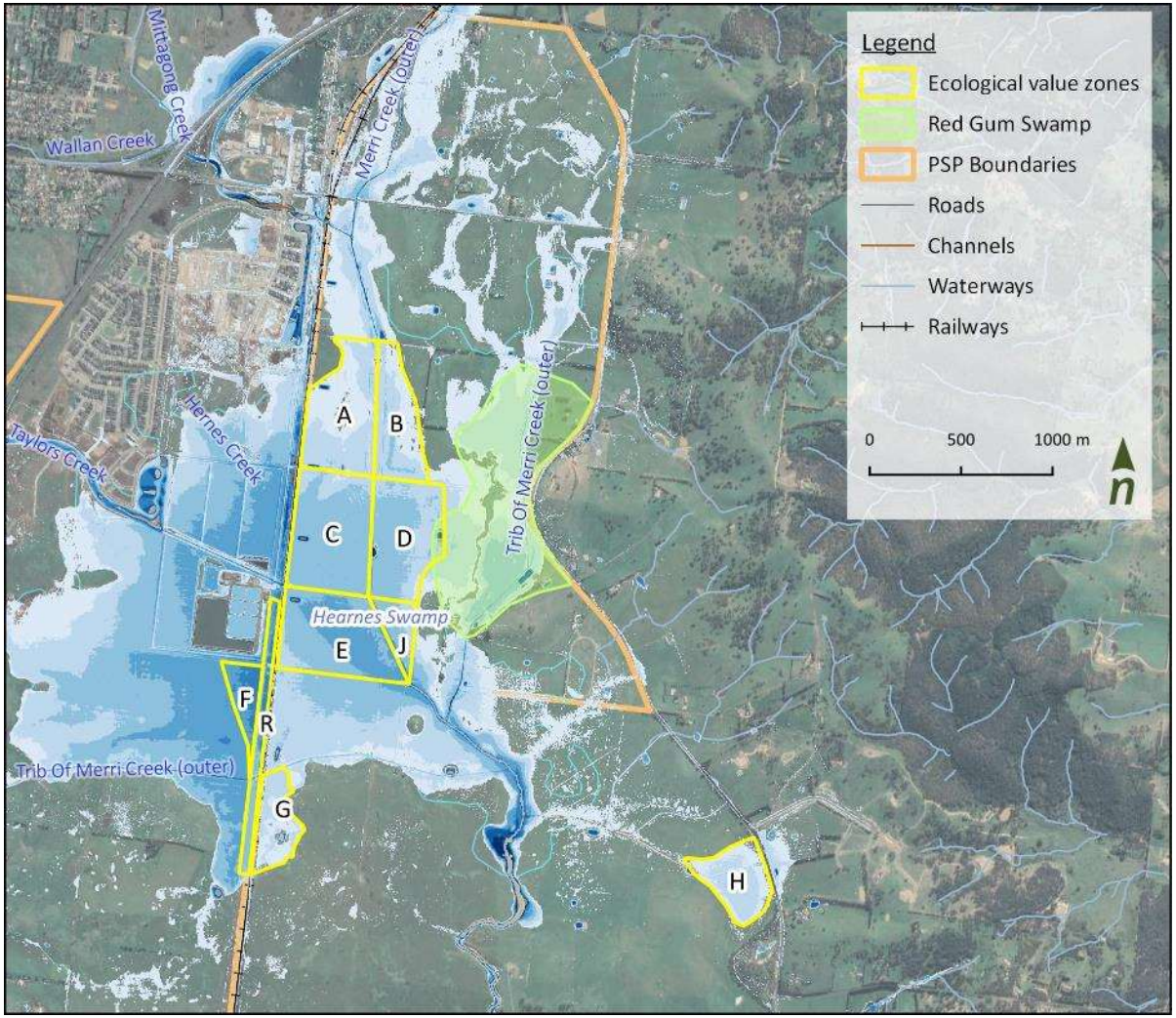
This wetland ecological community includes flora, fauna and micro-organisms and is consider present in both wet and dry periods, but is far more readily distinguished in wet seasons. A number of location identifiable as SHW were located in the Wallan East study area.

When water is present usually after substantial winter rainfall, wetland plants are clearly evident, however during drought or seasonal dry periods plants may not be visible above ground. SHWs rapidly reverts to their wet form upon inundation if the hydrological and biological characteristics of the wetland are relatively intact.

SHW characterised by a particular hydrology, geographical position and vegetation structure. They are isolated, freshwater wetlands that are usually inundated on a seasonal basis through rainfall. We identified a number of SHW in the study area. Overlaying flood modelling has assisted in identifying locations as has detailed flora assessment. These sites are detailed below and in some cases new locations of SHW were recorded. Many sites met Part D *Condition Threshold Species Diversity* for SHW and are confirmed as *Very High Quality Wetlands* via this methodology. Further detail and mapping of each site is outlined below.



Wallan East- SHWs and remnant Red Gum Swamp



Seasonal Herbaceous Wetlands occur through a core area. At this site the community is Plains Grassy Wetland (PGW) EVC 125.

Seasonal Herbaceous Wetlands can be categorised according to quality depending on their species composition. We have mapped quality at a 'paddock scale'. These are coarse scale upper estimates for area. Comprehensive fine scale mapping of the precise boundaries of areas of different composition within each unit was not undertaken due to limitations in available time for field mapping. Our survey method complies with DELWP and EPBC recommendations and requirements for the mapping of these vegetation types.

Summary values of wetland and swampy habitat zones				
ID	**Area (ha)**	**Community**	**SHW**	**Quality**
A	14.1	PGW	Y	Very High
B	15.9	PGW	Y	Very High and Variable
C	28.3	PGW	N	Variable
D	23.5	PGW	Y	Very High and Variable
E	26.5	PGW	N	NA
F	6.2	PGW	Y	High
G	10	PGW	Y	Very High
H	12.3	PGW	Y	Very High
I	70	Red Gum Swamp	N	
J	6	PGW	N	Low
R	~6	PGW	Y	Very High

Attachment C
NGT Submission on Hanna Swamp (2020)

Nature Glenelg Trust

Nature Glenelg Trust

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17th May 2020

Strategic Planning Staff – Northern Growth Corridor
Victorian Planning Authority
Level 25, 35 Collins Street
Melbourne Victoria 3000

RE: Submission by Nature Glenelg Trust:
Highlighting the need for integrated catchment management planning across PSP's
in the northern growth corridor, including specific feedback on the Beveridge North West PSP

Background

Nature Glenelg Trust (NGT) is a not-for-profit environmental organisation with a strategic focus and scientific expertise in delivering wetland restoration outcomes across south-eastern Australia. We have a proven track record of working with local communities, government agencies and private landholders, and have delivered over 40 wetland restoration projects in a wide range of circumstances and across all land tenures. In some cases this has involved brokering solutions where deadlocks between various parties had emerged and prevented action to resolve water management issues for decades. For examples of work that illustrates NGT's approach, plus links to past NGT projects, please see http://natureglenelg.org.au/revisiting-the-rrr-conference-part-2-breaking-long-term-deadlocks-to-restore-wetlands-on-public-and-private-land/.

NGT was initially invited by the Friends of Merri Creek to examine the restoration potential of Herne Swamp in 2018, noting that this natural wetland area (and its catchment) overlaps multiple zones within the Mitchell Shire Council planning scheme, and includes several areas subject to the Precinct Structure Planning process.

We have subsequently visited the site on a number of occasions and formed relationships with representatives from a range of additional stakeholder organisations or groups including the Merri Creek Management Committee, Yarra Valley Water, Mitchell Shire Council, Mitchell Shire Environment Advisory Committee, Wallan Environment Group, Melbourne Water, DEWLP and some of the developers in the area and their consultants.

This eventually led to our organisation being more formally engaged in 2020 by:

- Mitchell Shire Council – to provide them with independent scientific advice, as required and upon request, in relation to catchment management and wetland restoration planning in and around Wallan, including Herne Swamp.
- Yarra Valley Water – to guide their wetland restoration efforts in the western portion of Herne Swamp, within and surrounding the Wallan Sewage Treatment Plant.

This has followed on from an earlier voluntary assessment of the restoration potential of Herne Swamp, including the public release of a discussion paper by NGT in March 2019 (see: http://natureglenelg.org.au/lets-start-a-conversation-about-the-future-of-herne-swamp-and-the-wallan-wallan-wetlands/). NGT also continues to liaise with and provide technical advice and support to local community environment groups.

I trust this will help to explain the background context to this submission.

Please also note that this is an independent submission by Nature Glenelg Trust and not associated with the formal engagements described.

Raising key principles so far apparently lacking in PSPs around Wallan

Over time, NGT has gradually become more fully acquainted with the planning issues associated with the upstream catchment areas surrounding Herne Swamp. As part of this process, in recent weeks we have reviewed the status of and information associated with the following PSPs:

- Beveridge North West
- Wallan South and Wallan East (Part 1)

Notwithstanding the fact that both planning processes are still underway, the indicative mapping for both of these PSPs appears to have overlooked a few key principles that we request urgently be taken into account before drainage designs and the layout of development is fully locked in. In summary, those key issues are to:

1. clearly **recognise the underlying changes to the natural watercourses and wetlands** in these areas that took place in the past to facilitate agriculture, but are <u>not</u> appropriate to permanently entrench with urbanisation (and pose serious risks to this future land use if ignored).
2. fully **integrate the restoration of historic natural watercourse flow-paths and associated in-stream or floodplain wetlands** as natural assets with multiple benefits (environmental, cultural, social and economic) into future development plans, layout and drainage designs.
3. ensure that waterway and catchment planning within any PSP area also identifies and anticipates the inter-connected up- or down-stream issues in neighbouring areas, to **ensure strategic water management outcomes can be seamlessly delivered across planning boundaries**.

Addressing these issues will result in better planning outcomes and reduce future catchment risks, especially potential flooding after episodic rainfall events of low-lying areas within the development footprint and better regulate flows to the constricted section of the Upper Merri Creek immediately downstream. Inundation of this downstream area (Herne Swamp, see image below and explanation at this link), already occurs regularly and is likely to increase in intensity and frequency under the predicted impacts of climate change. Such events will be further exacerbated once the hard surfaces typical of urbanisation increase the speed and volume of flows generated in the catchment.

Looking south (towards Melbourne) over Herne Swamp after heavy rainfall on the 4th April 2020. Note the North-East Railway line bisecting the wetland, where (prior to artificial drainage) steam locomotives once used to stop to refill with water. (Drone image courtesy of The North Central Review, with marking up of artificial drains by Mark Bachmann)

Even now, as a result of current levels of vegetation clearance, development and artificial drainage, channelisation and diversions of waterways in upstream catchment areas, water reaches this naturally constricted section of Merri Creek (of which Herne Swamp is an in-stream floodplain wetland) far more quickly than would previously have occurred. The turbidity (muddiness) of the water in the image above clearly demonstrates the capability of these rainfall events to carry sediment and cause erosion, impacting on water quality and posing significant risks to downstream waterway health.

Later in this submission, we will explore in more specific detail why and how water reaches this area so rapidly, even though urbanisation is yet to take hold in most of the upstream catchment area subject to the two PSPs.

Outlining how existing Melbourne Water strategic policy strongly supports our submission

In our professional opinion, these foundational principles are much more than just another item in a long list of the optional considerations that emerge in urban planning and design discussions. For example, decisions about siting of a future road, school, oval, town centre area or housing may face certain constraints but are, for the most part, spatially flexible.

In contrast, the location of natural features like the original route and extent of waterways, just like the stunning volcanic peaks in the Wallan area, are fixed natural assets in the landscape. When properly recognised as such, these assets in turn form an underlying framework for planners to integrate into their strategic designs. When this occurs, we create more aesthetic, functional and environmentally sensitive spaces for future residents. Indeed, I understand that Yarra Valley Water, as the main owner of land within the Beveridge North West PSP area, is seeking a development with sustainability and sensitive urban design at its core.

Before I explore the finer detail to illustrate our key points, I would also like to draw your attention to some of the many areas of the *Healthy Waterways Strategy* (Melbourne Water, 2018) that support this philosophy. The strategy strongly promotes Integrated Water Management (IWM) philosophies and ensuring the environmental cultural, social and economic values of waterways are considered (page 71):

> *IWM supports preparedness to extreme events, and challenges from climate change and population growth. It aligns water and land use planning, and investment decisions that take into account beneficial outcomes, including those articulated in the Strategy. IWM will be key to meeting challenges with urban stormwater.*

There are so many relevant references throughout the Strategy that they are too numerous to list here. However, by way of summary, a few of the most notable performance objectives include:

RPO-14.	*Tools are in place and implemented to enable re-use and infiltration of excess stormwater, and restore urban waterways.*
RPO-15.	*Victoria's planning system is used effectively to protect and enhance waterway values.*
RPO-16.	*Protection mechanisms are in place for headwaters to ensure that they are retained as features in the landscape for environmental, social, cultural and economic benefits.*
RPO-17.	*Water quality in waterways and bays is improved by reducing inputs of sediment and other pollutants from urban construction and development.*
RPO-19.	*Options to transform modified waterways (by creating more natural, community-loved spaces) are identified and implemented.*
RPO-20.	*The amenity, community connection and recreation values of wetlands are better understood.*
RPO-22.	*Cooler, greener and more liveable urban environments are created through revegetation and as part of managing excess stormwater.*
RPO-29.	*Programs, standards, tools and guidelines are in place to protect wetland vegetation communities from urban and rural threats, including adequate planning controls.*

Finally, in terms of more specific guidance, the Yarra catchment itself (which includes Merri Creek) has a 10-year performance target to:

> "***re-engage natural floodplain wetlands in key locations to meet ecological watering objectives, improve ecosystem services, cultural and social values***".

In a nutshell, future development plans for this area are now poised at a critical fork in the road:

The current path

Current layout and drainage plans, as proposed and presented, would permanently entrench a network of realigned waterways and artificial drains in the future urban landscape, resulting in the permanent loss of the natural, original, floodplain wetlands, contrary to every principle outlined above. This will cause a series of detrimental effects in the catchment that future managers will have to address for decades to come.

The alternative path

Alternatively, our submission is that the two PSPs have the rare opportunity to put all the principles of the *Healthy Waterways Strategy* into practice now, avoiding the future problems identified with the current path, and making this area a model of future urban development. Indeed this approach invokes the old axiom by Benjamin Franklin (1736) that an "*ounce of prevention is worth a pound of cure*".

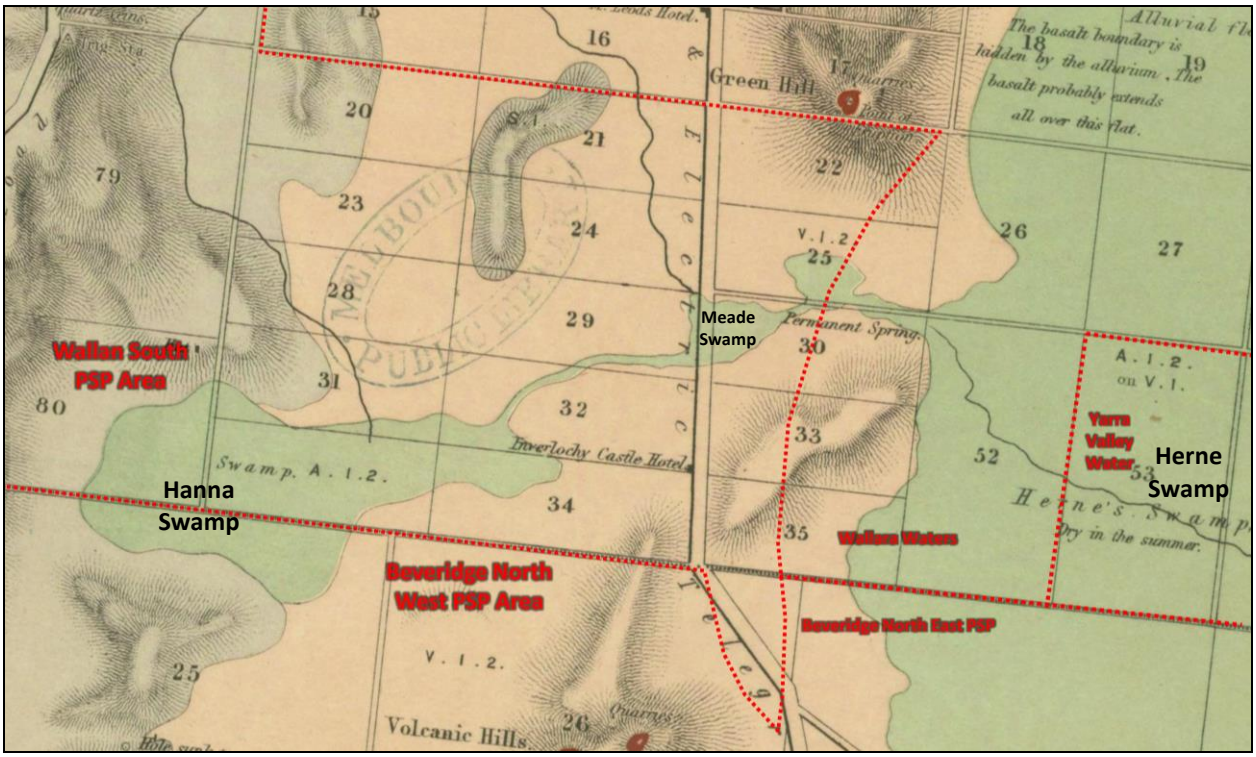
Exploring the detail: precisely what catchment changes have occurred in the two PSP areas?

A detailed, annotated overview of the changes to the chain of three wetlands around Wallan (Herne Swamp, Hanna Swamp and Meade Swamp) can be found in the attached presentation notes.

However, in brief, the three maps below illustrate the key changes:

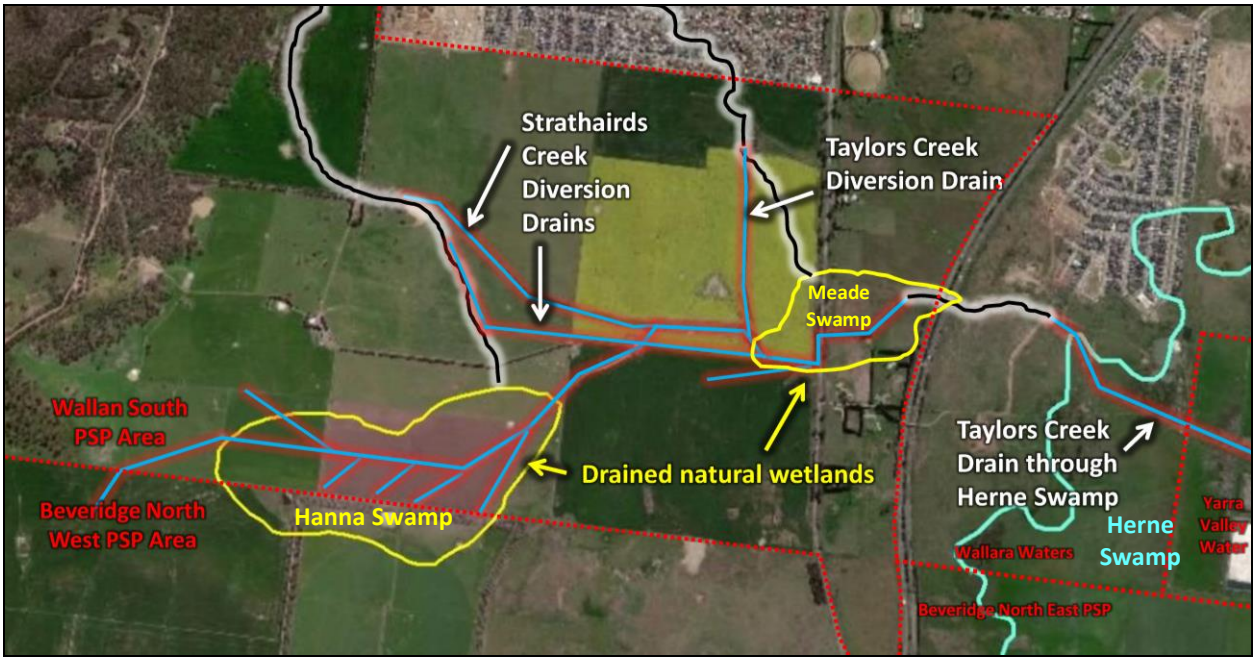
Pre-development Survey Plan – 1853

Pre-drainage Geological Map – 1862



These two maps clearly show the location of the original natural watercourses, the presence of alluvial / wetland soils, and, in the case of the 1853 image (if you look carefully), even the specific inundated areas within all three wetlands are marked. A sluggish swampy stream, rather than a defined or incised creek, connected all wetlands, as flows filled and spilled their way through this alluvial flat of low relief (i.e. gentle gradients).

Present – Aerial image showing indicative agricultural-era drainage, prior to urbanisation



As Nature Glenelg Trust does not yet have access to the most accurate LiDAR data for this area, there may be further artificial drains missing from the above image. However, this indicative drainage map clearly shows the comprehensive nature of artificial drainage in the Strathaird and Taylors Creek sub-catchments.

It is worth remembering that these drains were constructed in the era when waterways across the Australian continent were being de-snagged, dredged, diverted, channelised, straightened and deepened at every opportunity – activities that we now know are contrary to all modern objectives for waterway restoration and management. The only goal at that time was to get water off of the landscape as quickly as possible. At the same time, the original in-stream floodplain wetlands (marked above in yellow and blue) were seen was wastelands that were better suited to growing more productive pastures for grazing livestock after drainage.

Combined with vegetation clearance, these processes concurrently reduced both infiltration and groundwater recharge, while significantly increasing the volume of surface runoff and – crucially – the velocity of those flows. With dispersive, unstable sub-soils present in this catchment (as with many other areas across Victoria), this was an era of both topsoil losses and massive erosion of sub-soils along waterways. These degrading processes are yet to be comprehensively addressed in many Australian catchments today. However, because they have been in place for many decades, it is ironic that many artificial drains are now frequently mapped in the official data layers as "waterways". Even more perversely, in some parts of Victoria they have also been classified as "designated waterways", offered additional legal protections by statutory authorities, while the original natural wetlands and waterways (which in some cases, like in the Wallan area, have excellent restoration potential) are often forgotten and overlooked. Because they are missing from the data layers, they escape formal recognition and their restoration is never even considered.

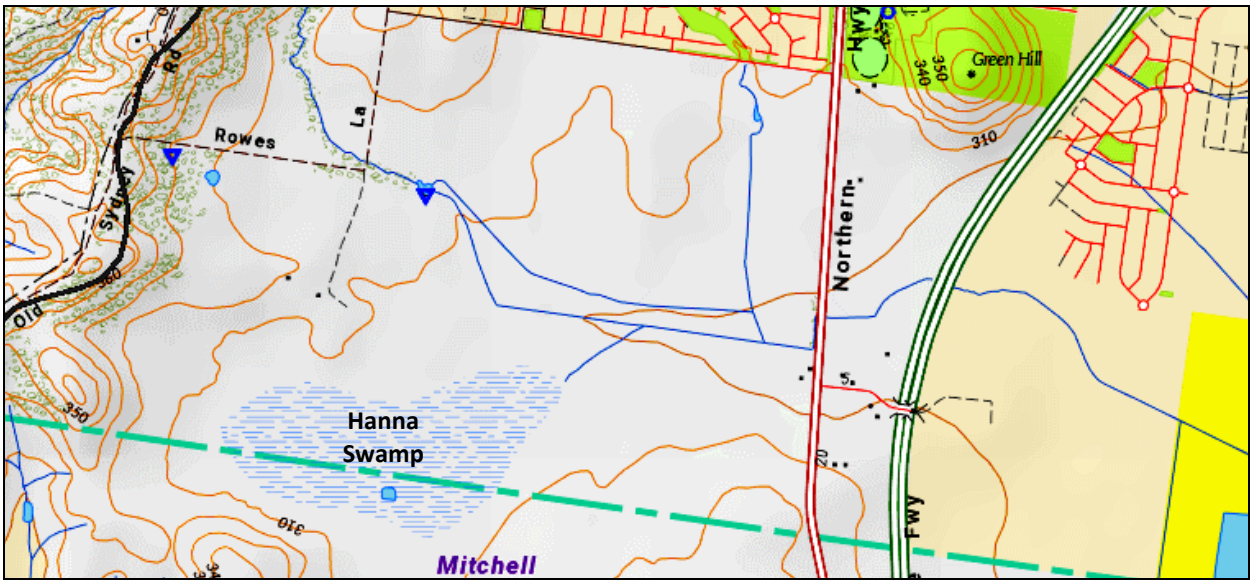
It is our contention that the design problems with the two PSPs that are subject to this submission can be traced back to inaccurate and unrepresentative waterway data being used as the basis for the drainage designs and development plans to date – by all parties – including the water authority, Melbourne Water. This is not intended to be critical, but simply to highlight how important validation of waterway and wetland mapping is not being undertaken and is leading to poor planning decisions.

For instance, of the three wetlands referred to in this submission, only Hanna Swamp is accurately recorded in the DELWP wetland layer, despite its modified state. Meade Swamp is entirely absent, and the portion of Herne Swamp that is mapped is so small that it is off the screen (to the east) on the DELWP base map shown over the page. These inaccuracies sometimes also reflect a bias in the scientific method of biodiversity surveys which typically only assess extant conditions and not original wetland or waterway extent, nor their restoration potential. The latter is absolutely critical for these ecosystems, because they are so responsive to

restoration, capable of recovering their functionality through rapid and spectacular natural habitat regeneration.

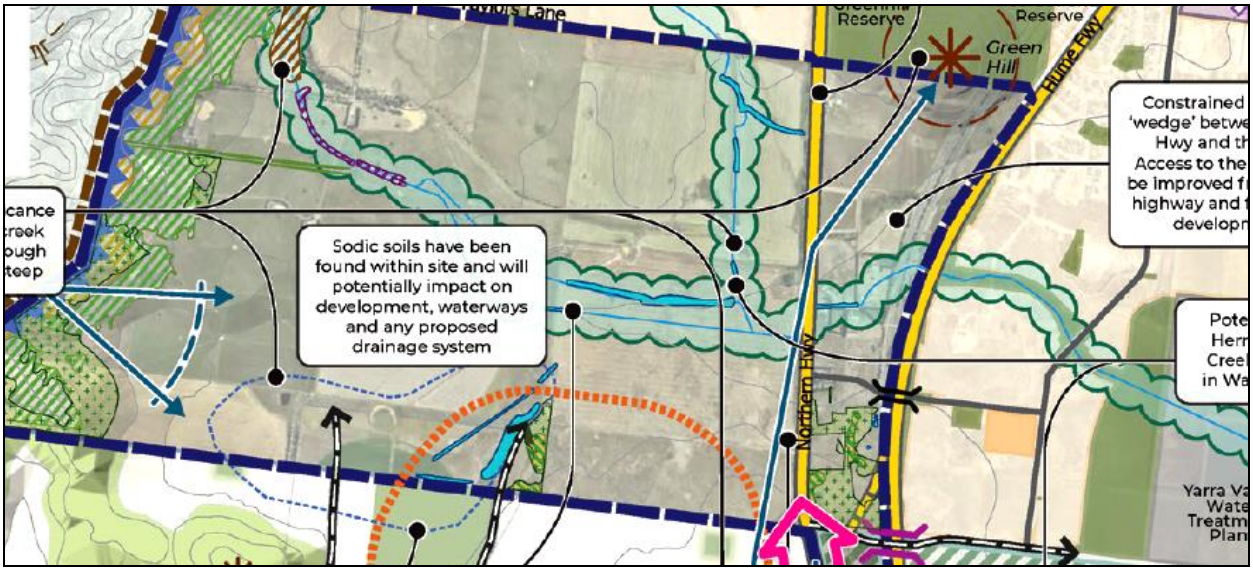
Further, I can confirm that the original flow paths of Strathaird and Taylors Creeks still physically exist on the ground and can be seen in the aerial photography. Yet the formal mapping is patchy and incomplete, with only a select number of the arterial artificial drains represented, as shown below.

Present DEWLP waterways and wetlands mapping: incomplete mapping data results in poor planning decisions



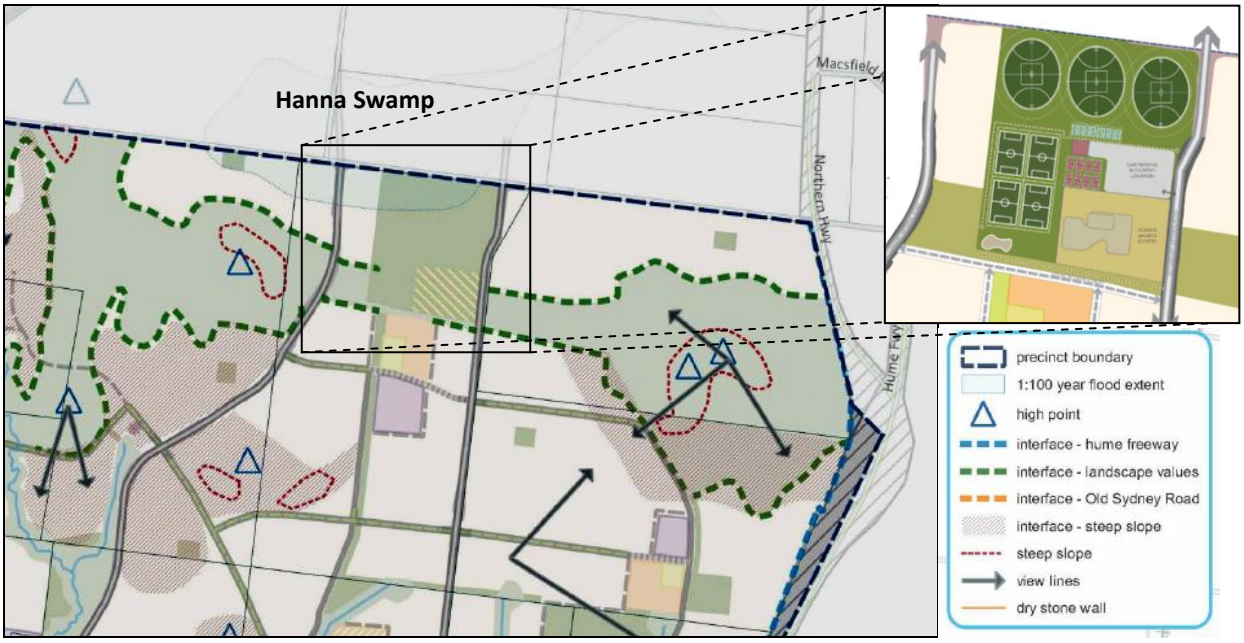
One only then has to glance at and compare the relevant portions of the maps for both of the PSPs to see how fundamental design errors have innocently been made, simply by adopting the assumptions contained within the incomplete waterway mapping found in DELWP's base mapping data layers.

Present PSP mapping for Wallan South: not only replicating the waterway and wetland mapping errors, but entrenching a potential missed opportunity to achieve the objectives of the Healthy Waterways Strategy



Of note, despite Hanna Swamp being shown on some of the maps for both PSPs, and clearly being recognised in the 1 in 100 year flood modelling, the opportunity to restore this natural wetland has so far been overlooked. Additionally, in the Beveridge North West PSP, the current mapping proposes that a major new north-south arterial road will be built that would bisect the swamp, as shown above and over the page.

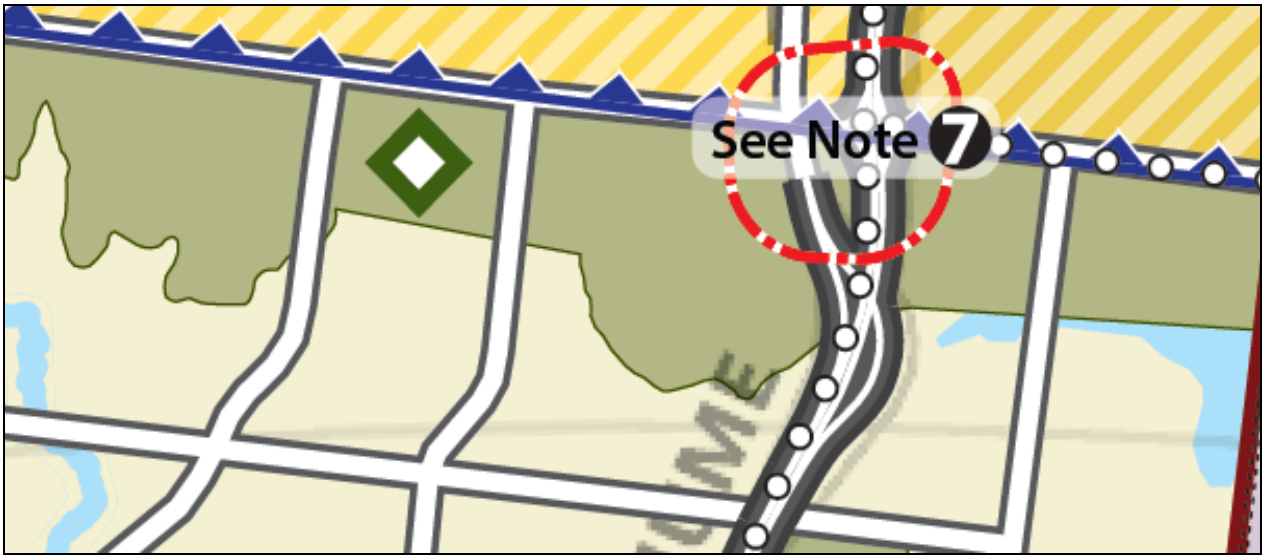
Present PSP mapping for Beveridge North West: despite Hanna Swamp being a known wetland feature and considered a flooding risk, its restoration potential and integration into nearby open space has been overlooked.



Further, despite being surrounded by proposed open space that links nearby volcanic features, the wetland is overlooked. A portion of the eastern end of Hanna Swamp is earmarked as an open space precinct for recreational facilities – a land use that is not consistent with wetland restoration.

Interestingly, this layout is inconsistent with the original broad concept design (below) that appeared in the plan for the Northern Growth Corridor (2012), which identified this entire zone, across both the Hanna Swamp wetland and adjacent volcanic peaks, to be retained as open space.

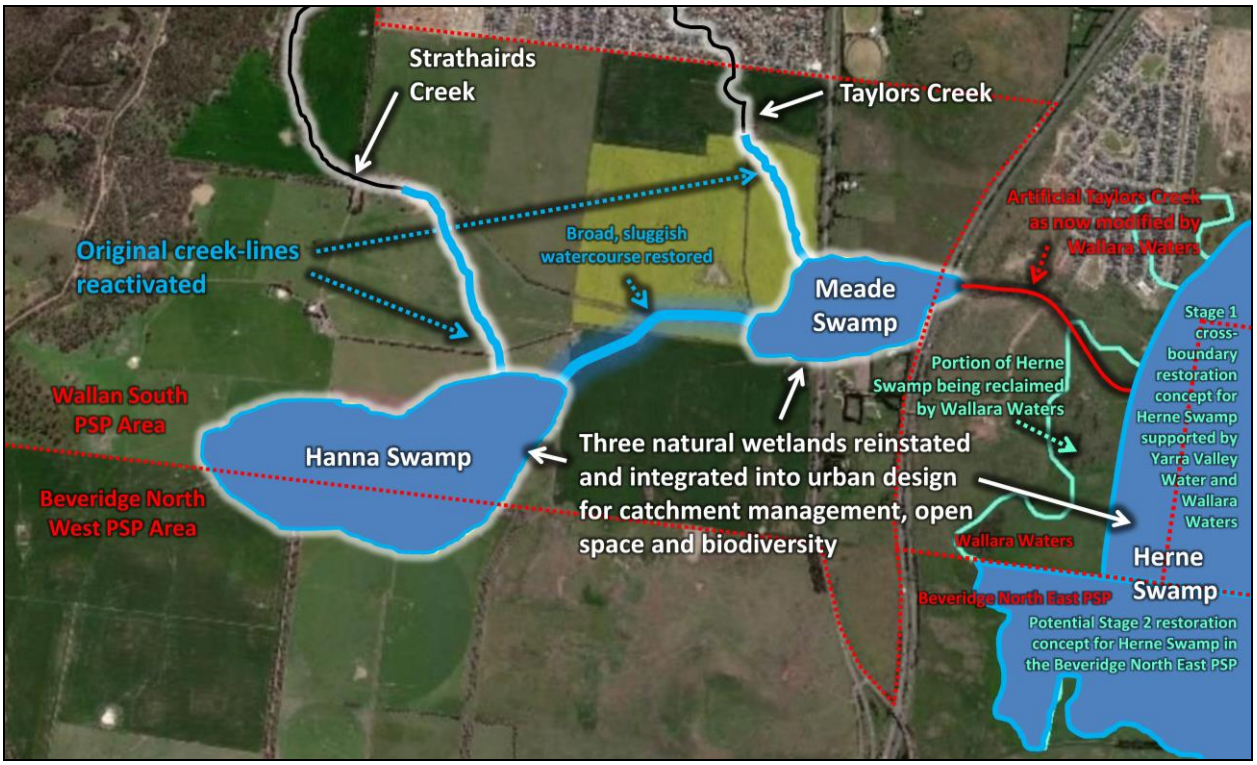
Inset from the North Growth Corridor Plan (August 2012) – showing the same area as above: open space would have linked Hanna Swamp with nearby volcanic peaks and facilitated its restoration. Note that a proposed road also bisected the wetland (which is unmarked) in this plan.



This boundary zone between the two PSPs is of particular concern, because if the southern portion of Hanna Swamp is developed and its restoration is not integrated into the design of the Beveridge North West PSP, then it will be impossible for the Wallan South PSP to reinstate the original Strathaird Creek alignment and concurrently restore this in-stream floodplain wetland. This is an obvious case where some consistent design principles for waterways and wetlands across planning zones are required to be set and adopted, as part of an overall catchment plan, before key layout and design decisions are fixed in any individual zone.

Articulating the alternative vision for waterways across the two PSPs

Potential Future: A vision for restored waterways and wetlands around Wallan, in turn providing a landscape framework for future urban development (also see images over page for recent conditions)



There are a number of things to unpack in this alternative vision, but all are consistent with what best-practice urban development would achieve by adopting the objectives of the *Healthy Waterways Strategy* (HWS). The table below captures those elements, specifically in the context of waterway and ecological issues:

Element	Waterway and Ecological Benefits	HWS Objective met
• Reactivation of original creek lines & removal of diversion channels & drains	• Slowing flow velocity & erosion potential • Recovering biodiversity values	RPO-14 RPO-15 RPO-16 RPO-17 RPO-19 RPO-22
• Restoration of natural wetlands in the upper catchment	• Slowing flow velocity • Restoring natural in-catchment capacity to store runoff and protect downstream areas during peak flow events • Providing some capacity for groundwater recharge and infiltration (a process that will otherwise be interrupted through urbanisation) • Removal of sediment, nutrients & pollutants, improving Merri Creek water quality downstream • Rapid ecological response because wetlands are natural. Spontaneous triggering of seed bank	
• Naturalisation of the broad-sluggish watercourse that originally connected Hanna Swamp and Meade Swamp	• Slowing flow velocity • Reversing the detrimental physical effects of waterway channelisation on habitat values	
• Restoration of the natural footprint of Herne Swamp in Beveridge North East PSP	• Creating a natural (not constructed) wetland edge • Retention of critical flood buffering and storage capacity in the system, noting that upstream and adjacent runoff after episodic rainfall events will increase with urban development	
Element	**Waterway and Ecological Issues**	**HWS Objective**
• Planning decisions made long ago entrench the physical footprint of the Wallara Waters development, resulting in the loss of a portion of Herne Swamp	• This is now the subject of investigations and constructive discussion between all parties, seeking to integrate Stage 1 restoration of Herne Swamp into drainage design before finalised • Note: the loss of water storage capacity through the reclamation of part of Herne Swamp is an ongoing risk	RPO-15 RPO-29

Panoroma from Green Hill, Wallan, after heavy (but not at all unusual) rainfall in the local catchment on the 4th of April, showing: Herne Swamp (left), the Taylors Creek drain as now modified by Wallara Waters (centre, left of the freeway), and Meade Swamp (right). Mount Fraser is in the background.

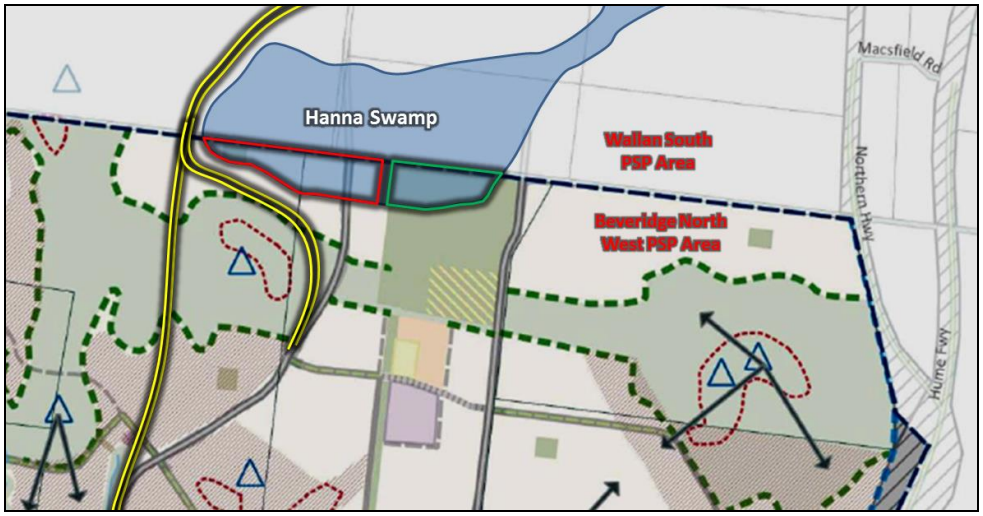
Inset of a portion of Herne Swamp behind Wallara Waters (left) and a portion of Meade Swamp is temporarily reinundated (right)

Photos courtesy of Rob Eldridge (Councillor at Mitchell Shire Council)

Whilst not specifically outlined here, the same principles that can already be applied to current plans (e.g. detailed designs that achieve linked open space, linear trails, etc.) can readily be achieved under this alternative approach the layout and design of waterways and wetlands. For example, trails that follow the natural waterway corridors, linked to trail loops around the restored wetland edges, complemented by boardwalks, would form an ideal recreational network for integrating and capitalising upon the restoration potential of these natural assets.

Highlighting and addressing the key design impacts of the alternative vision

Three identified impacts of the alternative vision of a restored Hanna Swamp in the boundary zone of the Beveridge North West PSP.

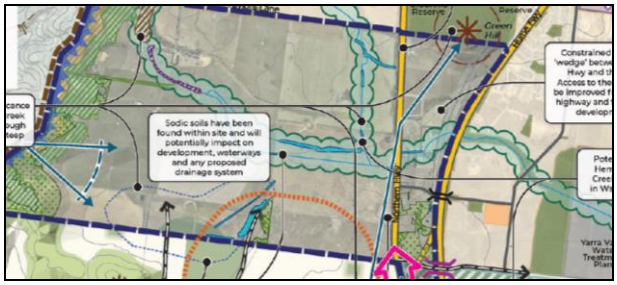


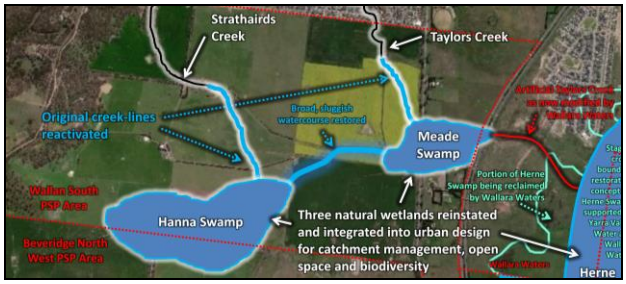
As shown in the map above, the key design impacts of implementing the vision for waterways articulated in this submission for the Beveridge North West PSP area are:

1. The re-alignment of the planned arterial road that would otherwise bisect the wetland. This would need to be moved to the west, and two proposed alternative alignments (that require checking on the basis of topography) are shown in yellow.
2. The re-location of the ovals in the northern portion of the recreational space (outlined green). Integrating the restored wetland at this location into existing designs is otherwise highly consistent with the planned use for this area, but would cause its layout to be rearranged. The recreation precinct would perfectly link into the linear and loop trails (discussed previously) by integrating the natural wetland layout into this open space.
3. A small reduction in the area now apparently earmarked for development, which is marked red.

In the Wallan South PSP area, the main change at this early stage is to the alignment of the proposed waterways and the change in area dedicated to wetland restoration which could not then be reclaimed and used for development.

Comparing the broad differences in layout associated with reactivation of the natural waterways and restoring the natural in-stream wetlands of the Wallan South PSP.





Revisiting the key principles discussed earlier in this submission

1) The **underlying changes to the natural watercourses and wetlands** that took place in the past to facilitate agricultural development have been clearly detailed in this submission. The choice now is simply:

- do we wish to permanently entrench these catchment changes, and then accept the inevitable water management risks this creates or exacerbates?

  or

- do we wish to recover currently lost waterway values, and in doing so, meet the objectives of IWM, the *Healthy Waterways Strategy* and the local planning scheme?

2) If the latter is pursued and allowed to underpin detailed designs, then **integrating the historic natural watercourse flowpaths and associated in-stream or floodplain wetlands** will deliver multiple benefits:

- **Environmental** – improved outcomes for water quality, waterway health and biodiversity.
- **Cultural** – recovering lost or/or degraded natural landscape features is consistent with respecting the aspirations of First Nations people, and creates the possibility of positive future engagement in relation to cultural water and flows.
- **Social** – linking these natural assets/features (and their story) into the recreational and aesthetic fabric of the new urban development will engage future residents in their local environment and it history, and encourage increased participation in its care.
- **Economic** – using existing natural features to reduce the speed of catchment flows and erosion impacts, and strategically capture, control and store runoff from episodic rainfall events has real, measurable economic benefits. Not only is it cheaper to build according to these design principles in the first place, because these forgotten landscape features already exist (i.e. they do not have to be "constructed"), but by slowing and regulating flows through a chain of three natural, restored wetlands, a much greater level of redundancy (i.e. back-up capacity) is also designed into the system. Additionally, these restored wetlands actually require this water to facilitate their recovery, so a major risk (unwanted flooding) is flipped and turned into an opportunity (wetland restoration).

3) By looking ahead and **ensuring strategic water management outcomes are seamlessly delivered across planning boundaries**, a whole series of water management challenges in this catchment can be avoided that would otherwise have been anticipated. A component of the upper Merri Creek catchment that is currently considered highly degraded would be restored and begin recovering against a whole range of environmental measures, including water quality and biodiversity. In doing so, this seamless coordination across planning zone boundaries would deliver an underlying waterway framework that works with, rather than against, the natural landscape.

Conclusion

In closing, this is a critical moment where the future trajectory of a number of important issues in the upper Merri Creek catchment will be decided. Strategically and proactively addressing these matters in advance (including the risks otherwise posed by individual development plans with corresponding piecemeal planning decisions), now provides the perfect leadership opportunity for the VPA, supported by Mitchell Shire, to meet the core objectives of IWM, the *Healthy Waterways Strategy*, and the local Planning Scheme (see Appendix).

I would be grateful for the opportunity to support this submission in person at the upcoming hearings, and can be contacted on 0421 97 8181, or mark.bachmann@ngt.org.au

We thank you for the opportunity to comment and look forward to your response.

Yours sincerely,

Mark Bachmann
Principal Ecologist and Manager
Nature Glenelg Trust

Please note the following attachments in support of this submission:

1. Appendix: Supporting information in the local planning scheme
2. Nature Glenelg Trust Presentation notes: "Exploring the relevance of wetland restoration around Wallan to the DELWP Regional Park Feasibility Assessment and Melbourne Water Catchment Modelling"
3. Nature Glenelg Trust Discussion Paper: *"Restoration Vision for the Wallan Wallan Wetlands, including Herne Swamp, as the centrepiece of the Wallan Wallan Regional Park: Discussion Paper – March 2019"*

Appendix: Supporting information in the local planning scheme

Growth areas - Clause 11.03-2S

Identify the location of open space to be retained for recreation, and/or biodiversity protection and/or flood risk reduction purposes guided and directed by regional biodiversity conservation strategies.

Show significant waterways as opportunities for creating linear trails, along with areas required to be retained for biodiversity protection and/or flood risk reduction purposes.

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

Objective:

To protect and enhance river corridors, waterways, lakes and wetlands.

Strategies:

Protect the environmental, cultural and landscape values of all water bodies and wetlands.

Ensure development responds to and respects the significant environmental, conservation, cultural, aesthetic, open space, recreation and tourism assets of water bodies and wetlands.

Ensure development is sensitively designed and sited to maintain and enhance environmental assets, significant views and landscapes along river corridors and waterways and adjacent to lakes and wetlands.

Ensure development does not compromise bank stability, increase erosion or impact on a waterbody or wetland's natural capacity to manage flood flow.

Policy documents - Consider as relevant:

Healthy Waterways Strategy (Melbourne Water, 2013)

Floodplain management – Clause 13.03-1S

Objective - To assist the protection of:

The natural flood carrying capacity of rivers, streams and floodways.

The flood storage function of floodplains and waterways.

Floodplain areas of environmental significance or of importance to river health.

Strategies:

Identify land affected by flooding, including land inundated by the 1 in 100 year flood event or as determined by the floodplain management authority in planning schemes.

Avoid intensifying the impact of flooding through inappropriately located use and development.

Policy guidelines - Consider as relevant:

Regional catchment strategies and special area plans approved by the Minister for Energy, Environment and Climate Change or Minister for Water.

Any floodplain management manual of policy and practice, or catchment management, river health, wetland or floodplain management strategy adopted by the relevant responsible floodplain management authority.

Catchment planning and management – Clause 14.02-1S

Objective:

To assist the protection and restoration of catchments, water bodies, groundwater, and the marine environment.

Strategies:

Require appropriate measures to filter sediment and wastes from stormwater prior to its discharge into waterways, including the preservation of floodplain or other land for wetlands and retention basins.

Ensure planning is coordinated with the activities of catchment management authorities.

Water quality – Clause 14.02-2S

Objective:

To protect water quality.

Strategies:

Discourage incompatible land use activities in areas subject to flooding, severe soil degradation, groundwater salinity or geotechnical hazards where the land cannot be sustainably managed to ensure minimum impact on downstream water quality or flow volumes.

Integrated water management – Clause 19.03-3S

Objective:

To sustainably manage water supply, water resources, wastewater, drainage and stormwater through an integrated water management approach.

Strategies:

Plan and coordinate integrated water management, bringing together stormwater, wastewater, drainage, water supply, water treatment and re-use, to:

- Take into account the catchment context.
- Protect downstream environments, waterways and bays.
- Minimise drainage, water or wastewater infrastructure and operational costs.
- Minimise flood risks.
- Provide urban environments that are more resilient to the effects of climate change.

Integrate water into the landscape to facilitate cooling, local habitat improvements and provision of attractive and enjoyable spaces for community use.

Ensure that development protects and improves the health of water bodies including creeks, rivers, wetlands.

Manage stormwater quality and quantity through a mix of on-site measures and developer contributions at a scale that will provide greatest net community benefit.

Floodplains – Clause 21.04-2

The catchments of the various rivers and streams within Mitchell include areas of flood prone land, where flooding has historically caused substantial damage to the natural and built environment.

Floods are naturally occurring events and the inherent functions of the floodplains to convey and store floodwater should be recognised and preserved.

Natural flooding of floodplains and their associated wetlands provides essential breeding habitats for bird and aquatic species, and promotes the health of rivers and floodplains.

It is evident that the impact of floods is increasing due to land use and vegetation changes, in particular:

Urban expansion in floodplains which has reduced flood storage, obstructed flood flows and increased the risk to life, health and safety to occupants of the floodplain.

Key issues:

Maintaining natural environmental processes within floodplains.

Objective 1:

To sustainably manage floodplains.

Strategies:

Discourage raised earthworks that reduce natural flood storage, obstruct and/or redistribute flood flows, and increase flow velocities and levels.

Discourage urban expansion within floodplains that reduces flood storage, obstructs flood flows and increases the risk to life, health and safety.

Water – Clause 21.05-2

Objective 1:

To improve the quality of water in waterways and catchments.

Strategies:

Support integrated catchment management.

Protect and restore native vegetation corridors along waterways.

Minimise the quantity and retard the flow of stormwater run-off from urbanised areas.

Create wetlands, where possible, to encourage natural flow systems, improve stormwater quality and encourage and increase native biodiversity.

Attachment D
Components of Seasonal Herbaceous Wetland Vegetation

Components of Seasonal Herbaceous Wetland (SHW) vegetation

Graminoids are a major structural component of the vegetation, at least in the outer zones. The dominant species variously comprise either grasses (usually combinations of *Amphibromus* spp., *Glyceria australis*, *Rytidosperma duttonianum* and *Lachnagrostis perennis* spp. agg.) or sedges (*Carex tereticaulis* or occasionally *Baumea arthrophylla*). The vegetation is also characterised by a range of aquatic to semi-aquatic forbs associated with wet sites of fertile plains habitats. In deeper wetlands, the central zones can be relatively species-poor, with aquatics such as *Cycnogeton* spp., *Potamogeton cheesemanii* and *Myriophyllum* spp. comprising much of the vegetation. Shallower parts of relatively intact wetlands can be extremely diverse. A range of daisies can be present in the most intact sites on the volcanic plains – these include *Xerochrysum palustre*, *Microseris scapigera*, *Senecio psilocarpus*, *Coronidium gunnianum*, *Allittia cardiocarpa*, *Brachyscome paludicola* and *Craspedia paludicola*. Some other notable forbs include *Eryngium vesiculosum*, *Stellaria angustifolia*, *Montia australasica*, *Cardamine* spp. and *Utricularia* spp. The forbs species are to varying extents grazing sensitive, and many are easily displaced from the vegetation, particularly where the wetlands are grazed by cattle. Other associated species include Fern allies (*Marsilea* spp. and *Pilularia novae-hollandiae*) and small- to medium-sized sedges include *Eleocharis* spp., *Schoenus* spp. and *Isolepis fluitans.*

In terms of rehabilitation of modified SHW sites, viewing the vegetation as comprising several broad groupings of taxa is useful, as follows:

Structural graminoids: Some of these species are relatively tolerant of grazing. In sites where the hydrology has been compromised by drainage, some of these can be either relatively persistent in the seedbank (in the case of sedges) or readily recolonise by seed dispersal from small populations persisting in refugia in and around a wetland.

Obligate aquatics: These species can be relatively persistent through dry periods as soil-stored seed or sometimes recolonise from avian transport between sites. Once present at a wetland, populations can have substantial capacity for increase under suitable hydrological conditions.

Opportunistic species: A range of native forbs and some grasses and rushes are opportunistic in wetlands and tolerant of disturbed sites (potentially including in urban areas). These include species such as *Lythrum hyssopifolia*, *Epilobium hirtigerum*, *Dysphania pumilio*, *Epilobium billardierianum subsp. cinereum*, *Lachnagrostis filiformis*, *Senecio quadridentatus*, *Juncus bufonius* and *Juncus amabilis.* While a valid component of the flora, these may be prevalent as pioneer species, but in themselves are not distinctive of SHW.

Mud herbs: Some small herbs which germinate on shallow water or on drying mud following drawdown can be very persistent in the seedbank. They are often associated with the floors of lakes or floodway ponds which may stay either inundated or dry for long periods. This component of the wetland flora is generally not well represented in SHW vegetation but can include plants such as *Callitriche* spp. and *Centipeda* spp.

Inundation tolerant to semi-aquatic forbs, especially daisies: Many of the species in this category are the most vulnerable to disturbance and the least likely to recolonise without deliberate reintroduction.

Attachment E
Evaluation criteria and questions applied to NGT proposal and comparison of Scale Swamp and Hanna Swamp

Evaluation criteria for proposed ecological interventions
The following criteria can be helpful in assessing the suitability of proposed applied management actions. To validly meet the description of an 'ecological intervention', such actions would need to meet certain conditions, such as:

1. Validly address a demonstrated existing problem or evidence-based impending problem.
2. Be located and timed appropriately to address the relevant problem.
3. Be based on an understanding of the biology of the component species.
4. Not cause negative side effects or impacts of lasting consequence.
5. Deliver a demonstrable positive outcome.
6. Not be based on the same thought processes that caused the problem in the first place.
7. Be subject to some kind of scrutiny (e.g. monitoring) to ensure that the preceding conditions have been met.

Evaluation of the NGT proposal (NGT 2020) against criteria:

- **Be located and timed appropriately to address the relevant problem:** The site is identified as a defined wetland basin and the intention is to restore as close as possible a natural hydrology. Evidence as to the extent to which the proposal would restore the prior ecosystem is not provided.
- **Be based on an understanding of the biology of the component species:** The depth component of the proposed hydrology is consistent with the relevant wetland type. There is no detail provided in relation to the component species outside of reference to a remnant seed bank, without supporting data.
- **Not cause negative side effects or impacts of lasting consequence:** The issue of promotion of introduced plants is not addressed. The details of a restoration strategy and required management are not supplied – in the absence of a more detailed management plan, this criterion is difficult to evaluate.
- **Deliver a demonstrable positive outcome:** Provided the intervention is undertaken sensitively, positive ecological outcomes for some wetland affiliated species would be inevitable – however it is unclear to what extent these would equate to a goal of 'restoration' nor is it defined how this goal would be characterized or evaluated. Examples of works at other sites are presented, but supporting data to evaluate the extent of restoration of prior vegetation communities are not provided.
- **Not be based on the same thought processes that caused the problem in the first place:** This is not the case in the instance of this proposal.
- **Be subject to some kind of scrutiny (e.g. monitoring) to ensure that the preceding conditions have been met:** This consideration is not addressed, at least in this stage of the proposal.

Summary: The proposed ecological intervention is generally not in direct conflict with these criteria: However detailed characterisation of proposed outcomes and strategies to achieve these is lacking. Supporting data for the anticipated responses of the vegetation to the restoration of a more natural hydrological regime is also lacking. Consequently there are major questions as to what level of ecosystem recovery would be an acceptable outcome from the intervention.

Specific Questions to ask in undertaking wetland restoration
Has the proposal sufficiently defined a measure of success and what would success consist of? If not what would an appropriate method be?

Response: The proposal assumes success based on previous projects without defining what this would constitute. The perspective appears to be that reinstating the prior hydrology would initiate restoration of the wetland, or at least processes leading towards this. Data from outcomes of other examples of reinstating a more natural hydrology are not provided. Some qualification of desired outcomes could include objectives

such as increased diversity of native wetland species, reduced cover of introduced species, and increase in abundance and extent of remnant SHW flora.

Has the NGT proposal described species or structures expected to develop and has an inundation regime been described to achieve this?

Response: No basic floristic objectives are specified – these could include re-establishment of key species (e.g. wetland grasses), maintenance and dispersal of remnant forbs from refugia in the southern section of the wetland. There is no mention of assisted reintroductions, if so, at least a basic list of desired species could be compiled, with an objective such as actively recruiting into the wetland. A key element of evaluating outcomes of management plans is initial inventory of taxa present - the proposal has not yet provided this level of detail.

The proposed inundation depth of 45-50 cm in the deepest areas accompanied by natural drawdown is within the range of the ecological requirements of the Plains Grassy Wetland EVC. The extent to which changes in the catchment of Strathairds Creek may impact timing of inundation and water quality are not addressed.

Has the proposal described seral stages that would be anticipated and how would they be managed to address issues like exotic species, biomass and amenity? (NB 'seral stages' refers to the incremental development of ecological succession over time in response to changes driven by previous responses advancing towards its climax community or in some cases oscillating between states).

Response: None of these issues are addressed. The proposal does not go into detail or include a detailed action plan.

Has the proposal identified specific threats to be managed?

Response: There is no mention of specific threats to be managed, beyond those that the proposal could assist with (such as reducing downstream flooding risk and reduction of erosion).

Has a systematic consideration of species response been provided?

Response: There is no specific mention of any plant species beyond the assumption that the project would generally benefit SHW species and that a relevant seed bank persists.

Has the NGT proposal considered the future urban context of the site and the changes that will occur as a result?

Response: There is no baseline condition presented for the desired outcomes of the proposal – in the absence of such it is difficult to present any framework for evaluation of change. The impacts of proximity to urban areas such as edge effects, potential storm water and pollutant inputs, weed invasions, public concerns about potential fire risk, etc. are not discussed in any detail, nor is the desirable extent of buffering from adjacent development.

Has the NGT proposal considered the context of other SHW in the study area?

Response: The proposal does not go into the condition or distribution of remnant SHW vegetation or taxa in the area. No species are mentioned by name or threat status.

Scale Swamp as a comparison to Hanna Swamp

Scale Swamp occurs on basaltic terrain of western Victoria. It is reported as having a long-term history of drainage for grazing and low-intensity cropping prior to decommission of a drain and installation of fencing around the restored high water mark (Farrington, 2018).

The soil-stored seedbank at this wetland was investigated by Casanova (2012). Apart from opportunistic species shared with disturbed sites such as *Lachnagrostis filiformis* and *Juncus bufonius* and two species of Charophyte, very few vascular wetland species were germinated from the soil at this site, and certainly not an assemblage that could be identified as comprising a SHW community (*Elatine gratioloides*, *Isolepis cernua*, *Juncus* sp. and *Myriophyllum variifolium*).

Casanova noted that 'cropping results in a reduced diversity and density of plants, although swamp plant communities retain some resilience to such disturbance' and 'Cropping also effects germination from the seed bank of these wetlands'. Casanova further notes that cropped wetlands have a lower biodiversity, larger areas of open water (and bare ground) instead of meadow when inundated, and that vegetation was most likely to recover where swamps retain uncultivated land within them or have only recently been cropped.

Farrington comments that 'Unlike many of our other restoration sites, Scale Swamp is relatively shallow and more grassy than the deeper, freshwater marshes we [NGT] have worked on'. Farrington provides a description of the development of wetland vegetation at this site, noting 'In large parts there has been an almost entire replacement of exotic pasture grasses with the native Australian sweet grass (*Glyceria australis*) and also increased coverage by native sedges (*Eleocharis acuta*) and other aquatic herbs (*Potamogeton, Myriophyllum* and *Ranunculus* species)'.

Farrington further notes that 'Despite previous research at the site (by Michelle Casanova) showing that a diminished native wetland plant seedbank persisted at the site, crucially the restored hydrological regime has given those wetland species that have held on, the vital competitive edge they had been waiting for'.

The comparison of the response at Scale Swamp to expectations for Hanna Swamp requires some unpacking. Firstly it is reported that Scale Swamp was subject to grazing and low-intensity cropping. The northern section of Hanna Swamp has been subject to intense land-use practices, and also considering the depauperate wetland flora associated with the drains, it seems highly unlikely that any substantial seed bank of native wetland species persists in the soils of the pasture. While the site is prone to occasional inundation, it is believed that the drainage system in the northern paddocks is sufficiently effective that inundation is only extremely temporary. It is believed that these inundation events are insufficient to promote any wetland flora outside of the drains, which remain wet for substantially longer periods. However, the southern parts of the wetland still retain a greater range of wetland flora which does provide some opportunity for recolonization, provided the remnant flora is not drowned by the reinstated inundation regime.

It would be helpful to have bit more data on the persistence of wetland flora at Scale Swamp and any nearby wetlands prior to restoration of the hydrological regime, as well as a comprehensive inventory of the current flora. The species reported as responding to the reinstated hydrological regime at Scale Swamp are representative of wetter versions of SHW and definitely have clearly provide significant habitat values. However, unless this site was originally remarkably species-poor, the provided list of species is far short of a full complement of the prior flora, particularly in relation to the diverse array of forbs which are characteristic of the outer zones of relatively intact SHW, so the term 'restoration' needs to taken in context. It is considered very unlikely that anywhere near the original floristic diversity would re-establish in the absence of deliberate reintroduction and intensive management.

A consideration for future management of Hanna Swamp is the limitations imposed by water quality, given the proximity of urban development. The potential negative impact of urban stormwater on SHW is clearly evident where they spill into the wetlands of the prior Gisborne Racecourse.

While the results at Scale Swamp are highly encouraging as to the potential outcomes of reinstating prior hydrological regimes, without further information the extent to which they are transferable to Hanna Swamp is not a given. Some wetland flora (e.g. *Amphibromus nervosus*, *Eleocharis acuta*, *Juncus* spp., *Myriophyllum* spp.) would doubtless be promoted by reinstatement of a seasonal inundation regime at Hanna Swamp. It is also highly probable that some introduced taxa, in particular perennial grasses, would benefit from increased water availability in the absence of weed control, especially around the wetland margins. In summary, a modified wetland can be expected to respond to a reinstated hydrology in an individual manner according to

its history, the availability of propagules for recolonization of the native wetland flora, those introduced plant species that are present, and factors such as pressures from adjacent land-use and water quality.

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