Hume Planning Scheme Amendment C207 and C208

Expert Witness report provided to Planning Panels Victoria

Drainage Evidence

(C208 - Property 1,2 and C207 - Property 61,64,687)

Prepared for Villawood Properties

Prepared by Jonathon McLean

August 2017

1 Witness Details

I, Jonathon McLean of Alluvium Consulting Australia (Alluvium), 105 – 115 Dover Street, Cremorne, Victoria 3121, prepared this report. I hold the position of Senior Consultant.

I have a Bachelor of Engineering (Civil) from Monash University 1990, Graduate Diploma Water Resources and Environmental Engineering Monash University 1994, Graduate Diploma MBA Program Technology Management APESMA Deakin University 2001.

I am a member of the River Basin Management Society (RBMS) and a former 10 year committee member of the Victorian Stormwater Industry Association (2001-2010).

My major fields of expertise and interest are hydrology, hydraulics, urban drainage, catchment planning and management, flood estimation, surface water modelling, stormwater treatment and waterway management.

Related Experience:

- Over a period of 20 years I have regularly been involved with the design and strategic planning of drainage strategies and systems within residential, commercial and industrial developments.
- My expert advice has been sought by both the private sector (eg developers) and the public sector (catchment management authorities and local government).
- I have been actively involved in the development of the Best Practice Environmental Guidelines for Urban Stormwater.
- I have attended and presented at various industry conferences and seminars.
- I have a sound understanding of the role of Local Government, Catchment Management Authorities, Environment Protection Authority and other agencies in stormwater planning and management.

Therefore my expertise and experience in flood modelling and urban stormwater management associated with civil engineering and development projects, qualifies me to make this report.

2 Instructions

Alluvium has provided stormwater management advice to the proponent – Villawood Properties – to address the issues associated with future residential development on their landholdings of interest within the Sunbury South PSP and Lancefield Road PSP.

I have been instructed by Tamara Brezzi from Norton Rose Fulbright to provide expert evidence advice on the drainage issues related to the Villawood sites (identified as property nos. 1, 2 in the Lancefield Road PSP and property nos. 61, 64, 68 in the Sunbury South PSP) taking into account:

- the exhibited C207 and C208 documents, background reports and submissions

In particular I have been briefed to specifically address the following issues:

- the appropriateness of the wetland/basin assets proposed in the Lancefield Road PSP with respect to Villawood property's. In particular the following assets:
  - Wl-05a, Wl-06 and Wl-07, which are within a 96A permit application (P18854 and P18855)
  - Wl-01, Wl-02, Wl-03, Wl-04, Wl-05, Wl-08

- the appropriateness of the wetland/basin assets proposed in the Sunbury South PSP with respect to Villawood property's. In particular the following assets:
  - Wl-12 and Wl-15, which are within a 96A permit application (P18858)
  - Wl-19, Wl-20 and Wl-21

- Melbourne Water's objection letter (14 Feb 2017) with regard to the permit application for Sherwood Heights (P18854 and P18855) ;

- Melbourne Water's objection letter (14 Feb 2017) with regard to the permit application for Redstone Hill (P18858).

This evidence report responds directly to the above issues by providing a summary of the investigations, assumptions and assessments that have been undertaken in defining and reviewing the wetland/basin assets for Villawood Properties landholdings.

3 Information / Documentation

In preparing this evidence Jonathon McLean has had regard to:

Reports:

- PSP 1074 Sunbury South Precinct Structure Plan – VPA (Public exhibition Nov 2016)
- PSP 1075 Lancefield Road Precinct Structure Plan – VPA (Public exhibition Nov 2016).
- PSP 1074, PSP 1075 Sunbury South/Lancefield Road Background Report (Public Exhibition Nov 2016) A
- Redstone Hill, Villawood, "Preliminary Functional Design Report for Shepherds Lane DSS – WLRB1" by Alluvium (July 2017)
- Redstone Hill, Villawood, "Preliminary Functional Design Report for Turnberry Drive DSS – WLRB1" by Alluvium (July 2017)
- Redstone Hill, Villawood, "Preliminary Functional Design Report for Redstone Hill DSS – WL7" by Alluvium (August 2017)
- Sherwood Heights, Villawood, "Preliminary Functional Design Report for Devon Park DSS – WL13 and WL 14" by Alluvium (July 2017)
- Raes Road, Villawood, "Preliminary Functional Design Report for Devon Park DSS –WL11" by Alluvium (August 2017)

Other Information:

- Melbourne Water's Shepherds Lane DSS 6343 Scheme plan
- Melbourne Water's Turnberry Drive DSS 6345 Scheme plan
- Melbourne Water's Redstone Hill DSS 6801 Scheme plan
- Melbourne Water's Devon Park DSS 6827 Scheme plan
- Site Inspections
- Aerial Photography
- Constructed Waterways in New Urban Developments – Melbourne Water (2013)
- Australian Rainfall & Runoff (1997) – Engineers Australia
- Urban Stormwater Best Practice Environmental Management Guidelines (1999)
- Melbourne Water letter dated 14 Feb 2017 titled *"Amendment C207 – Hume Planning Scheme – Sunbury South (PSP1074) Section 96A Permit Application – Redstone Hill Estate"*
- Melbourne Water letter dated 14 Feb 2017 titled *"Amendment C208 – Hume Planning Scheme – Lancefield Road (PSP1075) Section 96A Permit Application – Sherwood Heights"*
- Harwood Andrews letter dated 14 July titled *"Amendments C207 and C208 to the Hume Planning Scheme – Sunbury South PSP and Lancefield Road PSP*
- Melbourne Water's *"Design, Construction and Establishment of Constructed Wetlands: Design Manual (Draft, 2016)";*
- Melbourne Water's document titled *"Principles for Provision of Waterway and Drainage Services for Urban Growth (2003)";*
- Melbourne Water's *"MUSIC Guidelines (2016)";*
- DELWP's "*Growling Grass Frog Habitat Design Standards – Melbourne Strategic Assessment (2017)"*.

Jonathon McLean adopts this evidence as a true and correct statement of his opinions and the facts he believes to be true in this matter.

4 Facts, Matters and Assumptions

This report is based upon an assessment and review of the information provided to me as referenced in Section 3 and the numerous site visits undertaken.

The Villawood managed landholdings cover a combined area of over 600 hectares in Sunbury. These are identified as property nos. 1, 2 in the Lancefield Road PSP and property nos. 61, 64, 68 in the Sunbury South PSP subject (refer to Figure 1 and Figure 2). The subject sites in the Lancefield Road PSP are contained within the Jacksons Creek watershed whilst the subject sites in the Sunbury South PSP are located within both the Jackson Creek and Emu Creek watersheds.

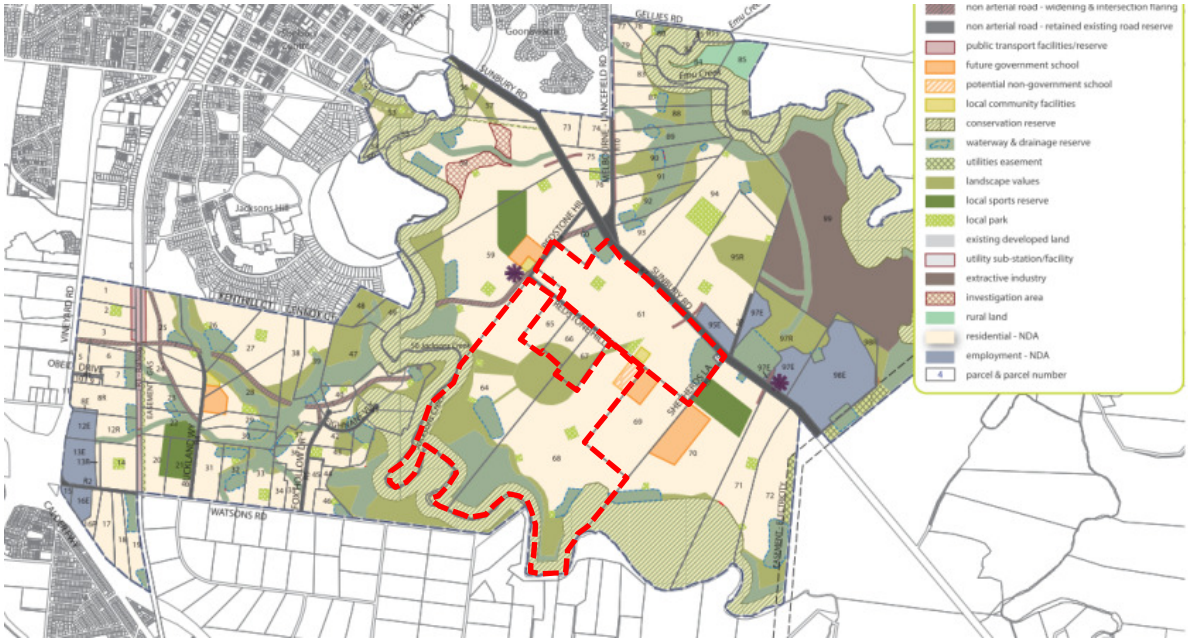


Figure 1: Location of subject sites in the Sunbury South PSP (red line)

Figure 2: Location of subject sites in the Lancefield Road PSP (red line)

4.1 Stormwater Quantity – Assumptions

The following design rainfall parameters were adopted for Sunbury based upon the Bureau of Meteorology's "Intensity Frequency Duration (IFD) Tool – AR&R 87).

Table 1: AR&R Design Rainfall parameters (Donnybrook)

Parameter	Value
1hr 2yr	19.69
12hr 2yr	3.98
72hr 2yr	1.06
1hr 50yr	40.39
12hr 50yr	7.49
72hr 50yr	2.15
Skew	0.33
F2	4.3
F50	14.94
Zone	1

For assets Wl-12 and Wl-15 in the Sunbury South PSP a hydrologic model (RORB) was utilised for the retarding basin catchment analysis and assessment. The following rainfall loss models were adopted for existing conditions (Table 2) and developed conditions (Table 3).

Table 2: RORB parameters for existing conditions model

Rainfall station	Sunbury
Initial loss	15 mm
Continuing Loss	2.5 mm/hr

Table 3: RORB parameters for developed conditions model

Rainfall station	Sunbury
Initial loss	15 mm
Runoff Coefficient (100yr)	0.60

To reflect ultimate development conditions the pre-developed scenario was modified to reflect post development conditions. To understand the hydrologic impacts, the following standard Melbourne Water fraction impervious values were used as a guide (Figure 3).

Local scale sub-catchment flows have been estimated using the rational method in accordance with Melbourne Water's "Land Development Manual" and the GAA's (now VPA) "Engineering Design and Construction Manual for Subdivision in Growth Areas".

Zone	Zone Code	Brief Description / Examples	Normal Range	Typical Value
Residential Zones:				
Residential Growth Zone, General Residential Zone and Neighbourhood Residential Zone	RGZ, GRZ & NRZ	Large Residential. (Allotment size 601m^2 – 1000m^2)	0.50 – 0.80	0.60
		Standard densities. (Allotment size 300m^2 – 600m^2)	0.70 – 0.80	0.75
		High densities. (Allotment size <300m^2)	0.80 – 0.95	0.85
Low Density Residential Zone	LDRZ	Allotment size >1001m^2	0.10 – 0.30	0.20
Mixed Use Zone	MUZ	Mix of residential, commercial, industrial and hospitals.	0.6 – 0.90	0.75
Township Zone	TZ	Small townships with no specific zoning structures	0.40 – 0.70	0.55
Industrial Zones				
Industrial 1 Zone	IN1Z	Main zone to be applied in most industrial areas	0.70 – 0.95	0.90
Industrial 2 Zone	IN2Z	Large industrial zones away from residential areas	0.70 – 0.95	0.90
Industrial 3 Zone	IN3Z	Buffer between Zone 1 and Zone 3	0.70 – 0.95	0.90
		- for garden suppliers/nurseries	0.30 – 0.60	0.50
		- for quarries	0.10 – 0.30	0.20
Commercial Zones				
Commercial 1 Zone	C1Z	Main zone to be applied in most commercial areas	0.70 – 0.95	0.90
Commercial 2 Zone	C2Z	Offices, manufacturing industries and associated uses	0.70 – 0.95	0.90
Rural Zones				
Rural Zone	RUZ	Main zone to be applied in most rural areas	0.05 – 0.20	0.10
Rural Living Zone	RLZ	Predominantly residential use in rural areas	0.10 – 0.30	0.20
Public Land Zones:				
Public Use Zone				
- Education	PU2Z	- schools and universities	0.60 – 0.80	0.70
- Service and Utility	PU1Z	power lines, pipe tracks and retarding basins	0.00 – 0.10	0.05
		- reservoirs	0.40 – 0.60	0.50
- Health and community	PU3Z	- hospitals	0.80 – 0.90	0.85
- Transport	PU4Z	- railways and tramways	0.60 – 0.80	0.70
- Cemetery/ Crematorium	PU5Z	- cemeteries and crematoriums	0.50 – 0.70	0.60
Local Government	PU6Z	- Libraries, sports complexes and offices/depots.	0.50 – 0.90	0.70
- Other Public Use	PU7Z	- Museums	0.50 – 0.80	0.60
Public Park and Recreation Zone	PPRZ	Main zone for public open space, incl golf courses.	0.00 – 0.20	0.10
Public Conservation and Resource Zone	PCRZ	Protection of natural environment or resources	0.00 – 0.05	0.00

Figure 3: Fraction impervious values for various land uses

4.2 Stormwater Quality – Assumptions

In accordance with Melbourne Water's MUSIC Guidelines and to be consistent with the Melbourne Water's scheme approach, Melbourne Airport rainfall station was used with a 10-year rainfall simulation template between the years of 1971-1980.

5 Lancefield Road PSP - Assets Wl-05a, Wl-06 and Wl-07

Villawood Properties manage the land referred to in the Lancefield Road PSP as property 2. The portion of property 2 that is located on the western side of Jacksons Creek is referred to as the "Sherwood Heights Estate".

Within the Sherwood Heights Estate are three stormwater assets labelled in the PSP as follows (refer to Figure 4):

- Asset Wl-05a, which is a "wetland" referred to as WL13 in Melbourne Water's Devon Park DSS
- Asset Wl-06, which is a "wetland" referred to as WL14 in Melbourne Water's Devon Park DSS
- Asset Wl-07, which is a "sediment pond" referred to as SB14 in Melbourne Water's Devon Park DSS

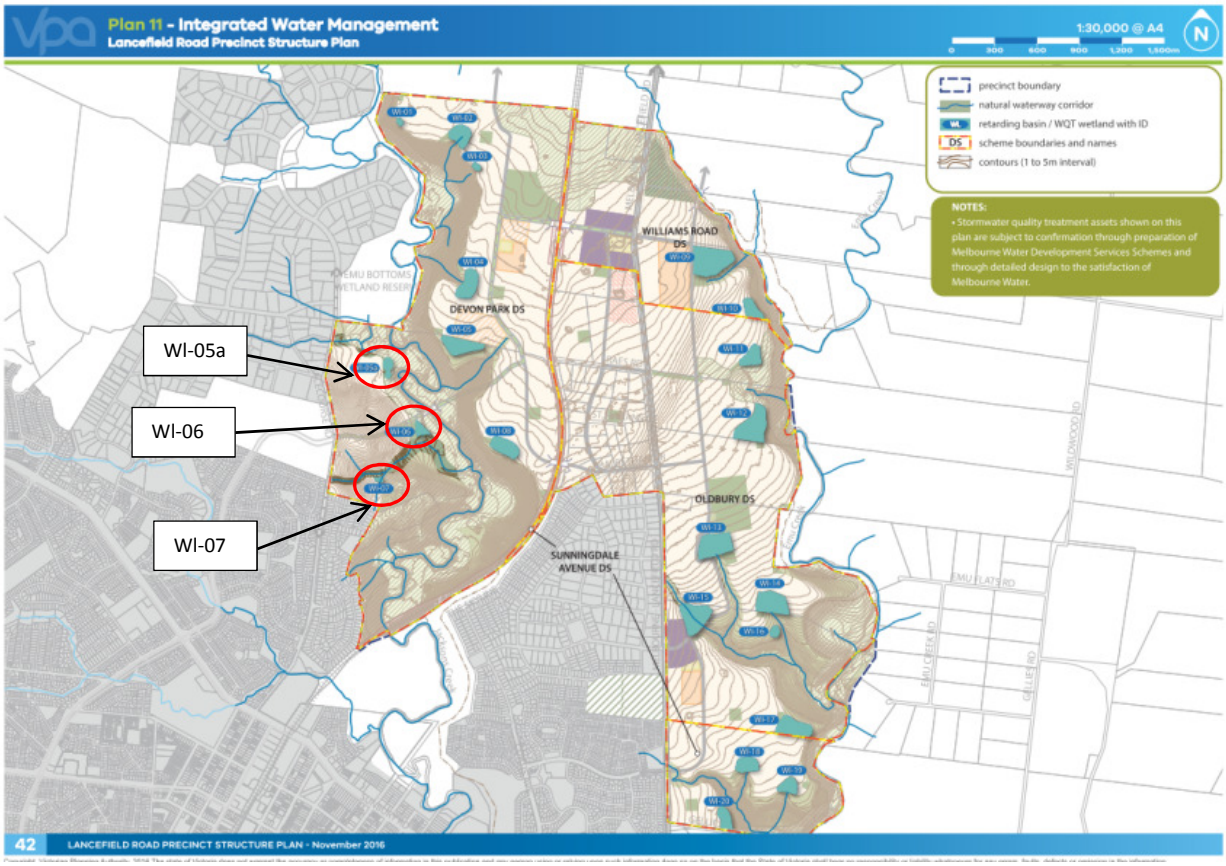


Figure 4: Location of subject assets (Wl-05a,Wl-06,Wl-07) in the Lancefield Road PSP (red line)

5.1 The issue

Villawood has submitted a Section 96A application for the Sherwood Heights Estate, to be considered concurrently with the Lancefield Road PSP. However in February 2017, Melbourne Water submitted an objection to the permit due to "significant discrepancies between the Sherwood Heights masterplan and Melbourne Water's current draft DSS design". As highlighted in Figure 5, the key items were:

1. *Lots and roads are proposed over Melbourne Water's designated waterway corridor (pink circle). Roads and lots must be located outside Melbourne Water's waterway corridor.*

2. *Lots and roads are proposed over asset WI-05a (yellow circle). Roads and lots must not be proposed within the area required for drainage assets under the draft Devon Park DSS.*

3. *No provision has been made for the required waterway corridor, south-west to Jacksons Creek (black circle). A waterway and associated corridor are essential in this location (in accordance with the PSP and DSS).*

4. *The waterway corridor is not wide enough and terminates at a high-point in the landscape (blue circle). This is labelled linear park in the subdivision masterplan, but the required function is a drainage asset. The subdivision must make provision for this essential waterway corridor. In addition, the masterplan also shows lots that are shown backing on to the waterway in this section. This is unacceptable as per Requirement R55.*

5. *The subdivision must make provision for asset Wl-7 (blue circle)*

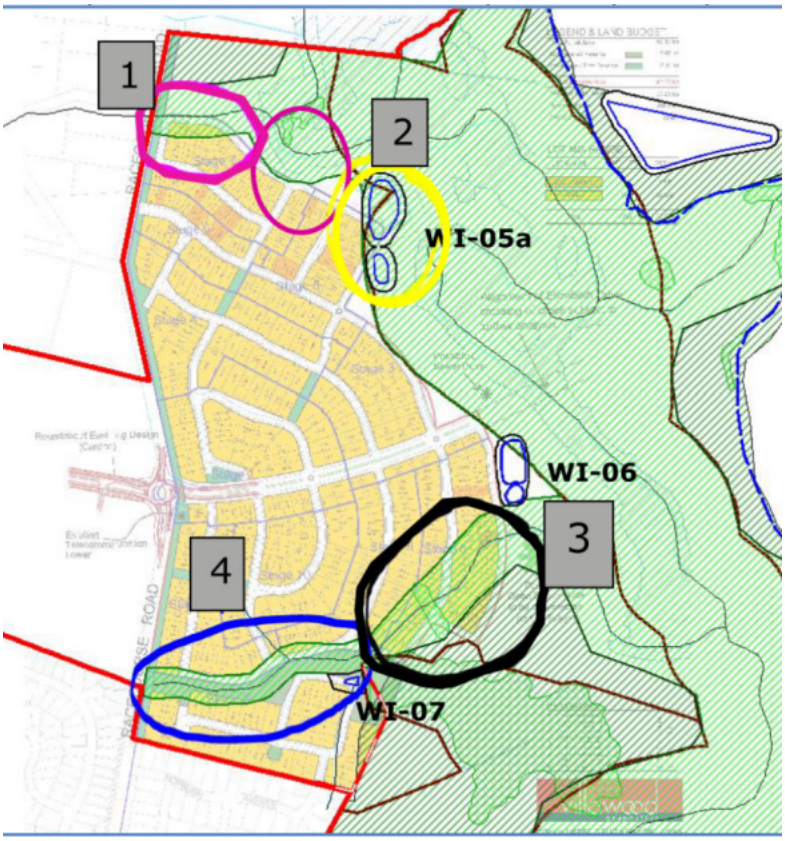


Figure 4: Reference plan showing the key items of Melbourne Water's objection to the permit

However since the PSP exhibition, there have been a couple of significant changes that impact the proposed 96A permit plan for Sherwood Heights. One involves the re-alignment of the Elizabeth Drive extension and bridge, which now directly clashes with the proposed Melbourne Water scheme wetland (ie Wl-06) as highlighted in Figure 6. The other is the proposed development boundary that has been agreed to between Villawood and VPA. The extent of development has been reduced on the eastern and northern edge of Sherwood Heights, with the development line boundary now essentially following the "break in slope" (refer to Figure 7).

As a result I have reviewed the above inconsistencies and proposed an alternative configuration for assets Wl-05a, Wl-06 and Wl-07. It is noted that Melbourne Water's scheme, in this location, has only been informed by a high level concept design. My review (refer to section 5.2) has been informed by a functional design in accordance with Melbourne Water's standards and requirements.

The focus of my review and evidence will address items 1,2 and 5 listed above.

I am aware that studies undertaken by Melbourne Water have identified geomorphic values along the existing drainage line in the southern portion of the site. However the scope of my expert evidence does not include items 3 or 4 apart from providing advice on the hydrology and hydraulic capacity of an urban drainage system to accommodate flows through the valley. As far as I am aware the development on the west side of Racecourse Road, known as Sunbury Fields, has prepared a drainage strategy that will include a wetland and retarding basin to control future developed flows (up to the 100 year ARI event) to a maximum rate of 1 cumec. Based on the existing topography such a flow could be accommodated in a pipe in the order of 525mm. A standard road reserve (eg 16m to 20m) would also have the capacity to safely convey around 4 to 5 cumecs of overland flow.

However it is my understanding that item's 3 and 4 (ie the waterway corridor) are being addressed by other experts with respect to urban design and development feasibility.

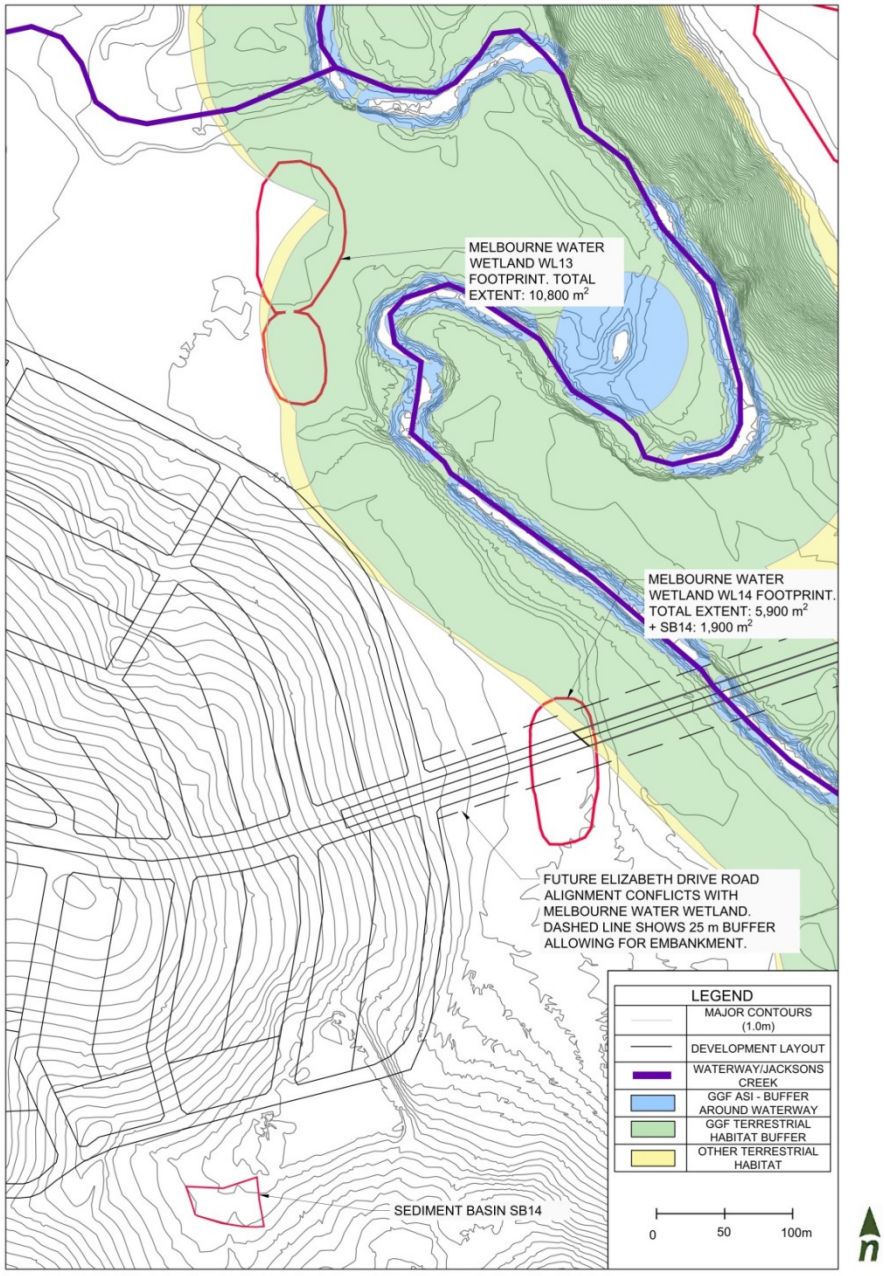


Figure 5: Plan showing conflict between asset Wl-06 and Elizabeth Drive alignment

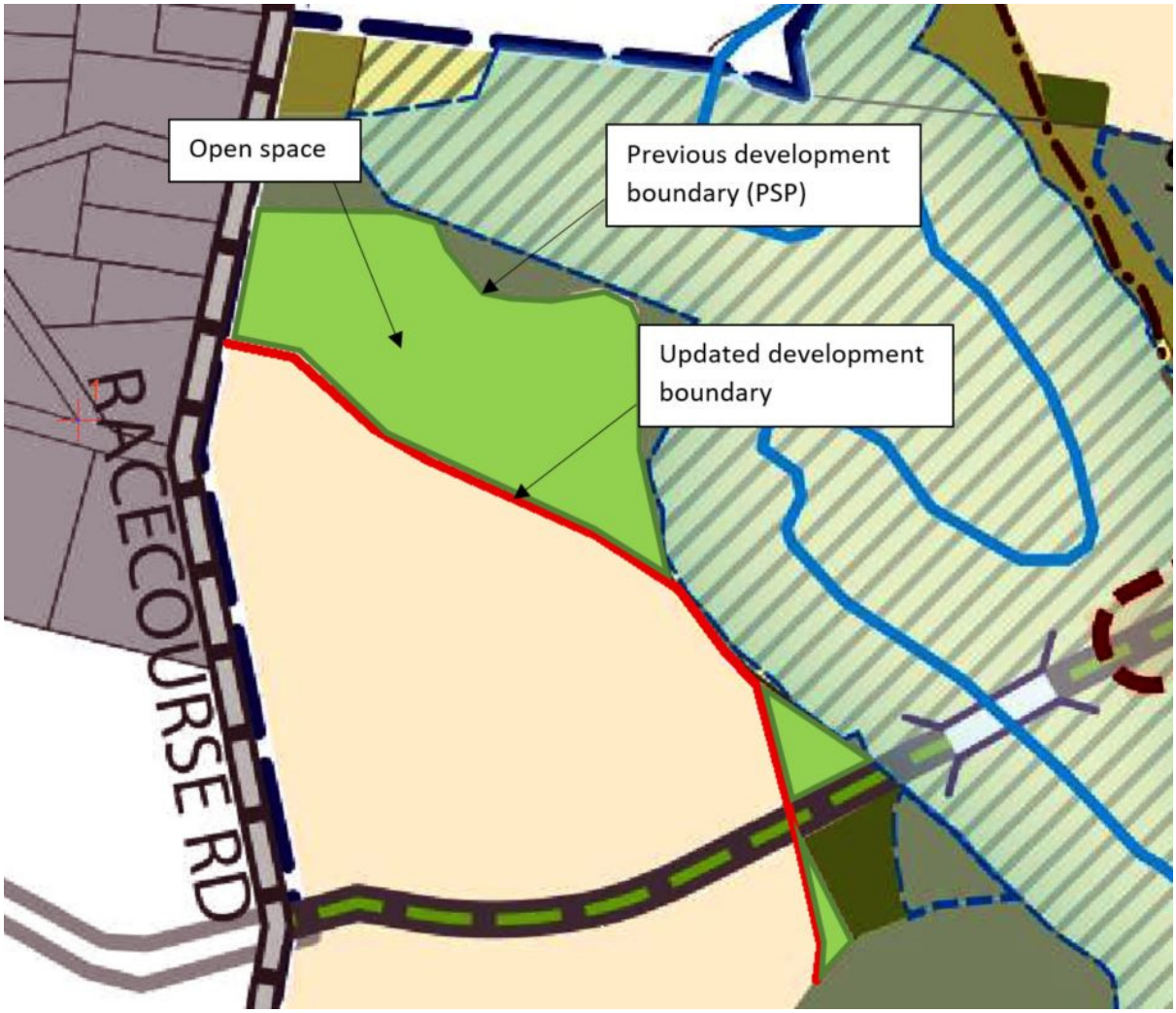


Figure 6: Change in development line boundary at Sherwood Heights

5.2 Alternative strategy and configuration

In reviewing the PSP I undertook the following analysis and investigations to determine the most appropriate strategy from both a location and land budget perspective:

- Site inspection
- Consideration of topography (survey, contours), feature survey and known physical or infrastructure constraints
- Created a MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model to establish the proposed treatment train strategy. The model estimates the amount of pollutants the catchment produces, the performance of treatment measures and the pollutant load generated once the catchment is treated.
- Concept and preliminary functional designs of the stormwater treatment assets

As shown in Figure 6, the proposed extent of development has been significantly reduced in the northern portion of the site. As a result all lots and roads in the north are now clearly outside of Melbourne Water's waterway corridor. Therefore in my opinion item 1 of Melbourne Water's permit objection has now been satisfied.

Catchment hydrology

The Sherwood Heights site occupies approximately 120 ha of land immediately adjacent to Jacksons Creek. A major proportion of the site is consumed by conservation corridors, open space and floodplain resulting in an overall potential development area of 36.8ha. Two major internal sub-catchments are present, dividing flows north and south of the proposed Jacksons Creek road crossing.

For the "north" sub-catchment, one very large, external catchment enters the site from the north-western corner. This discharges through an existing depression into Jacksons Creek. Although these flows travel through the study site, they have a relatively short course and are confined to their independent drainage pathway and floodplain. As such, they are not considered further for functional design of water quality treatment assets. The internal section of the "north" sub-catchment is approximately 15.32 ha.

The "south" sub-catchment includes two external catchments, entering from the western and southern boundaries that total 31.4ha. These are also outside of the PSP boundary. The external catchment to the west of Racecourse Road is a residential development currently under construction, which has its own on-site retardation and stormwater quality treatment. The external catchment to the south is an existing residential development that currently outfalls through the Sherwood Heights site. These catchments are not required to be treated for water quality purposes, but provision is made for their hydraulic and hydrologic effect on the local drainage system. The internal section of the "south" sub-catchment is approximately 21.2 ha.

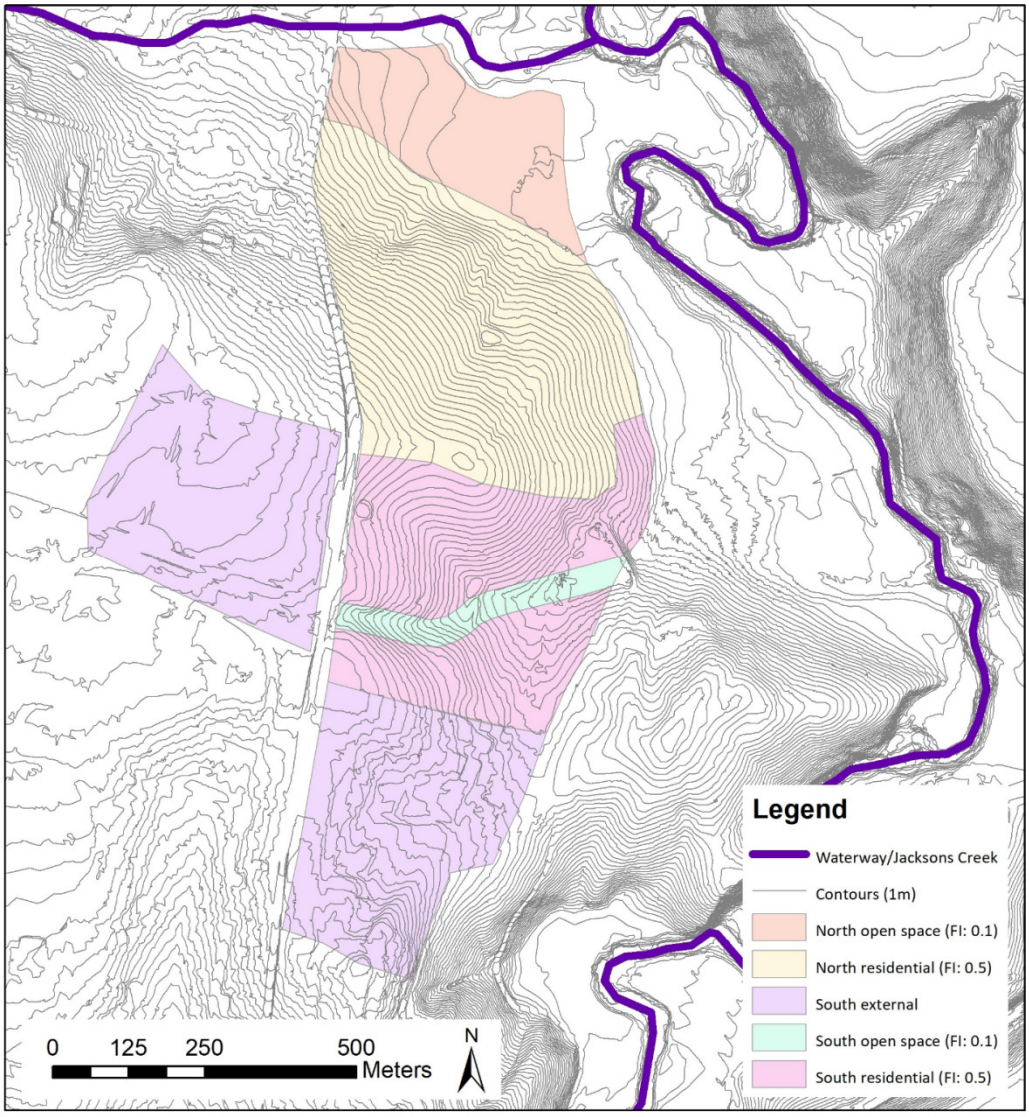


Figure 7: Catchments contributing to the proposed wetland assets

Functional design

I understand that a key principle for Melbourne Water's DSS is that all stormwater is to be treated to best practice before being discharged to Jacksons Creek. These targets are:

- 70% removal of the total Gross Pollutant load
- 80% removal of total Suspended Solids (TSS)
- 45% removal of total Nitrogen (TN)
- 45% removal of total Phosphorus (TP)

Functional designs have been completed based upon Melbourne Water's current MUSIC Guidelines and draft Constructed Wetlands Manual. Full details are provided in Attachment A.

In line with previous concept design work and in accordance with the layout of Melbourne Water's Devon Park DSS, separate treatment assets are proposed to treat the "north" and "south" sub-catchments. The Devon Park DSS currently shows a wetland/sediment basin in the "north" (WL13); and wetland/sediment basin (WL14) and additional sediment basin in the "south" (SB14). It is assumed the external catchment entering from west in the "south" sub-catchment will be treated to best practice standards from an upstream treatment system. This has been allowed for in the MUSIC model with a representative wetland which achieves best practice for its treatment train. Note external catchments are not considered for treatment performance, but their connection to the minor drainage network does affect the hydrology of the wetland systems in this design.

The key difference between the stormwater assets exhibited PSP and the alternative configuration identified in my evidence report are as follows:

- Asset Wl-05a is shown in the PSP to be constrained and partially located within the DELWP's Growling Grass Frog (GGF) conservation corridor. The alternative strategy makes use of the amended development line boundary and locates Asset Wl-05a within the open space/landscape values area and avoids the GGF corridor.
- The alternative configuration locates Asset Wl-06 to the north of the Elizabeth Drive road extension. The asset as shown in the exhibited PSP (and Melbourne Water's DSS) clashes with the alignment of the Elizabeth Drive creek crossing.
- The alternative configuration consolidates sedimentation basin Wl-07 with the larger wetland asset Wl-06. The PSP shows sediment basin Wl-07 as an isolated asset on relatively steep topography on the southern side of the proposed waterway corridor. However topographically the consolidation of these two assets can easily be achieved by piping flows under the proposed waterway corridor. In my opinion this should not be an issue as this section of the waterway will need to be significantly modified and reconstructed due to the removal of the existing dam and the future road reserve crossing. As a result the pipe crossing can occur downstream of the proposed road and upstream of the existing dam. Consolidation allows a smaller overall footprint and one less asset for Council to manage. This is consistent with Council's submission which stated "*It is noted that the PSPs identify 57 retarding basins across the two precincts. Of these, 51 are identified as the responsibility of Council. Council has concerns regarding both the number of, and cost to Council for the ownership / maintenance of these assets…….Opportunities should be explored to consolidate these and reduce the number of assets"*.

Two versions of the southern wetland (Wl-06) have been undertaken. One model only includes the internal Sherwood Heights/PSP catchment, which assumes the equivalent external catchment area and flow is diverted before the sediment basin. This model provides a smaller sediment basin (300m2) but the largest wetland treatment area (2400m2). The other model includes the full hydrological flow from the external catchment to the south going into the sediment basin but requires only the equivalent load reduction from the wetland system. This model produces a larger sediment basin (450m2) but a smaller wetland treatment area (1200m2).

To be conservative, the functional design layout has adopted "design envelope" that includes a hybrid consisting of the largest sediment pond and largest wetland to demonstrate that the available footprint in the section 96A permit application is more than sufficient.

The configuration of the revised treatment train (wetlands and sediment basins) is provided in Table 4. Wetland performance is given in Table 4 and 5, demonstrating the design meets Best Practice targets.

Table 4: Treatment asset parameters.

	Wetland "north"	***Sediment basin "north"***	***Wetland "south"***	***Sediment basin "south"***
NWL area, m^2	*3,600*	*360*	*2,400 or 1200*	*300 or 450*
Average depth, m	0.4	1.0	0.4	1.0
Extended detention, m	0.35	0.35	0.35	0.35
Extended detention time (hr)	72		72	

Table 5: Overall treatment train performance for the "north" system.

Parameter	**Total sources**	**Residual load**	**Percent removed (%)**
Total Suspended Solids (kg/yr)	11800	2400	80
Total Phosphorus (kg/yr)	25.6	8	69
Total Nitrogen (kg/yr)	190	101	47

Table 6: Overall treatment train performance for the "south" system.

Parameter	**Total sources (internal)**	**Removed in wetland/SB**	**Percent removed, (internal) (%)***
Total Suspended Solids (kg/yr)	9070	8530	99
Total Phosphorus (kg/yr)	18.9	14.9	82
Total Nitrogen (kg/yr)	138	62	46

*Note: performance may be greater than 100% due to flows from external catchment entering system. Performance given here is relative to new urban development only.

A comparison of the proposed alternative configuration of the wetland assets and the exhibited PSP (MW DSS) are shown in Figure 8.

Figure 9 and Figure 10 show the functional layout of the alternative designs for Wl-05a and Wl06.

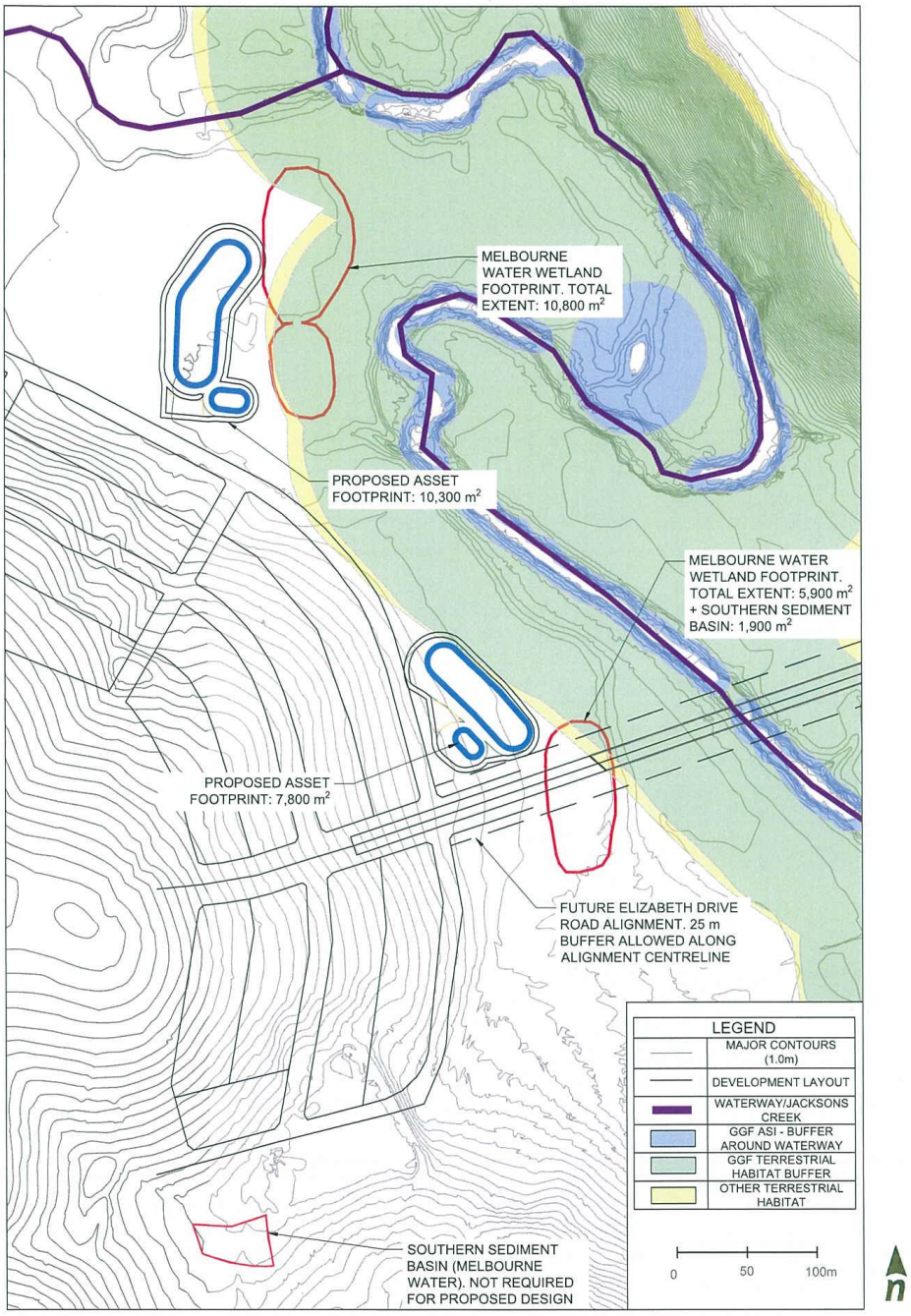


Figure 8: Alternative configuration of the wetland footprints compared to the current DSS

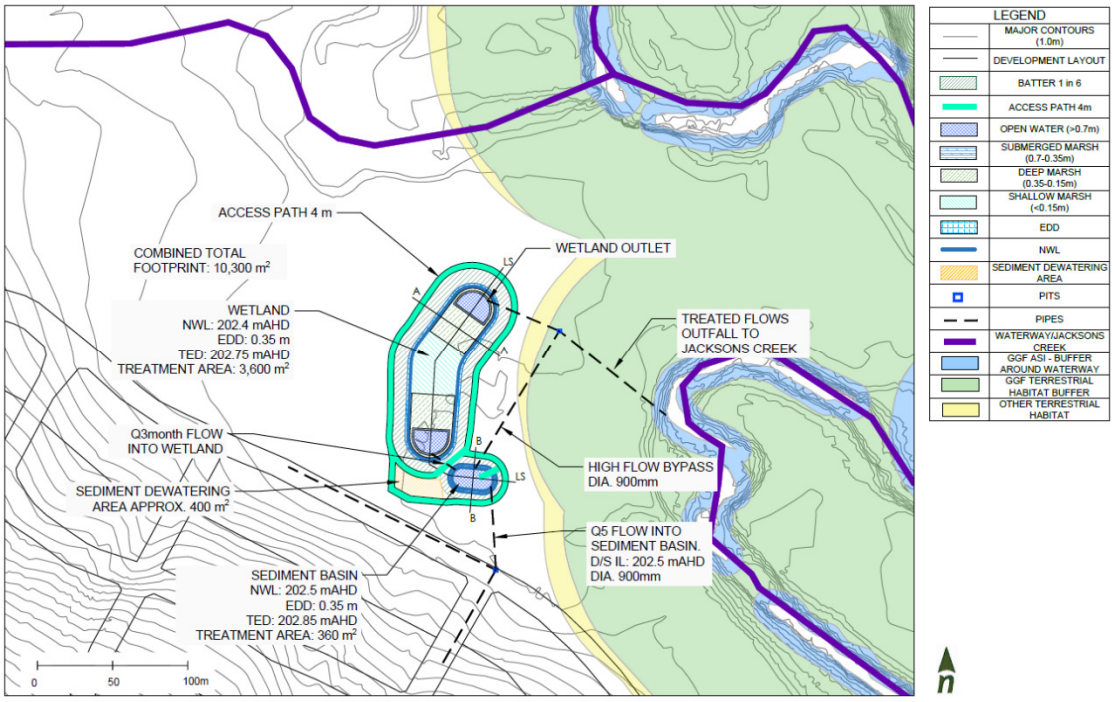


Figure 9: Functional layout of the alternative configuration for asset Wl-05a in the north

As shown in Figure 9, the proposed extent of development has been significantly reduced in the northern portion of the site. As a result all lots and roads in the north are now clearly outside of Melbourne Water's waterway corridor. Therefore in my opinion item 2 of Melbourne Water's permit objection has now been satisfied.

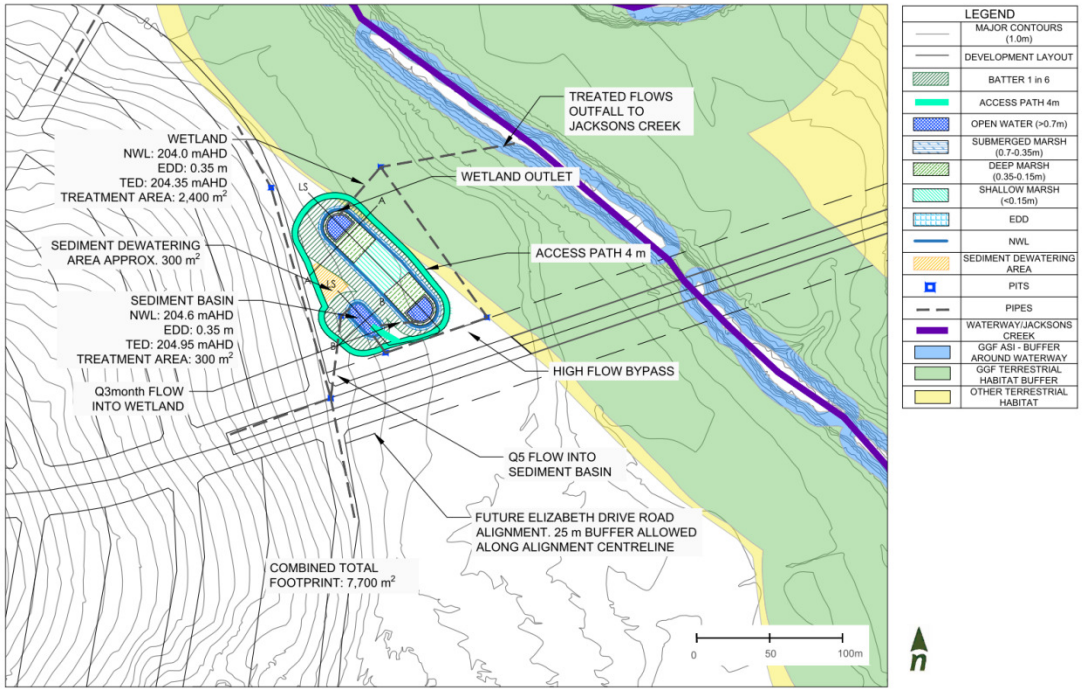


Figure 10: Functional layout of the alternative configuration for asset Wl-06 in the south

As described above and shown in Figure 10, the sediment basin Wl-07 can be consolidated with the larger wetland Asset Wl-06. Therefore in my opinion item 5 of Melbourne Water's permit objection has now been satisfied.

5.3 Recommendation

In my opinion the proposed alternative strategy and configuration for assets Wl05a and Wl06 provides the most appropriate outcome from an engineering feasibility perspective, having been informed by a functional design process. In contrast the current Melbourne Water DSS (and hence the exhibited PSP) is dated and does not reflect the latest agreed land use changes such as the Elizabeth Drive alignment and the reduced extent of developable land. The DSS for Wl-05a, Wl-06 and Wl-07 are based only on a high level concept design.

The alternative location for assets Wl-05a and Wl-06 (and consolidation of Wl-07) are:

- technically sound,
- have a reduced impact on the GGF conservation corridor,
- can deliver on the best practice stormwater quality targets,
- more efficient from a land budget and maintenance perspective.

As a result I recommend that the PSP and Melbourne Water's Devon Park DSS be amended to reflect the alternative configuration as presented in this evidence.

6 Lancefield Road PSP - Assets Wl-05

Villawood Properties manage the land referred to in the Lancefield Road PSP as property 1 and 2. The portion of property 1 and 2 that is located on the eastern side of Jacksons Creek is referred to as the "Raes Road site".

Within the Raes Road site there are numerous stormwater assets (ie six) labelled in the PSP. Section 6 of my evidence report focuses on the following (refer to Figure 11):

- Asset Wl-05, which is a "wetland" referred to as WL11 in Melbourne Water's Devon Park DSS

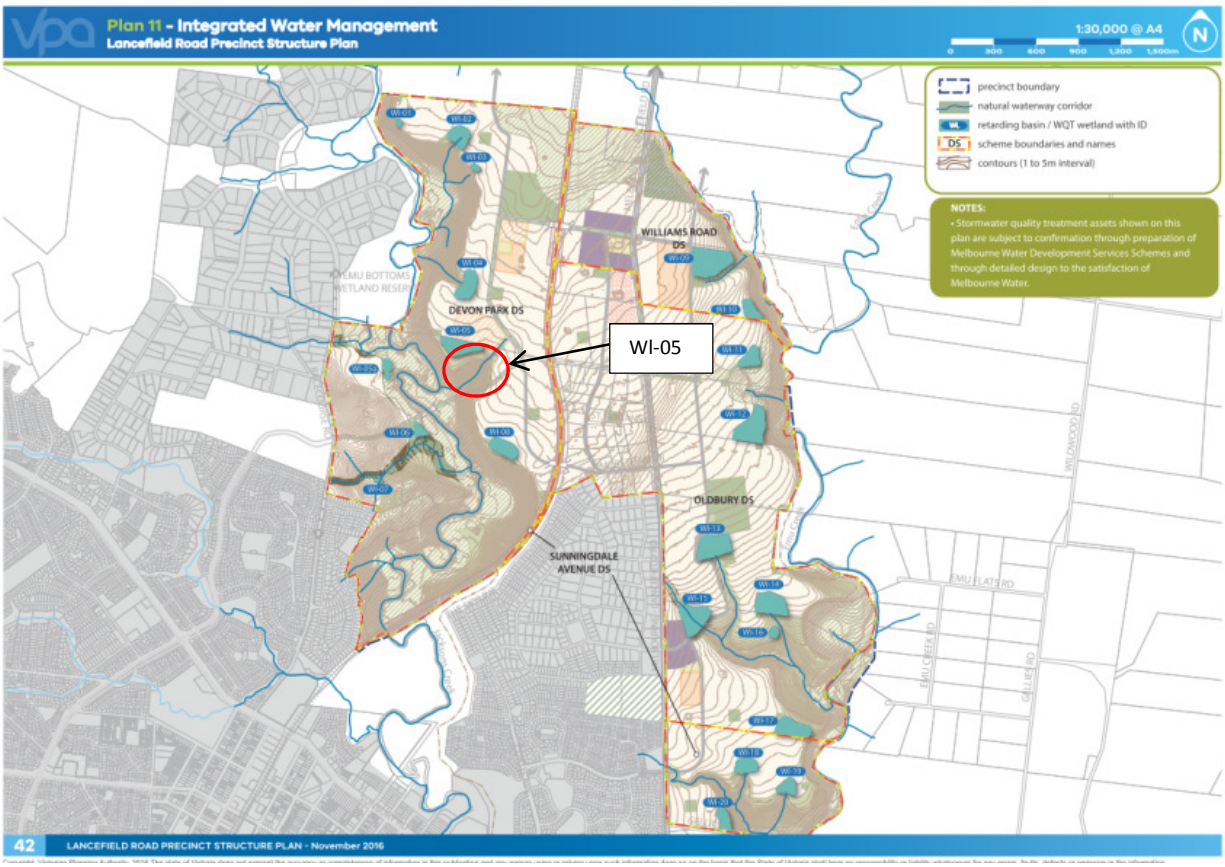


Figure 11: Location of subject assets (Wl-05) in the Lancefield Road PSP (red line)

6.1 The issue

The PSP has been informed by Melbourne Water's Devon Park Development Services Scheme (DSS). The DSS includes a wetland treatment asset (Wl-05) immediately to the west of the existing sharp gorge that forms the natural outfall of the catchment to Jacksons Creek. During preparation of the DSS there was considerable uncertainty regarding the future alignment of the proposed "Elizabeth Drive" connector road and its bridge crossing over Jacksons Creek. One of the alignments options involved the road following the valley low point in the landscape, which is the natural catchment outlet. It is my understanding that due to this uncertainty Melbourne Water located asset Wl-05 to the west of the low point to any potential conflict with the road.

However it appears that following more recent work from the VPA the uncertainty regarding the road alignment has been resolved and involved a shift further south (see Figure 12). As a result the question arises as to whether the location for asset Wl-05 as shown on the exhibited PSP, which was influenced by the Elizabeth Drive bridge crossing, is in the appropriate or optimum location with respect to the following issues:

- land take efficiency
- the urban design vision for the non-government school site (ie Salesian College)

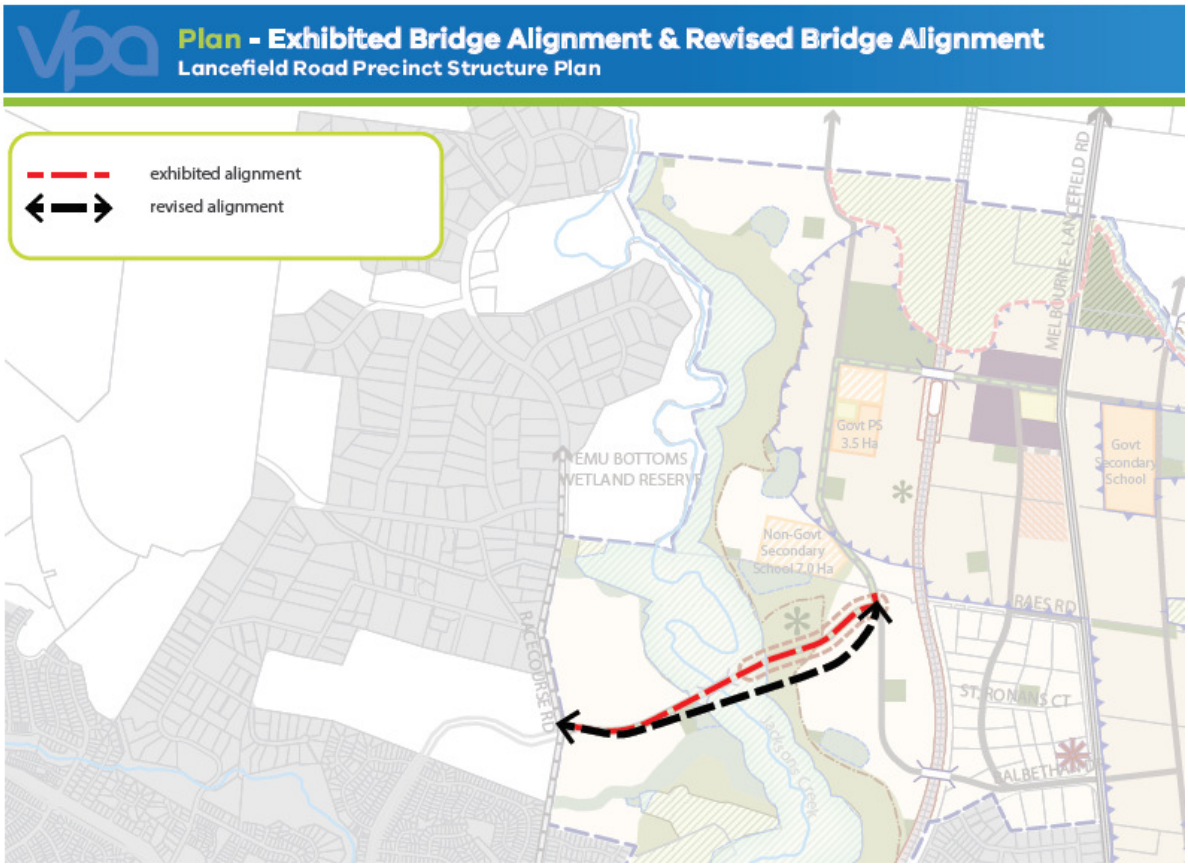


Figure 12: Revised bridge and alignment for Elizabeth Drive

6.2 Alternative strategy and configuration

In reviewing the PSP I undertook the following analysis and investigations to determine the most appropriate strategy from both a location and land budget perspective:

- Site inspection
- Consideration of topography (survey, contours), feature survey and known physical or infrastructure constraints
- Created a MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model to establish the proposed treatment train strategy. The model estimates the amount of pollutants the catchment produces, the performance of treatment measures and the pollutant load generated once the catchment is treated.
- Concept and preliminary functional designs of the stormwater treatment assets

Melbourne Water have only completed a high level concept design for WI-05 as part of their DSS, which has informed the PSP. In contrast the alternative strategy has been informed by a more in-depth functional design process.

Catchment hydrology

The upstream catchment extent of the proposed wetland (WI-05) was approximately 41.4 ha based on the current Melbourne Water DSS layout. However, this catchment includes areas to the north with elevation that would be very difficult to drain to the asset location. In addition, the alternative configuration proposed in this evidence results in an increased area of developable land to the south that was previously categorised as a drainage reserve. The catchment has been revised based on feasible grading of likely road reserves and underground pipes, and this increased the total developable area to be approximately 42.3 ha. Figure 13 shows a comparison of the DSS catchment plan and the revised catchment plan. Note that there is an additional water quality treatment asset (as shown in the PSP) at the short gorge just north of the catchment in Figure 13, which is intended to treat flows from the greater catchment to the north.

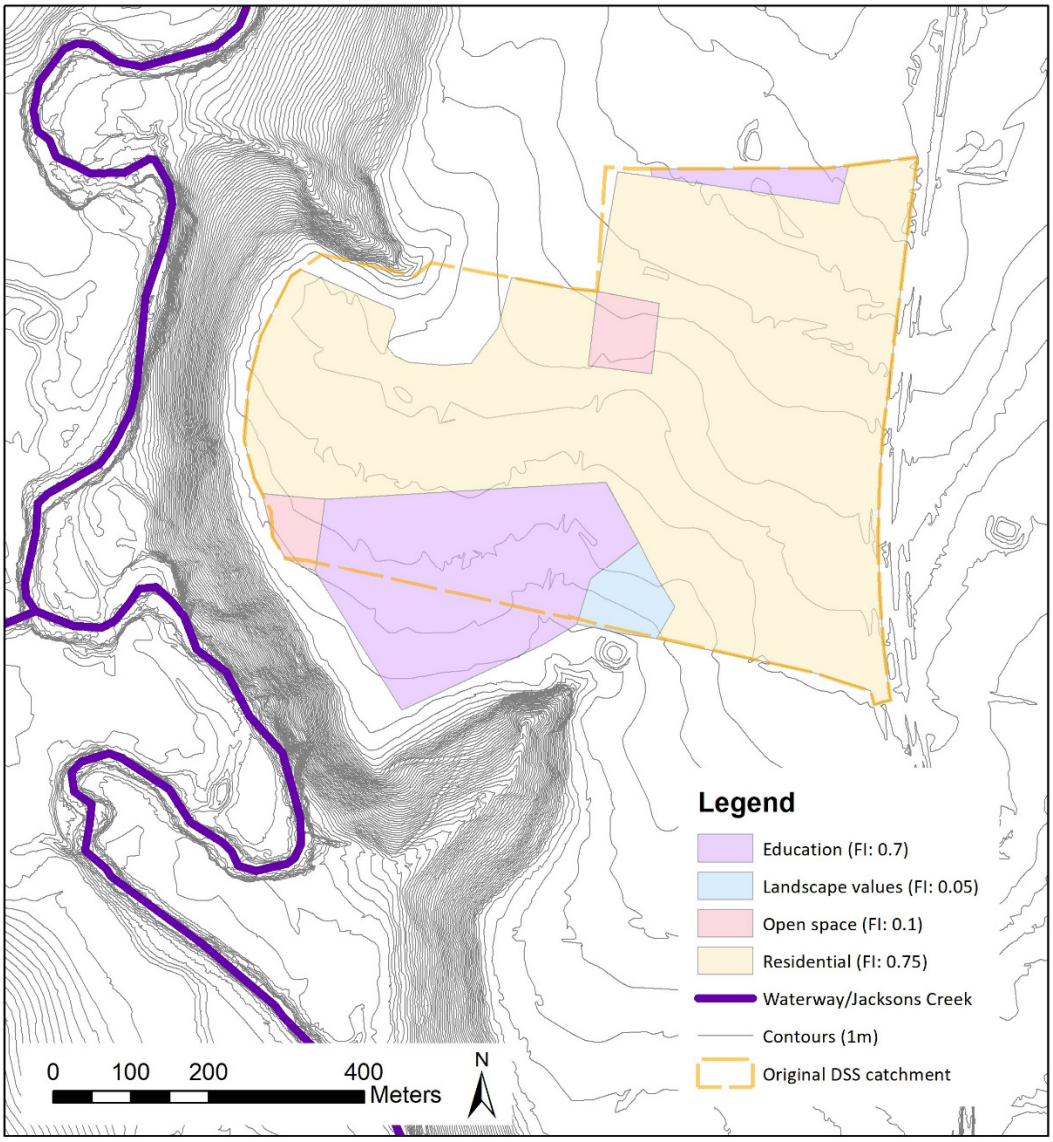


Figure 13. *Catchments contributing to the proposed wetland*

Functional design

I understand that a key principle for Melbourne Water's DSS is that all stormwater is to be treated to best practice before being discharged to Jacksons Creek. These targets are:

- 70% removal of the total Gross Pollutant load
- 80% removal of total Suspended Solids (TSS)
- 45% removal of total Nitrogen (TN)
- 45% removal of total Phosphorus (TP)

A functional design has been completed based upon Melbourne Water's current MUSIC Guidelines and draft Constructed Wetlands Manual. Full details are provided in Attachment B.

The subject site sits on a relatively flat landscape with a sudden, very steep escarpment leading to Jacksons Creek on the western boundary. Developable land in the area is constrained by requirements for setbacks from the escarpment edge. In addition, with a flattened landscape and irregular catchment, and considering future development layout, the location of the treatment asset must carefully consider the feasibility of the accompanying local drainage network

In accordance with Melbourne Water's Devon Park DSS the proposed WI-05 asset consists of a sediment pond and wetland treatment train.

Land-take efficiency

The basis for the alternative design configuration was to locate the WI-05 asset within the natural low-point/valley of the landscape to optimise the potential for the smallest possible footprint. This is in contrast to the DSS layout, which has shifted the location of the WI-05 asset to west of the valley to avoid a potential clash with the Elizabeth Drive alignment. From my experience working with the natural topography generally provides the most efficient outcome from a land budget perspective.

The configuration of the revised treatment train (sediment pond and wetland) is provided in Table 7 and functional layout in Figure 14. Wetland performance is given in Table 8, demonstrating the design meets Best Practice targets.

Table 7: Treatment asset parameters.

	Wetland	**Sediment basin**
NWL area, m^2	*9,000*	*900*
Average depth, m	0.4	1.0
Extended detention, m	0.35	0.35
Extended detention time (hr)	72	

Table 8: Overall treatment train performance for WI-05.

Parameter	**Total sources**	**Residual load**	**Percent removed (%)**
Flow (ML/yr)	146	134	8
Total Suspended Solids (kg/yr)	28700	5530	81
Total Phosphorus (kg/yr)	60	19	69
Total Nitrogen (kg/yr)	415	230	45
Gross Pollutants (kg/yr)	5730	0	100

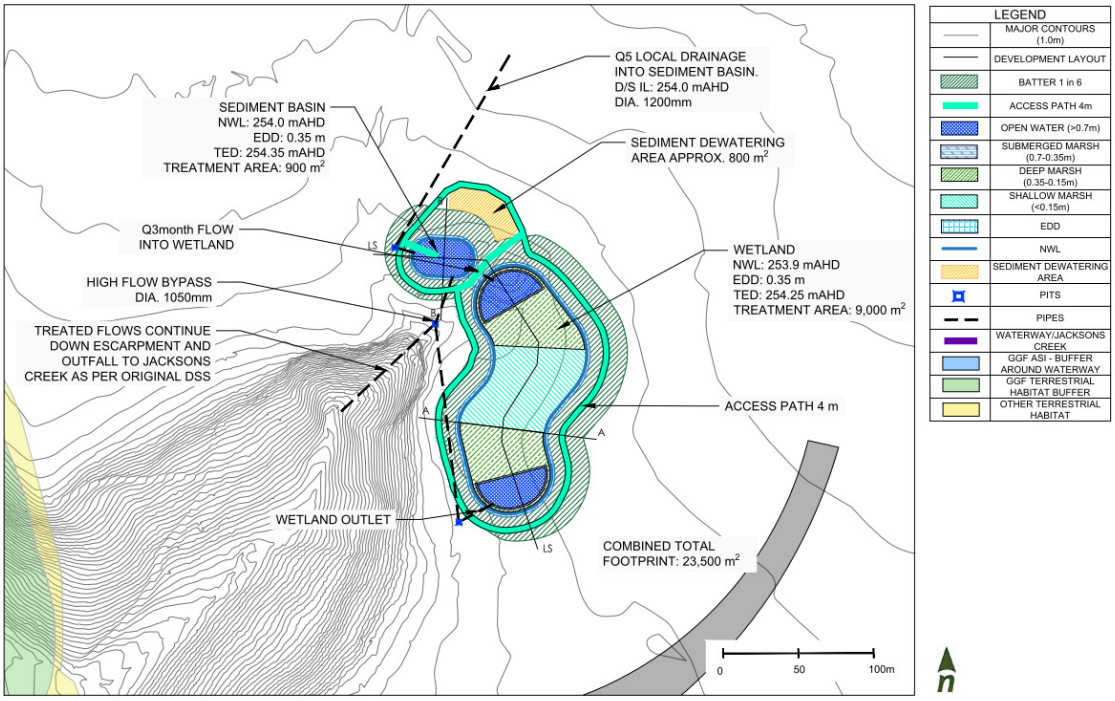


Figure 14: Functional layout of the alternative configuration for asset WI-05

A comparison of the proposed alternative configuration of asset Wl05 and the exhibited PSP (MW DSS) are shown in Figure 15. The required drainage reserve "land take" for the alternative configuration is 2.35ha compared with 2.55ha for the DSS concept.

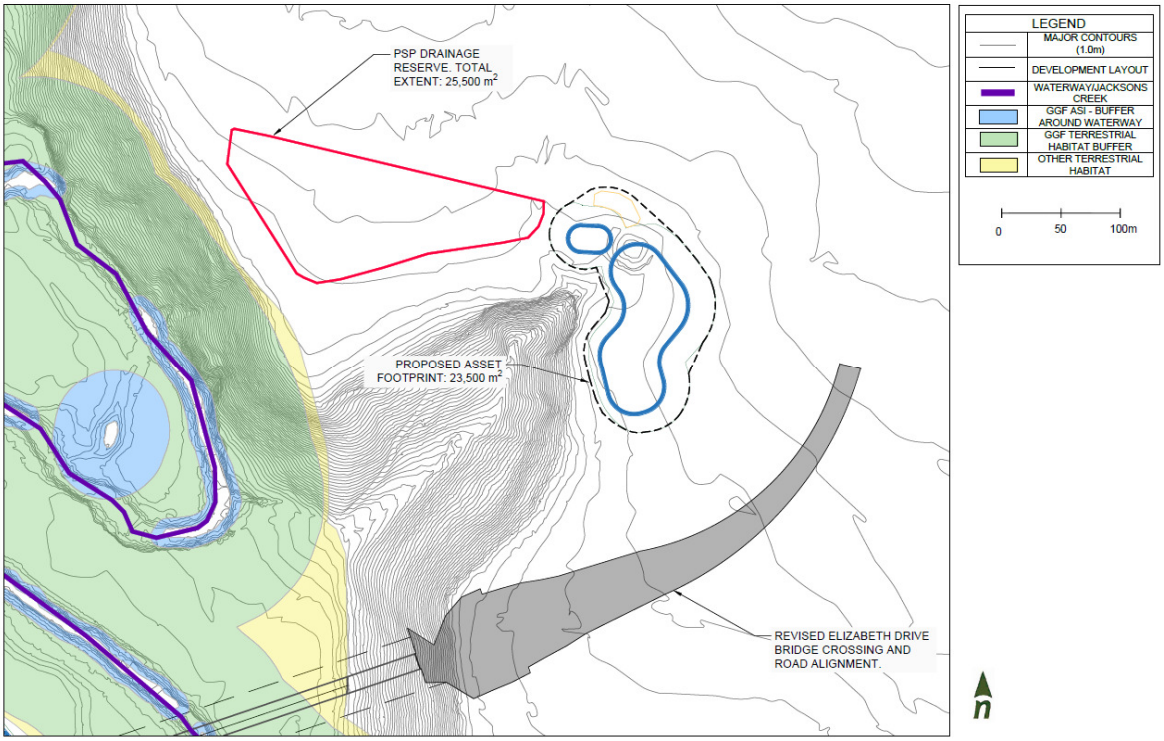


Figure 15: Alternative configuration of the wetland footprints compared to the current DSS

From a "land take" perspective the alternative configuration provides a slight reduction (ie 8%) in the required drainage reserve. However in my opinion, given the alternative configuration was based on a functional design and the DSS was a concept, this difference is marginal. However I believe that the functional design has demonstrated that the alternative configuration is technically sound and feasible.

Vision for the non-government school site

Salesian College have historically operated property 2 as a working farm and the intention is for the Salesians to continue their history with the site by occupying the non-government school site that has been identified in the PSP at the Raes Road site.

I understand that Villawood has been through an extended visioning and workshop process with the Catholic Education Office, Catholic Archdiocese and Salesians College regarding an appropriate location for a new campus. This processed established the objectives, principles and vision for the siting of the campus. The key outcomes were as follows:

- a large open campus / estate style site
- views over Jacksons Creek reserve and parkland
- links to the history and character of the former land use
- strong sense of identity and link to the community

An in-principle agreement was reached for the school to be indicatively located in the region shown in Figure 16. This conflicts with asset Wl-05 as proposed by the Devon Park DSS. The PSP has responded by locating the school site upstream of the Wl-05 drainage reserve. Whilst it appears (from the 2 dimensional plan) that the drainage reserve would not obstruct the view lines of the school campus, from a 3 dimensional perspective the shifting of the school further away from the escarpment will have an impact. That is the line of sight from the school campus will limit views over the Jacksons Creek reserve and compromise one of the key objectives and visions for the Salesian campus. This is in contrast the alternative configuration for Wl-05 as demonstrated in Figure 17.

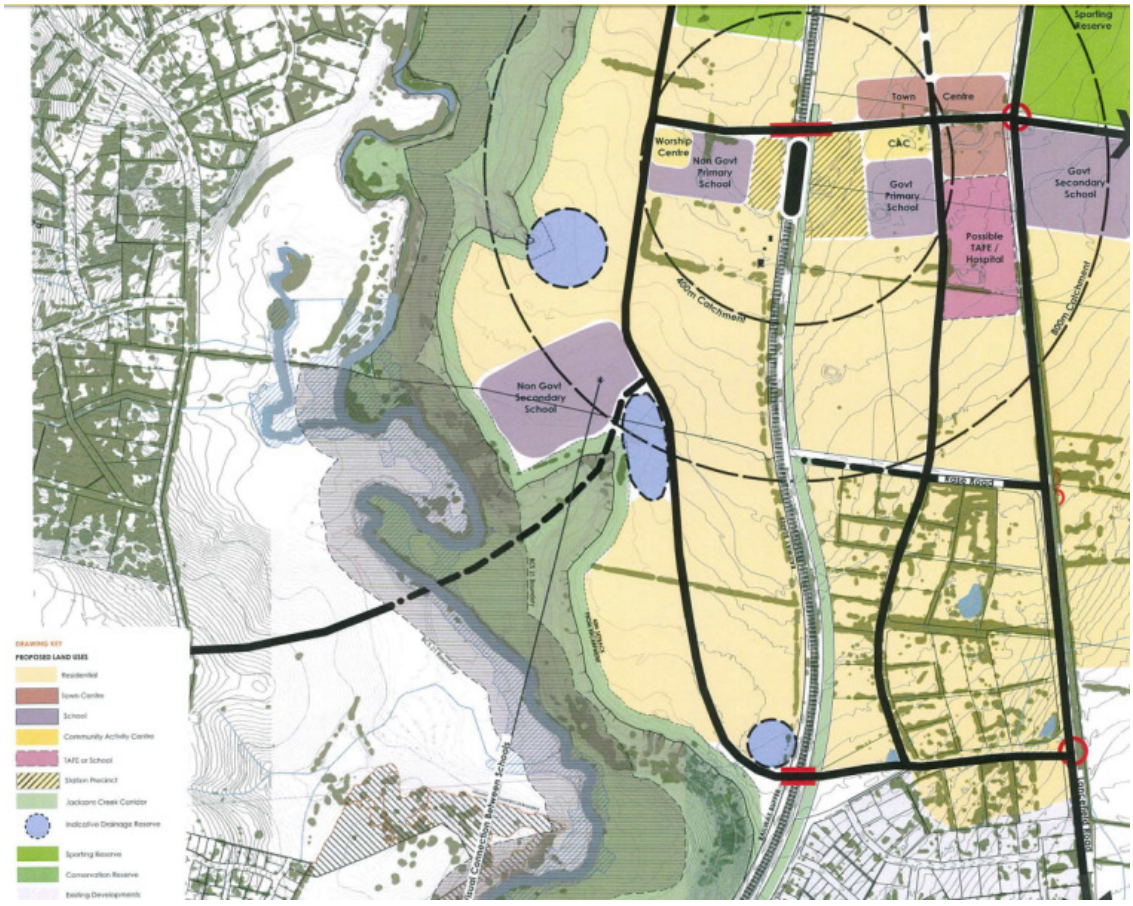


Figure 16: Preferred location for the Salesian campus site

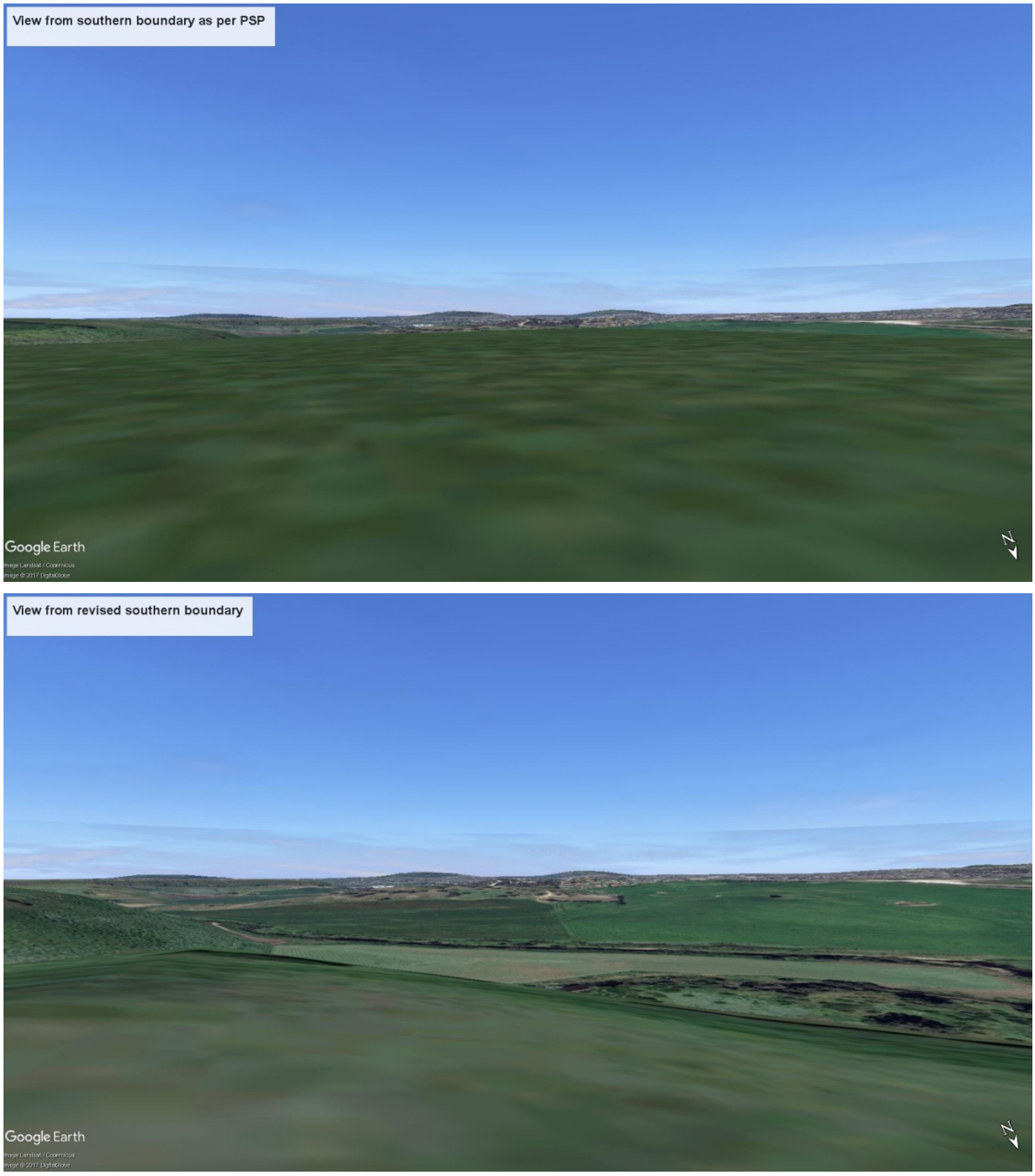


Figure 17: Line of sight for the non-government school site

6.3 Recommendation

The functional design of the alternative configuration for asset WI-05 responds to the agreed Elizabeth Drive alignment and allows the asset to be sited sympathetically to natural topography and therefore optimise the potential land budget footprint for the drainage reserve. However in my opinion the analysis showed that the proposed alternative configuration provides a marginal land budget efficiency gain (ie 8%) compared to the exhibited PSP.

However the alternative configuration for asset WI-05 is more consistent with enabling the objectives and vision for the proposed Salesian campus to be realised.

Given that the functional design has demonstrated that the alternative configuration is technically sound, I recommend that consideration be given to amending the PSP and Melbourne Water's Devon Park DSS to reflect the alternative configuration as presented in this evidence.

7 Lancefield Road PSP - Assets Wl-01,Wl-02,Wl-03,Wl-04,Wl-08

Villawood Properties manage the land referred to in the Lancefield Road PSP as property 1 and 2. The portion of property 1 and 2 that is located on the eastern side of Jacksons Creek is referred to as the "Raes Road site".

Within the Raes Road site there are numerous stormwater assets (ie six) labelled in the PSP. Section 7 of my evidence report focuses on the following (refer to Figure 18):

- Asset Wl-01, which is a "sediment basin" referred to as SB9B in Melbourne Water's Devon Park DSS
- Asset Wl-02, which is a "wetland" referred to as WL9 in Melbourne Water's Devon Park DSS
- Asset Wl-03, which is a "sediment basin" referred to as SB9A in Melbourne Water's Devon Park DSS
- Asset Wl-04, which is a "wetland" referred to as WL10 in Melbourne Water's Devon Park DSS
- Asset Wl-08, which is a "wetland" referred to as WL12 in Melbourne Water's Devon Park DSS

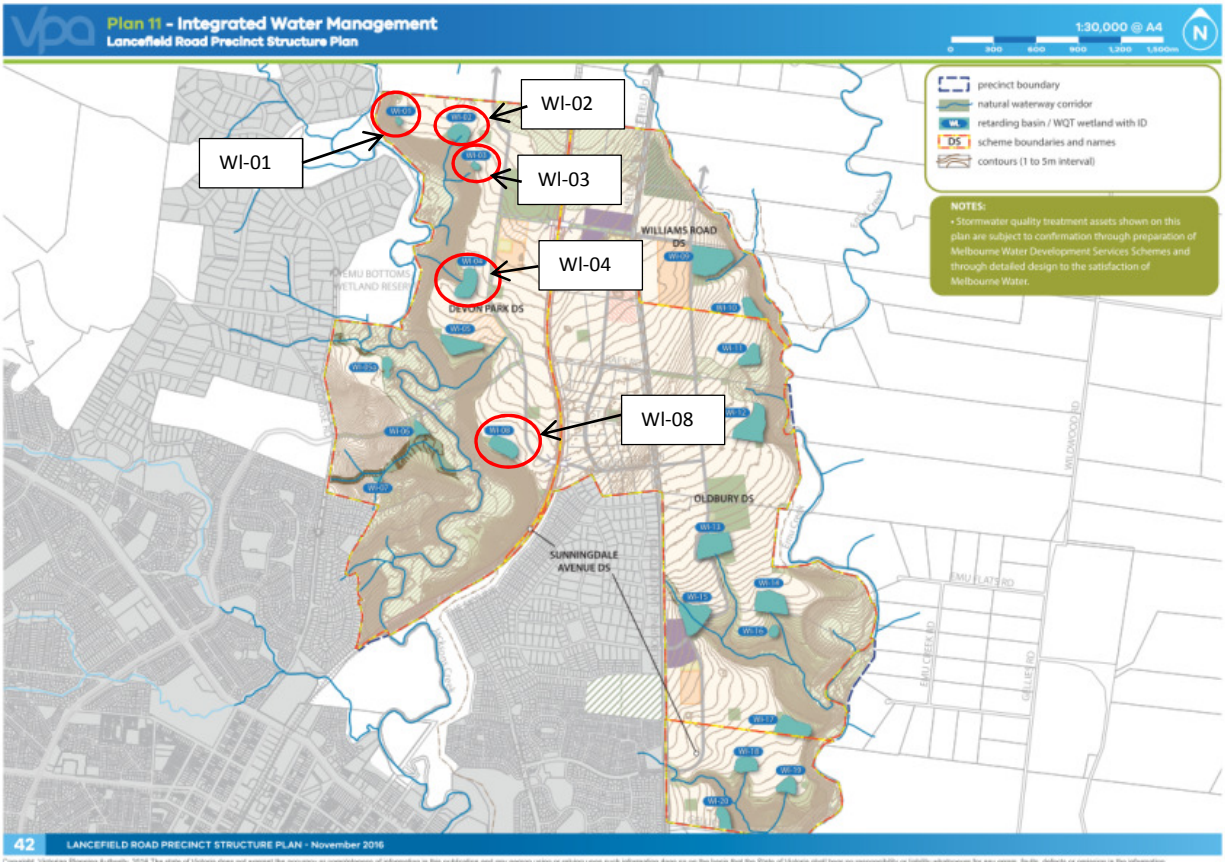


Figure 18: Location of subject assets in the Lancefield Road PSP (red line)

7.1 The issue

The exhibited PSP has been informed by Melbourne Water's Devon Park Development Services Scheme (DSS). Since exhibition Melbourne Water have completed additional assessments with regard to assets Wl-01,Wl-02,Wl-03,Wl-04 and Wl-08 which has resulted in the land budget for these drainage reserves increasing substantially.

As part of my evidence I have been briefed to review the change in these land budgets. The scope of the review was not to suggest alternative locations for the assets but to advise whether the increase in size is reasonable.

7.2 Review

I understand that since exhibition of the PSP, Melbourne Water has continued to refine the Devon Park DSS. In particular I am aware that Melbourne Water identified key assets to take to functional design that were in their opinion complex, high risk and high cost. It is my understanding that this was the case for WI-01, WI-02, WI-03, WI-04 and WI-08.

Based upon these functional designs Melbourne Water recently provided an updated plan of the drainage reserves required for the assets (refer to Figure 19). When comparing Figure 19 to the exhibited PSP (see Figure 18) it is clear that the footprint has significantly increased. This is highlighted in Figure 20 which shows that the footprint for asset WI-04 has increased by 54%.

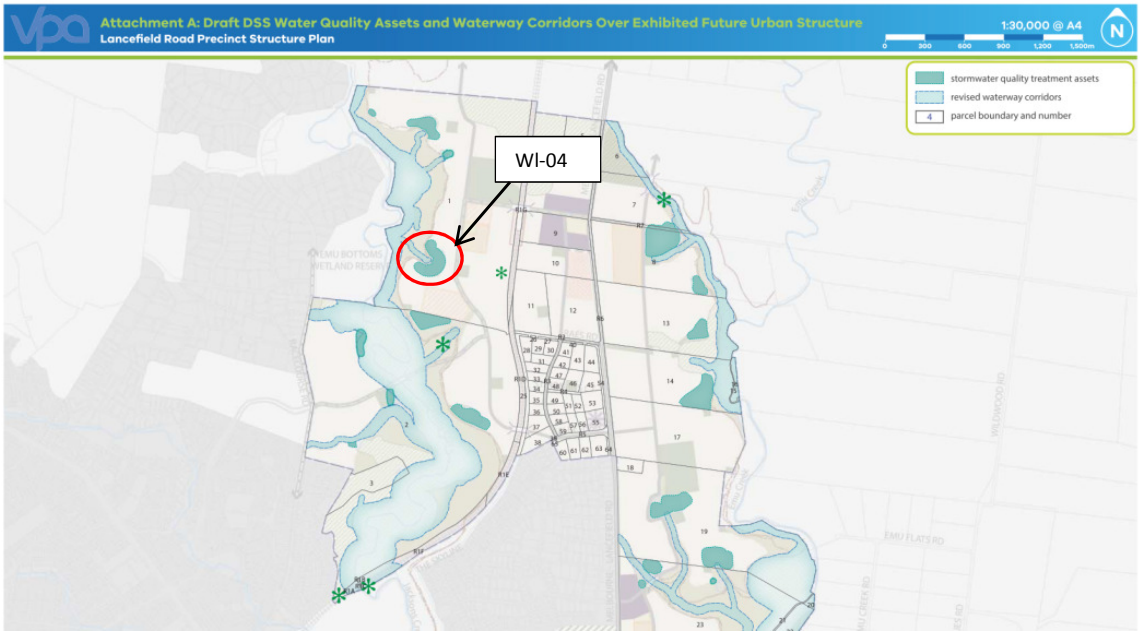


Figure 19: Updated DSS plan post exhibition

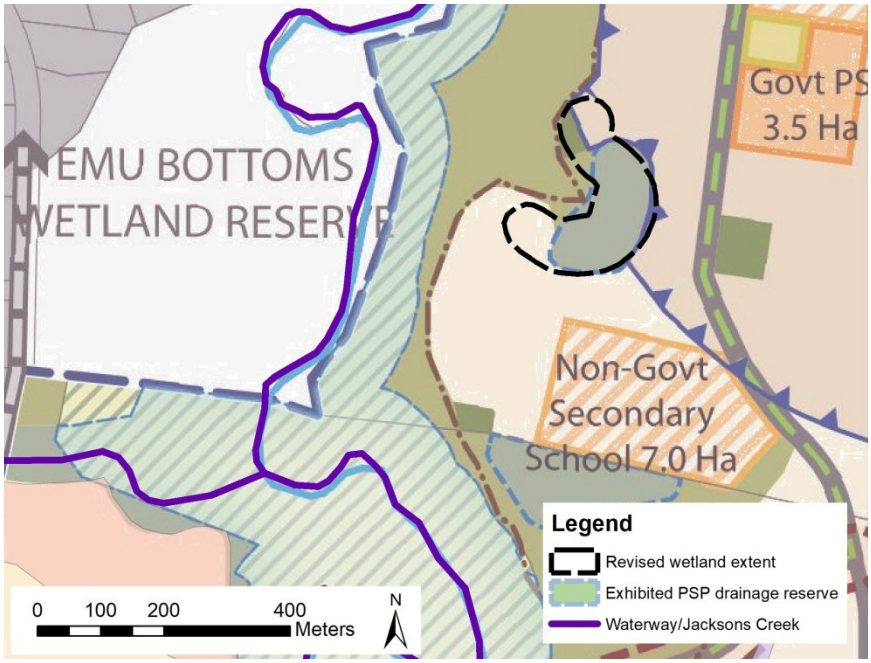


Figure 20: Comparison footprint of WI-04 between exhibited plan and updated DSS

There is no suggestion as part of my review to propose alternative locations for these key DSS assets. Therefore in my opinion the preparation of alternative functional designs for such complex systems is not warranted. What is relevant is to review the assumptions and design parameters that have been adopted in the Melbourne Water functional designs to determine if there are any opportunities to minimise the "land take". This would include:

- The extended detention depth
- The batter slopes
- Diversion flows and pipelines
- Catchments contributing to each asset and whether certain wetlands are linked the sediment basins or "over-treating" to compensate for the reduced sediment basin treatment
- Sizing of the sediment pond
- The storage (if any) proposed to mitigate flows and its relationship to the outfall pipeline

The above information was requested of Melbourne Water (ie functional design plans and functional design reports) but it had not been received at the time of writing this evidence report. It is possible that the proposed footprints are appropriate, however it is not possible to make an informed opinion regarding the "reasonableness" of these complex systems without the detail of functional design information that they were based upon.

8 Sunbury South PSP – Shepherds Lane DSS – Asset Wl-15

Villawood Properties manage the land referred to in the Sunbury South PSP as property 61, 63-69. Collectively, these properties are referred to as the "Redstone Hill" development. Property 61 is bound on the eastern side by Shepherds Lane, with a small private property (property 62 in the PSP) owned by Western Water located at the junction of Shepherds Lane and Sunbury Road.

Melbourne Water's Shepherds Lane Development Services Scheme (DSS) has been used to inform the Sunbury South PSP. The DSS stipulates a stormwater treatment asset labelled in the PSP as asset Wl-15, which is a combined "wetland and retarding basin" referred to as WLRB1 in the Shepherds Lane DSS (refer Figure 21 below).

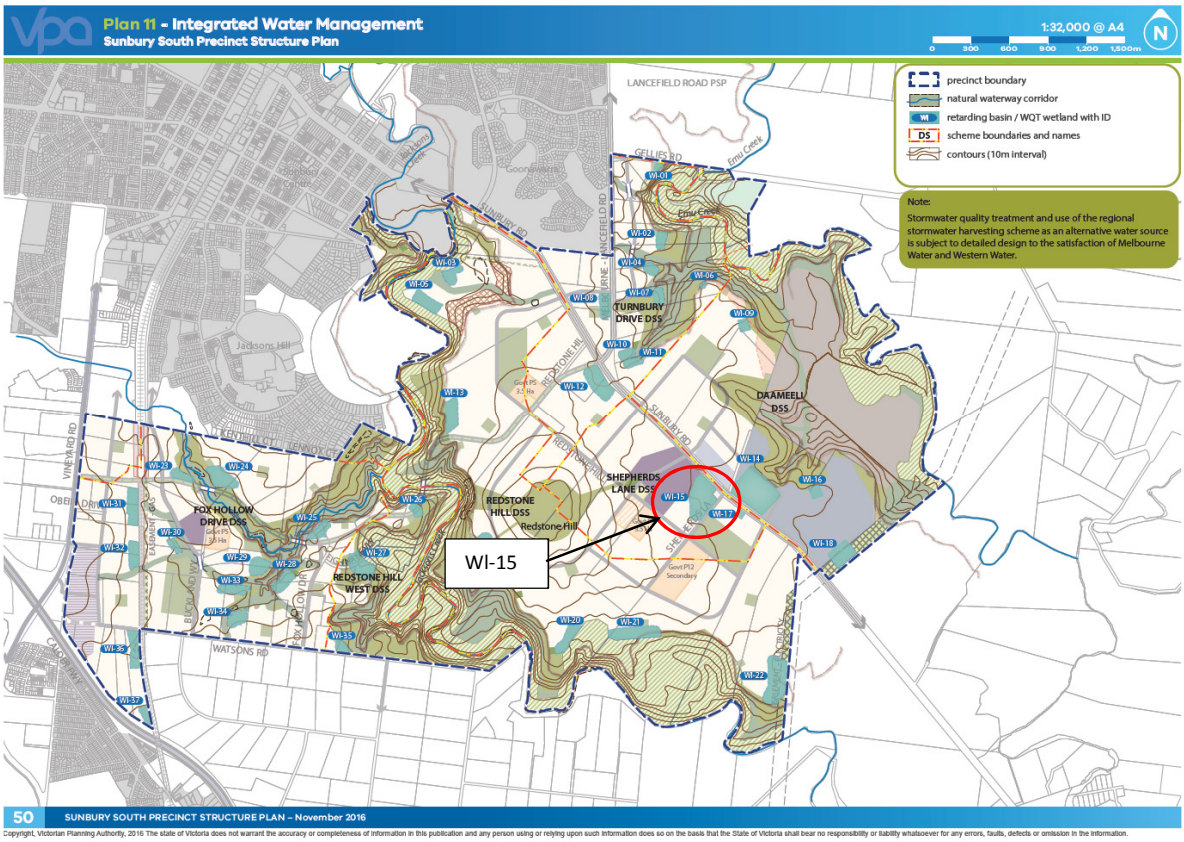


Figure 21: Location of asset Wl-15 in the Sunbury South PSP (red line)

8.1 The issue

Villawood has submitted a Section 96A application for the Redstone Hill development, to be considered concurrently with the Sunbury South PSP. A large portion of the 96A permit includes land serviced by the Shepherds Land DSS. However in February 2017, Melbourne Water submitted an objection to the permit, citing "the footprint area of stormwater treatment assets in the Redstone Hill subdivision masterplan layout is not large enough to treat stormwater to best practice". As highlighted in Figure 5 of their response, the key point was:

- "Based on modelling and calculations undertaken by Melbourne Water, the area of land the (sic) required for Wl-15 is 5.33 Ha (as shown in Table 9 of the exhibited Sunbury South PSP). Based on the application submitted, no provision has been made for the required asset in the subdivision masterplan."

As a result I have reviewed Melbourne Water's highlighted objection and proposed an alternative configuration for asset WI-15 to suit the proposed 96A permit application and Melbourne Water's objectives. It is noted that Melbourne Water's scheme, in this location, has only been informed by a high level concept design. My review (refer to section 8.2) has been informed by a functional design in accordance with Melbourne Water's standards and requirements.

8.2 Alternative strategy and configuration

The footprint and layout of the asset WI-15 has been optimised to accommodate Villawood's 96A permit application and Melbourne Water's objectives for stormwater quality and quantity. In developing this solution I undertook the following analysis and investigations to inform the design of the revised asset layout:

- Site inspection
- Consideration of topography (survey, contours), feature survey and known physical or infrastructure constraints
- Used a hydrologic model (RORB) supplied by Melbourne Water to determine the required flood attenuation volumes up to the 100 year ARI event.
- Created a MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model to establish the proposed treatment train strategy in accordance with Melbourne Water's *MUSIC Guidelines*. The model estimates the amount of pollutants the catchment produces, the performance of treatment measures and the pollutant load generated once the catchment is treated.
- Preliminary functional design in accordance with Melbourne Water's Final Draft *Design, Construction and Establishment of Constructed Wetlands: Design Manual*

The proposed solution is demonstrated in Figure 23 below. The drainage reserve area shaded green in Figure 23, as shown in Melbourne Water's DSS concept design, has been redistributed to the south west (shown in orange) in the proposed wetland/basin site. This alternate wetland/retarding basin footprint accommodates Villawood's 96A permit boundary whilst achieving Melbourne Water's objectives for the original asset.

Catchment hydrology

The total upstream catchment of the proposed wetland/basin is approximately 123.3 ha based on the current Melbourne Water DSS layout. However, the proposed Villawood development layout is very likely to grade an additional 5.0 ha of residential land west toward to the Turnberry Drive DSS treatment asset. As such, this allowance has been made to the design of the proposed wetland and the resulting total catchment extent is 118.3ha. Figure 22 shows the catchment plan for the proposed wetland.

The natural catchment is also shown in Figure 4, crossing Sunbury Road. Note that an additional treatment asset, a sediment basin (SB1 in the DSS) – positioned to the south-east of Villawood's property – is shown in the DSS as part of the overall stormwater quality and quantity management strategy for the entire catchment. Although the role and function of the SB1 asset is considered in the water quality and quantity design, the functional design of the larger wetland system on Villawood's landholding (WL-15) is the subject of this report. The total catchment contributing to the wetland system (WI-15) addressed in this report is 98.1 ha.

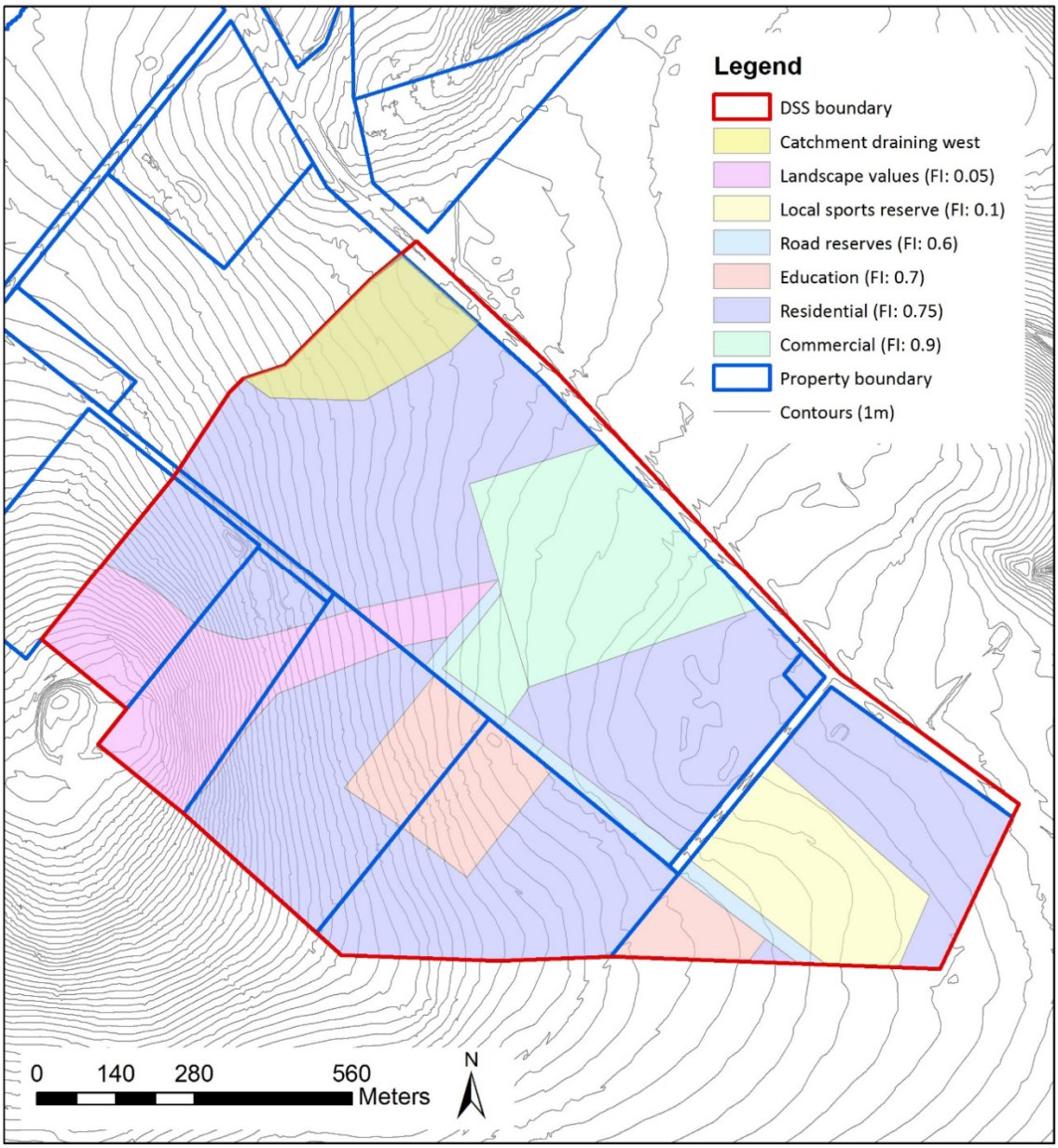


Figure 22: Catchments contributing to the proposed wetland.

Functional design

I understand that a key principle for the Shepherds Lane DSS is that all stormwater, at Sunbury Road, is to be treated to best practice before being discharged to Jacksons Creek. These targets are:

- 70% removal of the total Gross Pollutant load
- 80% removal of total Suspended Solids (TSS)
- 45% removal of total Nitrogen (TN)
- 45% removal of total Phosphorus (TP)

Functional designs have been completed based upon Melbourne Water's current MUSIC Guidelines and draft Constructed Wetlands Manual. Full details are provided in Attachment C.

The Shepherds Lane DSS includes an additional sediment basin (SB1) as a treatment asset south-east of WLRB1. In line with previous concept design work and in accordance with the layout of Melbourne Water's Shepherds Lane DSS, the majority of the treatment is provided within the proposed wetland upstream (ie WL-15) of Shepherds Lane within the Villawood site. This wetland asset "overtreats" its natural catchment to compensate for the reduced treatment provided by the sedimentation only asset downstream (ie SB1).

Due to the natural topography of the catchment and the future subdivisional drainage layout, the most practical and feasible design approach for the wetland (Wl-15) is to split the treatment train into two separate units. Incoming drainage from the "south" and "west" catchments outfall to individual sediment basins. Stormwater is treated separately and recombines at the outlet ponds from the dual fed wetland system. Although technically two separate systems, the wetland configuration is designed to minimise overall footprint and combine outlet and drainage infrastructure, where practical.

The key difference between the stormwater assets exhibited PSP and the alternative configuration identified in my evidence report are as follows:

- The wetland layout and hence total footprint of the asset has been optimised to accommodate the 96A permit boundary. This includes a slight restructure of the footprint southward.
- The treatment asset is split into two separate wetlands. A larger "south" wetland treats a relative larger area of the catchment. A system configured as a single wetland with dual inputs (as suggested by the PSP) would likely be unfeasible given natural surface topography and future subdivisional drainage layout. The change to system configuration also leads to a reduction in required treatment area and total asset footprint.

The configuration of the revised treatment train (wetlands and sediment basins) is provided in Table 9. Overall performance is given in Table 10, demonstrating the design meets best practice targets.

Table 9: Treatment asset parameters.

	Wetland "south"	***Sediment basin "south"***	***Wetland "west"***	***Sediment basin "west"***
NWL area, m^2	*14,000*	*1,100*	*8,000*	*800*
Average depth, m	0.4	1.0	0.4	1.0
Extended detention, m	0.35	0.35	0.35	0.35
Extended detention time (hours)	72		72	

Table 10: Overall treatment train performance.

Parameter	**Total sources**	**Residual load**	**Percent removed (%)**
Flow (ML/yr)	378	348	8
Total Suspended Solids (kg/yr)	73700	15000	80
Total Phosphorus (kg/yr)	151	49	68
Total Nitrogen (kg/yr)	1080	593	45
Gross Pollutants (kg/yr)	14300	11	100

Following a hydrologic assessment of Emu Creek, it was concluded that any additional flows from the Shepherds Lane DSS would not exacerbate downstream flooding issues. As such, there is no requirement to

retard flows discharging into Emu Creek. However, a retarding basin is required to attenuate concentrated flows at the wetland outlet (Wl-15) where the natural catchment outfall crosses Sunbury Road.

The existing Villawood site drains through the Western Water tank site and the external property to the south before crossing Sunbury Road via twin 600mm by 1200mm culverts. The invert level of the existing culverts is less than one metre below Sunbury Road. The future design of the WLRB1 needs to provide 100-year ARI flood protection to the Western Water tanks site.

The key requirement of the Shepherds Lane DSS is that the peak 100-year ARI developed flow at Sunbury Road is less than 4.8 m^3/s. To achieve this outcome, the DSS concept design for WL-15 incorporated the following characteristics:

- A wetland system in the base of basin with a Normal Water Level at RL 196.08
- 100-year storage volume of 46500 m^3 at WLRB1
- 100-year flood level of RL 197.25
- The lowering and upgrade of culverts under Sunbury Road as the existing infrastructure will not be able to be utilised as they will be too shallow compared to the depth of the future subdivisional drainage network.
- Overall drainage reserve area of 5.325ha

Villawood's proposed 96A permit layout and the proposed wetland configuration has been modelled in RORB to inform the retarding basin design. These modelling results are presented in Table 11 and Table 12, demonstrating the proposed alternate design meets the original objectives of the DSS for flow attenuation.

Table 11. RORB Modelling Results for Wl-15

Shepherds Lane RB (Wl-15)	Peak outflow from Wl-15	Peak developed flow at Sunbury Road	Existing peak flow at Sunbury Road
100 year ARI	3.15 m^3/s, 12hr	4.58 m^3/s, 12hr (3.74 m^3/s, 2hr)	4.8 m^3/s

Table 12. Wl-15 Details

Retarding Basin No.	Basin Name	Total RB Area (ha)	Peak Storage Level (mAHD)	Peak Storage (m^3)	Outlet Dimensions
Wl-15	Shepherds Lane RB	5.13	196.75	53,300	Side winding penstock at RL 195.0 1200mm pipe at RL 195.35

A comparison of the proposed alternative configuration of the wetland assets and the exhibited PSP (Melbourne Water DSS) are shown in Figure 23. I note that in my experience it is common for designs at the permit application stage (completed to a functional standard) to be more advanced, and hence differ slightly from higher-level concept designs completed during establishment of the DSS.

Figure 24 shows the functional layout of the alternative designs for Wl-15.

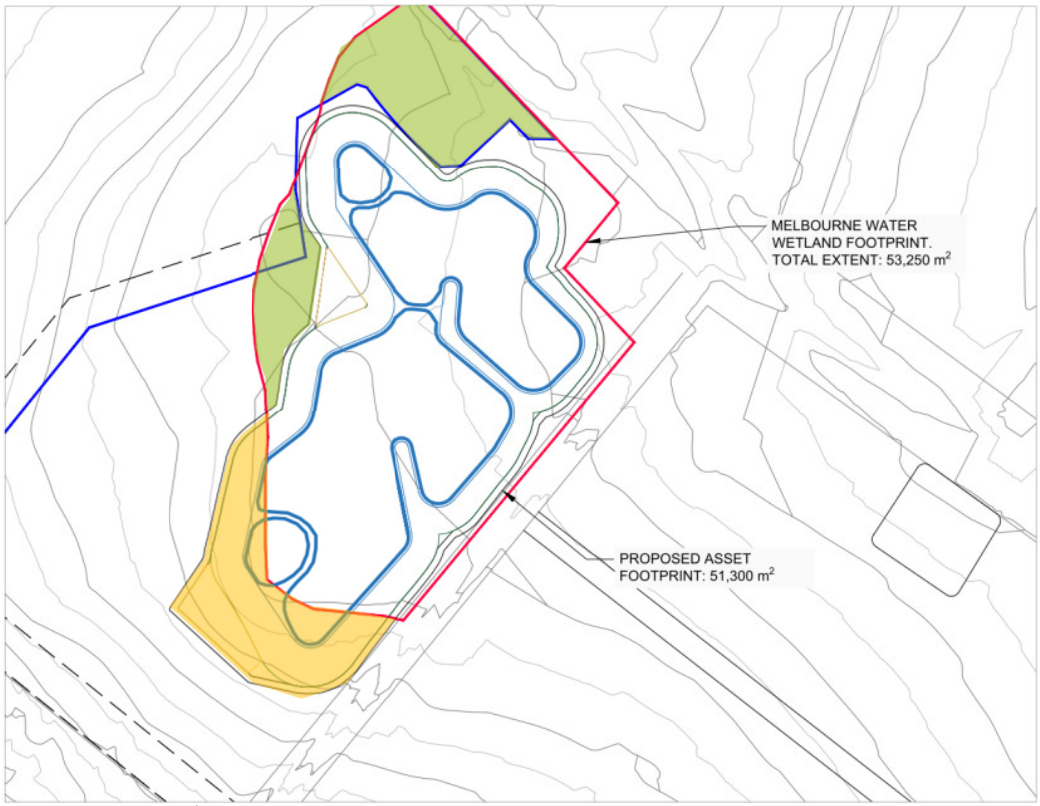


Figure 23: Wetland/retarding basin asset WI-15 – DSS reserve versus Villawood 96A layout

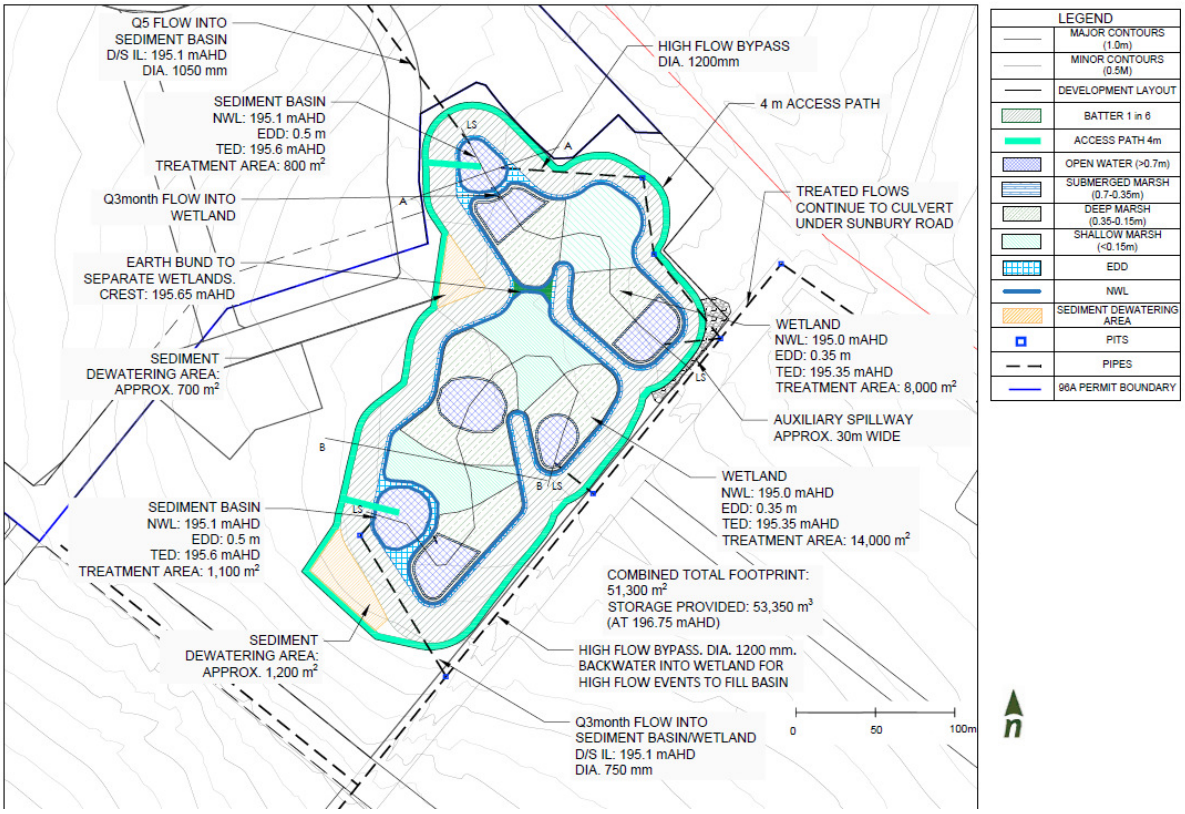


Figure 24: *Plan view of designed wetland structure*

As described above and shown in Figure 24, the total revised treatment asset footprint can be accommodated with Villawood's 96A permit boundary. The revised asset meets Melbourne Water's original objectives for Shepherds Lane DSS in providing water quality and quantity treatment. Therefore in my opinion the original objection raised by Melbourne Water's has now been satisfied.

8.3 Recommendation

In my opinion the functional design for the alternative design has demonstrated that the wetland and retarding basin can adequately fit within the proposed 96A permit plan boundary. This alternative design is simply a slight reconfiguration of the Melbourne Water DSS arrangement in order to respond to the urban design and subdivisional layout. The alternative design has been informed by a functional design, which provides more detailed analysis and investigation than the concept design undertaken for Melbourne Water's.

The alternative configuration for asset WI-15 is:

- technically sound
- has a reduced overall footprint
- can deliver on the best practice stormwater quality targets
- achieves required flow attenuation
- accommodates Villawood's proposed 96A permit boundary; and
- is more efficient from a land budget perspective.

The overall footprint for the WL-15 drainage reserve proposed in the alternative design is 5.13ha compared to Melbourne Water's 5.325ha. It is worth noting that the Wl-15 asset is not contained within the 96A permit area. However a small portion of the northern drainage reserve boundary is defined by the 96A permit application. As a result there is still some flexibility, via a future permit application, to further define the western drainage reserve boundary of the proposed asset.

As a result I believe that the 96A permit plan should be acceptable from a drainage perspective.

9 Sunbury South PSP – Turnberry Drive DSS – Asset Wl-12

Villawood Properties manage the land referred to in the Sunbury South PSP as property 61, 63-69. Collectively, these properties are referred to as the "Redstone Hill" development.

Melbourne Water's Turnberry Drive Development Services Scheme (DSS) has been used to inform the Sunbury South PSP. The DSS stipulates a stormwater treatment asset labelled in the PSP as asset Wl-12, which is a combined "wetland and retarding basin" referred to as WLRB1 in the Turnberry Drive DSS (refer Figure 25 below). Asset Wl-12 is shown in the PSP to be split across property 61 (Villawood) and property 60.

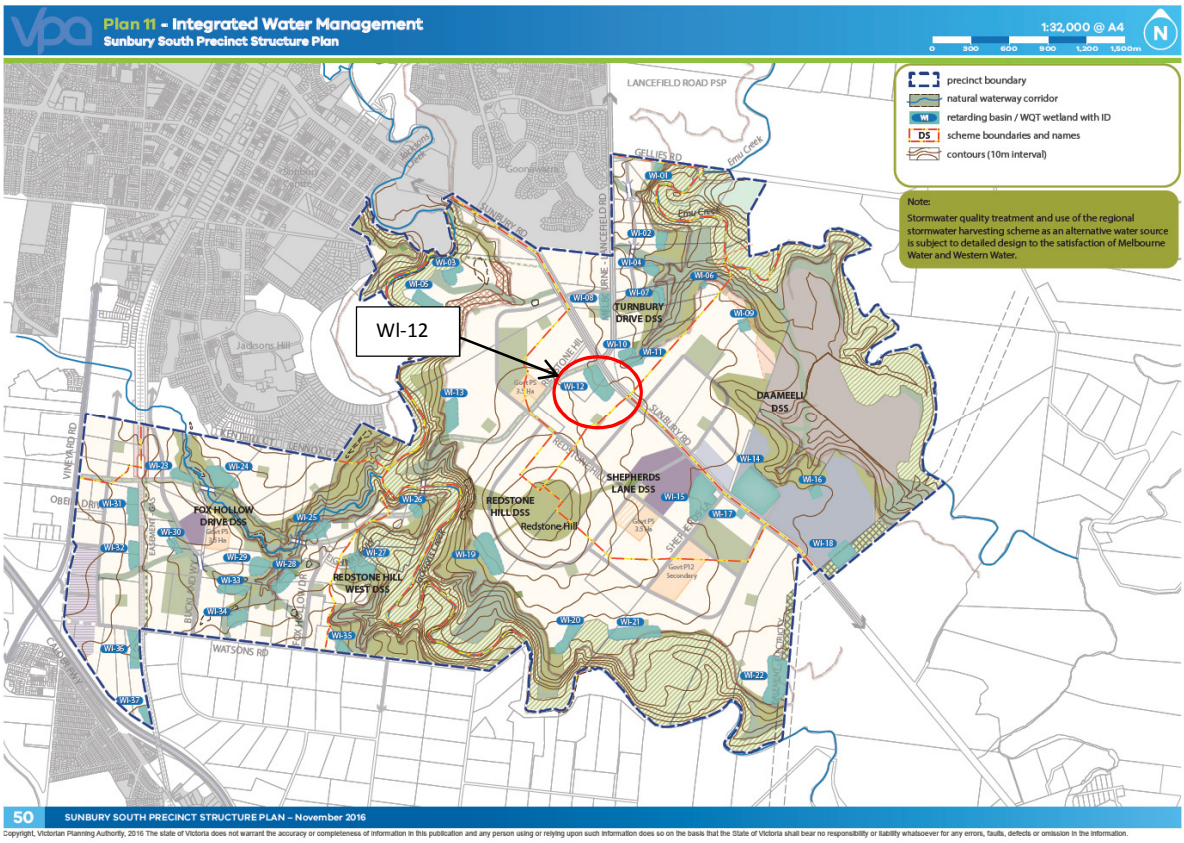


Figure 25: Location of asset Wl-12 in the Sunbury South PSP (red line)

9.1 The issue

Villawood has submitted a Section 96A application for the Redstone Hill development, to be considered concurrently with the Sunbury South PSP. A portion of the 96A permit includes land serviced by the Turnberry Drive DSS. However in February 2017, Melbourne Water submitted an objection to the permit, citing "the footprint area of stormwater treatment assets in the Redstone Hill subdivision masterplan layout is not large enough to treat stormwater to best practice". As highlighted in Figure 2 of their response, the key point was:

- "Based on modelling and calculations undertaken by Melbourne Water, the land area required for WI-12 is 3.62 Hectares (as shown in Table 9 of the exhibited Sunbury South PSP). Based on the application submitted, only 1.25 Ha has been provided for drainage. This is unacceptable."

As a result I have reviewed Melbourne Water's highlighted objection and proposed an alternative configuration for asset WI-12 to suit the proposed 96A permit application and Melbourne Water's objectives. It is noted that Melbourne Water's scheme, in this location, has only been informed by a high level concept

design. My review (refer to section 9.2) has been informed by a functional design in accordance with Melbourne Water's standards and requirements.

9.2 Alternative strategy and configuration

The footprint and layout of the asset WI-12 has been optimised to accommodate Villawood's 96A permit application and Melbourne Water's objectives for stormwater quality and quantity. In developing this solution I undertook the following analysis and investigations to inform the design of the revised asset layout:

- Site inspection
- Consideration of topography (survey, contours), feature survey and known physical or infrastructure constraints
- Used a hydrologic model (RORB) supplied by Melbourne Water to determine the required flood attenuation volumes up to the 100 year ARI event.
- Created a MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model to establish the proposed treatment train strategy in accordance with Melbourne Water's *MUSIC Guidelines*. The model estimates the amount of pollutants the catchment produces, the performance of treatment measures and the pollutant load generated once the catchment is treated.
- Preliminary functional design in accordance with Melbourne Water's Final Draft *Design, Construction and Establishment of Constructed Wetlands: Design Manual*

The proposed solution is demonstrated in Figure 26 below. The drainage reserve area shaded green in Figure 27, as shown in Melbourne Water's DSS concept design, has either been redistributed to the east (shown in orange) or identified as a "saving" in land footprint. This alternate wetland/retarding basin footprint accommodates Villawood's 96A permit boundary whilst achieving Melbourne Water's objectives for the original asset.

Catchment hydrology

The total upstream catchment of the proposed wetland is approximately 48.0 ha based on the current Melbourne Water DSS layout. However, the proposed Villawood development layout is very likely to grade an additional 5.0 ha of residential land toward to the Turnberry Drive treatment asset. As such, this allowance has been made to the design of the proposed wetland. Figure 26 shows the catchment plan for the proposed wetland.

An existing 1050mm pipe is located at Sunbury, which is located in-line with the boundary between property 60 and 61. There is a natural low point depression within this region.

Broadly, there are two main catchments in the study area, to the east and west of the natural drainage outfall, and separated by the existing property boundary. As the proposed wetland design will be a dual inlet configuration, design flows are calculated for the eastern and western sub-catchments separately.

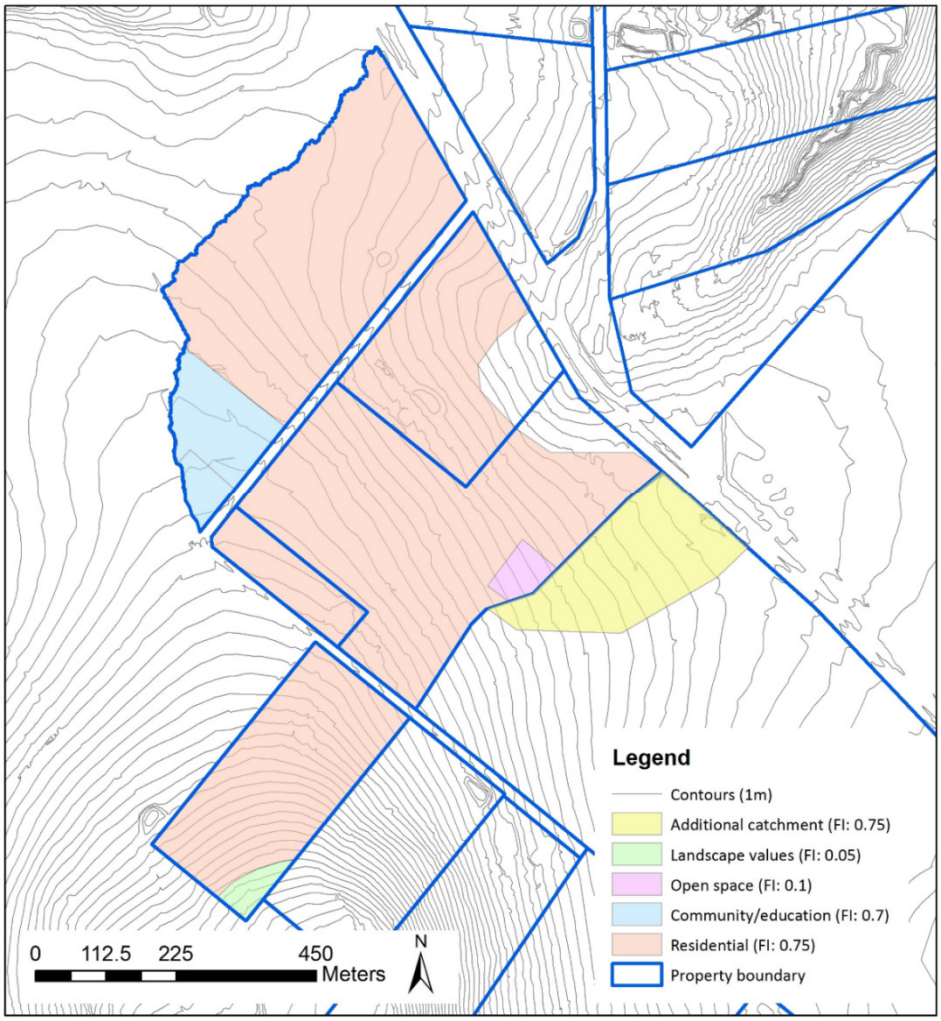


Figure 26: Catchments contributing to the proposed wetland.

Functional design

I understand that a key principle for the Turnberry Drive DSS is that all stormwater, at Sunbury Road, is to be treated to best practice before being discharged to Jacksons Creek. These targets are:

- 70% removal of the total Gross Pollutant load
- 80% removal of total Suspended Solids (TSS)
- 45% removal of total Nitrogen (TN)
- 45% removal of total Phosphorus (TP)

Functional designs have been completed based upon Melbourne Water's current MUSIC Guidelines and draft Constructed Wetlands Manual. Full details are provided in Attachment D.

The significant landscape constraints in the form of very steep grades at the proposed site lead to a large overall asset footprint for a given treatment area. Due to the natural topography of the catchment and the future subdivisional drainage layout, the most practical and feasible design approach for the wetland (WI-12) is to provide a "dual feed" wetland system. Incoming drainage from the "east" and "west" catchments outfall to individual sediment basins. Flows form the sediment basins then feed the wetland and recombine at the outlet pond in the wetland. The location of the outlet pond from each sediment basin is proportionally weighted according to the incoming catchment. This type of wetland configuration is designed to minimise overall footprint by minimising the asset width and in turn the batter extents (i.e. land budget) given the relatively steep topography.

The key difference between the stormwater assets exhibited PSP and the alternative configuration identified in my evidence report are as follows:

- The proposed design uses an extended detention depth (EDD) of 0.5m for both macrophyte zone and sediment basin, whereas the DSS has adopted 0.35m. Whilst Melbourne Water's Constructed Wetlands Manual does not prevent the use of an extended detention depth of greater than 0.35m, it requires a water level frequency analysis to be undertaken to ensure an appropriate suite of plant species (at least three) are available for the various shallow and deep macrophyte zones. The increase in EDD provides a reduction in treatment footprint, which when coupled with steep terrain, enables some significant savings in land footprint.
- The wetland layout and hence total footprint of the asset has been optimised to accommodate the 96A permit boundary. This includes a slight restructure of the footprint southward.

The configuration of the revised treatment train (wetlands and sediment basins) is provided in Table 13. Overall performance is given in Table 14, demonstrating the design meets best practice targets.

Table 13: Treatment asset parameters.

	Wetland	***Sediment Basin***
NWL area, m^2	*9,500*	*1,120 (combined)*
Average depth, m	0.4	1.0
Extended detention, m	0.5	0.5
Extended detention time (hours)	72	

Table 14: Overall treatment train performance.

Parameter	**Total sources**	**Residual load**	**Percent removed (%)**
Flow (ML/yr)	189	176	7
Total Suspended Solids (kg/yr)	37800	7530	80
Total Phosphorus (kg/yr)	77	24	69
Total Nitrogen (kg/yr)	540	293	46
Gross Pollutants (kg/yr)	7460	0	100

A water level frequency analysis was undertaken to demonstrate that the proposed wetland with an extended detention depth of 500mm meets Melbourne Water's requirements with respect to plant heights and wetland depths. In summary, Melbourne Water's criteria is that there needs to be a minimum of three plant species suitable for the shallow marsh zones and three plant species suitable for the deep marsh zones. The proposed wetland exceeds this as follows:

- 7 potential plant species for the shallow marsh zones
- 7 potential plant species for the deep marsh zones.

Following a hydrologic assessment of Emu Creek, it was concluded that any additional flows from the Turnberry Drive DSS would not exacerbate downstream flooding issues. As such, there is no requirement to retard flows discharging into Emu Creek. However, a retarding basin is required to attenuate concentrated flows at the wetland outlet (WLRB1) where the natural catchment outfall crosses Sunbury Road.

The existing low point/depression is straddled across Villawood's northern title boundary and the property to the north. The retarding basin in this design will utilise the existing culvert and store flows upstream of Sunbury Road.

The key requirement of the Turnberry Drive DSS is that the peak 100-year ARI developed flow at Sunbury Road is retarded to the capacity of the existing 1050mm concrete pipe. The existing 1050mm pipe is located at the proposed outlet of WLRB1, with approximately 3 metre height difference from the upstream crown to the road deck. To achieve this outcome, the DSS concept design for WLRB1 incorporated the following characteristics:

- A wetland system in the base of basin with a Normal Water Level at RL 202.5
- 100-year storage volume of 26,700 m^3 at WLRB1
- 100-year flood level of RL 204.10
- Reduction of the peak 100-year ARI design flow to the capacity of the existing pipe.
- Overall drainage reserve area of 3.49ha

Villawood's proposed 96A permit layout and the proposed wetland configuration as detailed in Section 4, has been modelled in RORB to inform the retarding basin design. Earthworks, batters and volumes were modelled in 12d to determine the stage-storage relationship.
The proposed functional design of the wetland/basin design as part of the 96A application has been informed by field survey undertaken by Villawood. This survey established that the invert level of the 1050mm pipe is RL200.86 and that the top of the road is RL204.7. As this detail was not available to Melbourne Water as part of their concept design for the DSS, the proposed hydraulics associated with the capacity of the existing 1050mm have been reviewed.

The proposed design has adopted a normal water level of RL 202.0, so that the retarding basin storage is in cut. The RORB modelling results and design details for WLRB1 are presented in Table 15 and 16.

Table 15: RORB Modelling Results for Wl-12

Turnberry Drive RB (WL1RB1)	Peak outflow from WLRB1	Existing peak flow at Sunbury Road
100 year ARI	2.88 m^3/s, 12hr	3.1 m^3/s

Table 16: Wl-12 Details

Retarding Basin No.	Basin Name	Total RB Area (ha)	Peak Storage Level (mAHD)	Peak Storage (m^3)	Outlet Dimensions
WL1RB1	Turnberry Drive RB	2.91	203.12	14,000	Side winding penstock at RL 202.0 Weir crest at RL 202.50 1050mm pipe at RL 200.86

As demonstrated above the proposed design will attenuate the peak 100 year developed flow to less than the existing 100-year peak flow and significantly less than the capacity of the existing 1050mm pipe. The proposed 100-year ARI flood level in the basin is RL203.12, whereas the top of the road is RL 204.7 which would provide a theoretical pipe capacity of 4.25 m^3/s. The natural surface along the northern title boundary is around RL 203.25, therefore the wetland retarding basin will be in "cut" and not require a new embankment to be constructed. During events when the EDD is exceeded (RL 202.5), the design flows are "throttled" by the existing 1050mm pipe which then passively drowns and "back floods" the wetland and basin area.

A comparison of the proposed alternative configuration of the wetland assets and the exhibited PSP (Melbourne Water DSS) are shown in Figure 27. Under the reconfiguration, the "land savings" have been distributed across the two landholdings (shown in green). The outcome is approximately a similar percentage spilt of the drainage reserve on each landholder as in the original DSS. Some of the drainage reserve area shaded green, as shown in Melbourne Water's DSS concept design, has been redistributed to the east (shown in orange) in the proposed wetland/basin site.

I note that in my experience it is common for designs at the permit application stage (completed to a functional standard) to be more advanced, and hence differ slightly from higher-level concept designs completed during establishment of the DSS.

Figure 28 shows the functional layout of the alternative designs for WI-12.

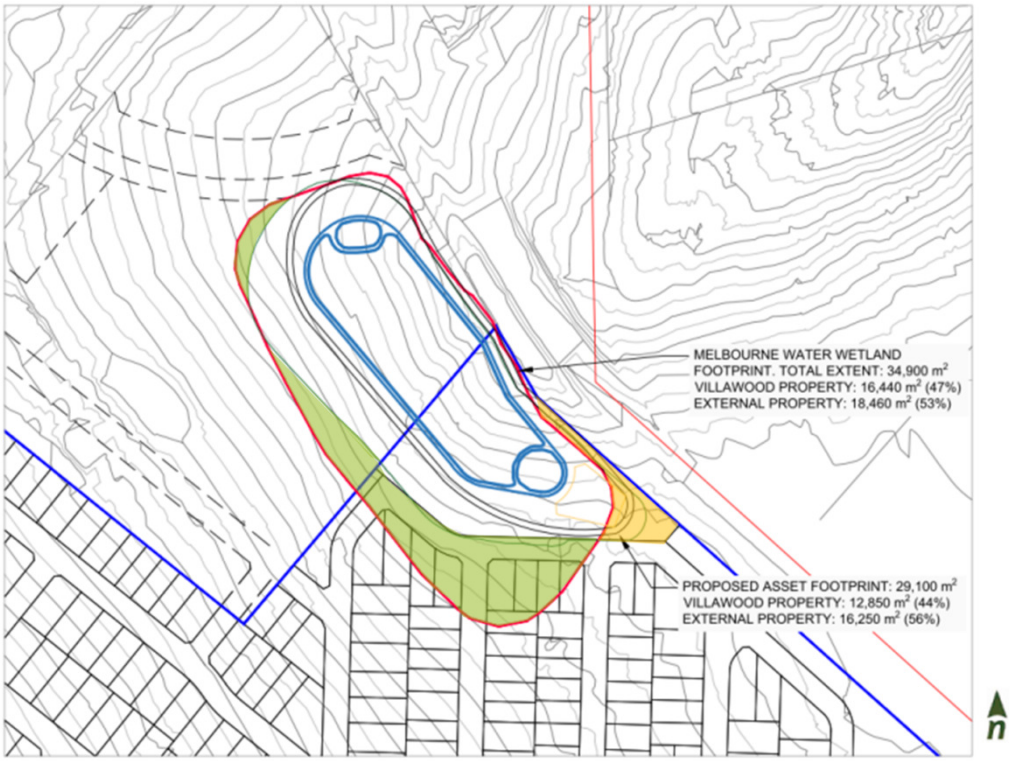


Figure 27: Wetland/retarding basin asset WI-12 – DSS reserve versus Villawood 96A layout

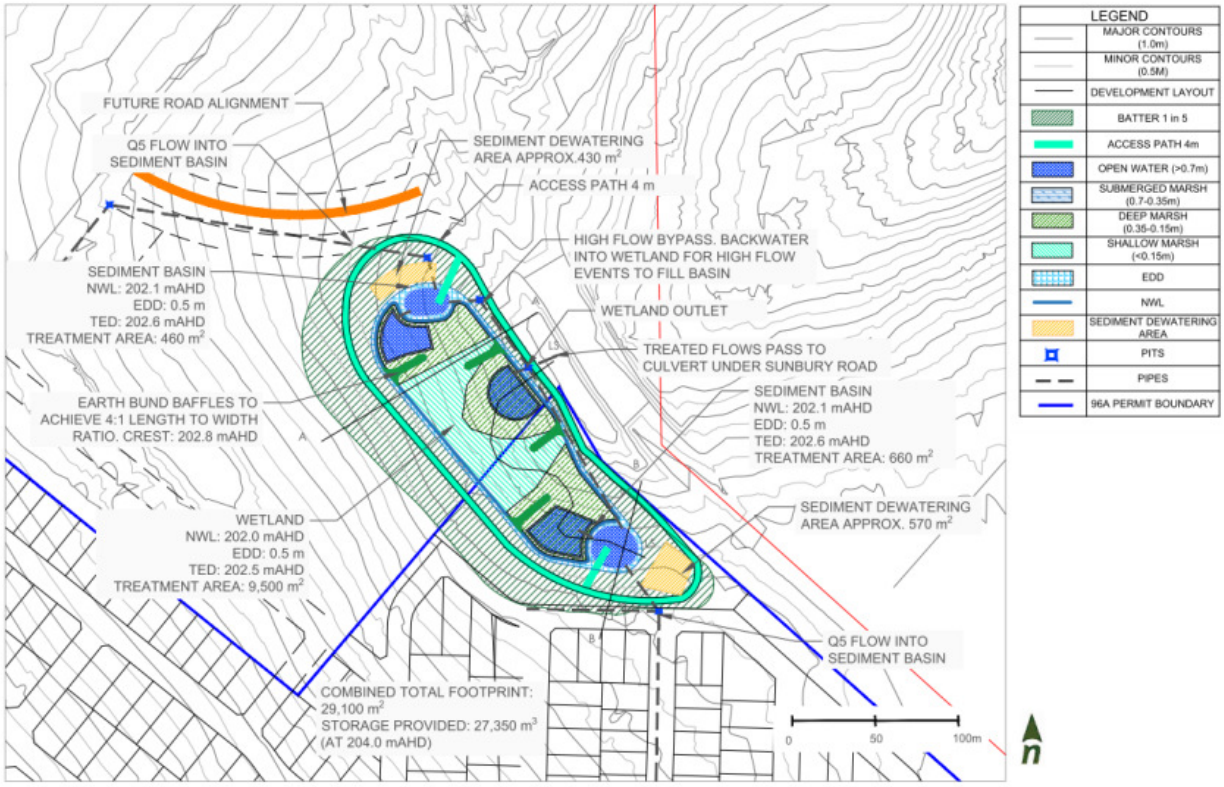


Figure 28: *Plan view of designed wetland structure*

As described above and shown in Figure 28, the total revised treatment asset footprint can be accommodated with Villawood's 96A permit boundary. The revised asset meets Melbourne Water's original objectives for Shepherds Lane DSS in providing water quality and quantity treatment. Therefore in my opinion the original objection raised by Melbourne Water's has now been satisfied.

9.3 Recommendation

In my opinion the functional design for the alternative design has demonstrated that the wetland and retarding basin can adequately fit within the proposed 96A permit plan boundary. This alternative design identified some "land footprint" saving by adopting an extended detention depth (EDD) of 500mm compared to Melbourne Water's typical value of 350mm. Given the topographic constraints and demonstration that the Melbourne Water's requirements can be met, I believe that the alternative approach for this site is appropriate. In addition to the EDD change the functional design re-configured the Melbourne Water DSS arrangement in order to respond to the urban design and subdivisional layout. The alternative design has been informed by a functional design, which provides more detailed analysis and investigation than the concept design undertaken for Melbourne Water's.

The alternative configuration for asset WI-12 is:

- technically sound
- has a reduced overall footprint
- can deliver on the best practice stormwater quality targets
- achieves required flow attenuation
- accommodates Villawood's proposed 96A permit boundary
- is more efficient from a land budget perspective
- achieves an approximately similar percentage split of the drainage reserve on each landholder a in the original DSS

The overall footprint for the Wl-12 drainage reserve proposed in the alternative design is 2.91ha compared to Melbourne Water's 3.49ha. Of this 1.285ha is proposed to be located within property 61 (Villawood) compared to 1.644ha based on Melbourne Water's DSS.

10 Sunbury South PSP – Redstone Hill DSS – Asset Wl-21

Villawood Properties manage the land referred to in the Sunbury South PSP as property 61, 63-69. Collectively, these properties are referred to as the "Redstone Hill" development.

Melbourne Water's Redstone Hill Development Services Scheme (DSS) has been used to inform the Sunbury South PSP. The DSS stipulates a stormwater treatment asset labelled in the PSP as asset Wl-21, which is a "wetland " referred to as WL7 in the Redstone Hill DSS (refer Figure 29 below). Asset Wl-21 is shown in the exhibited PSP to be located across property 68 (Villawood) and property 70, with the vast majority on property 70.

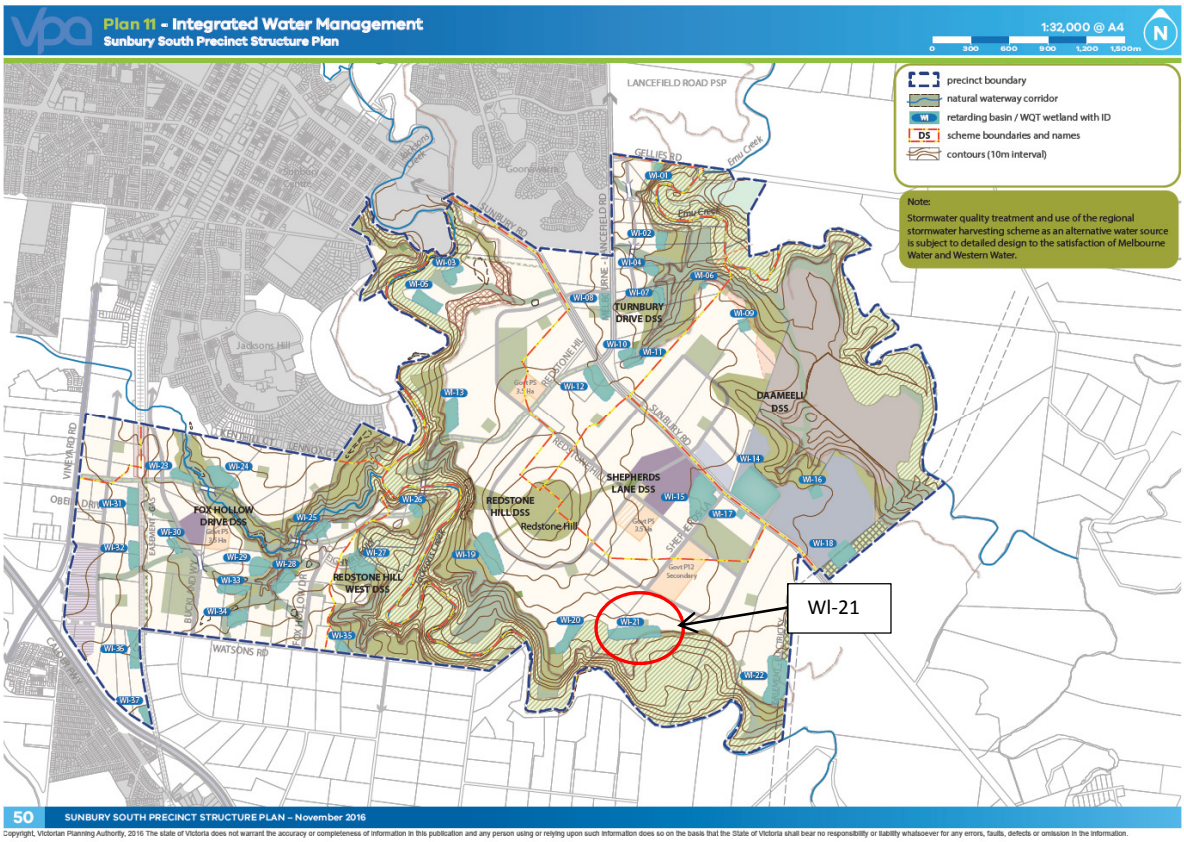


Figure 29: Location of asset Wl-21 in the Sunbury South PSP (red line)

10.1 The issue

I understand that the original work undertaken by Melbourne Water as part of the preliminary DSS identified asset Wl-21 to be located predominately on property 70 to fully maximise the developable land that could be drained to this asset. This information was used to inform the exhibited PSP. On the 9th June 2017, Melbourne Water provided Villawood with a revised shape file for asset Wl-21, which now showed Wl-21 to be located further "up-the-slope" and on Villawood's Redstone Hill site (ie property 68). It is my understanding that this change was instigated by an objective to provide water to the Growling Grass Frog (GGF) Area of Strategic Importance (ASI) site using the existing dam water level as the control. However in a verbal conversation with Aaron Dowling (Melbourne Water) in July 2017, I was advised that "following recent discussions with DELWP, it is now possible to modify the existing form of the dam and lower the water level if undertaken in accordance with DELWP's GGF Habitat design standards".

Based on the above and following previous work and investigations for concept designs for this catchment, I have undertaken a review of the proposed Wl-21 asset. This review was undertaken on the basis of site survey,

topographic and environmental constraints, and an objective to optimise the encumbered land footprint and development potential. A key objective in modifying the design was for the proposed stormwater treatment asset to provide treated water to the adjacent GGF area of strategic importance (ASI). This habitat area occupies an existing farm dam site, built up with an embankment on the southern perimeter. Figure 30 shows ASIs in conservation areas around Sunbury.

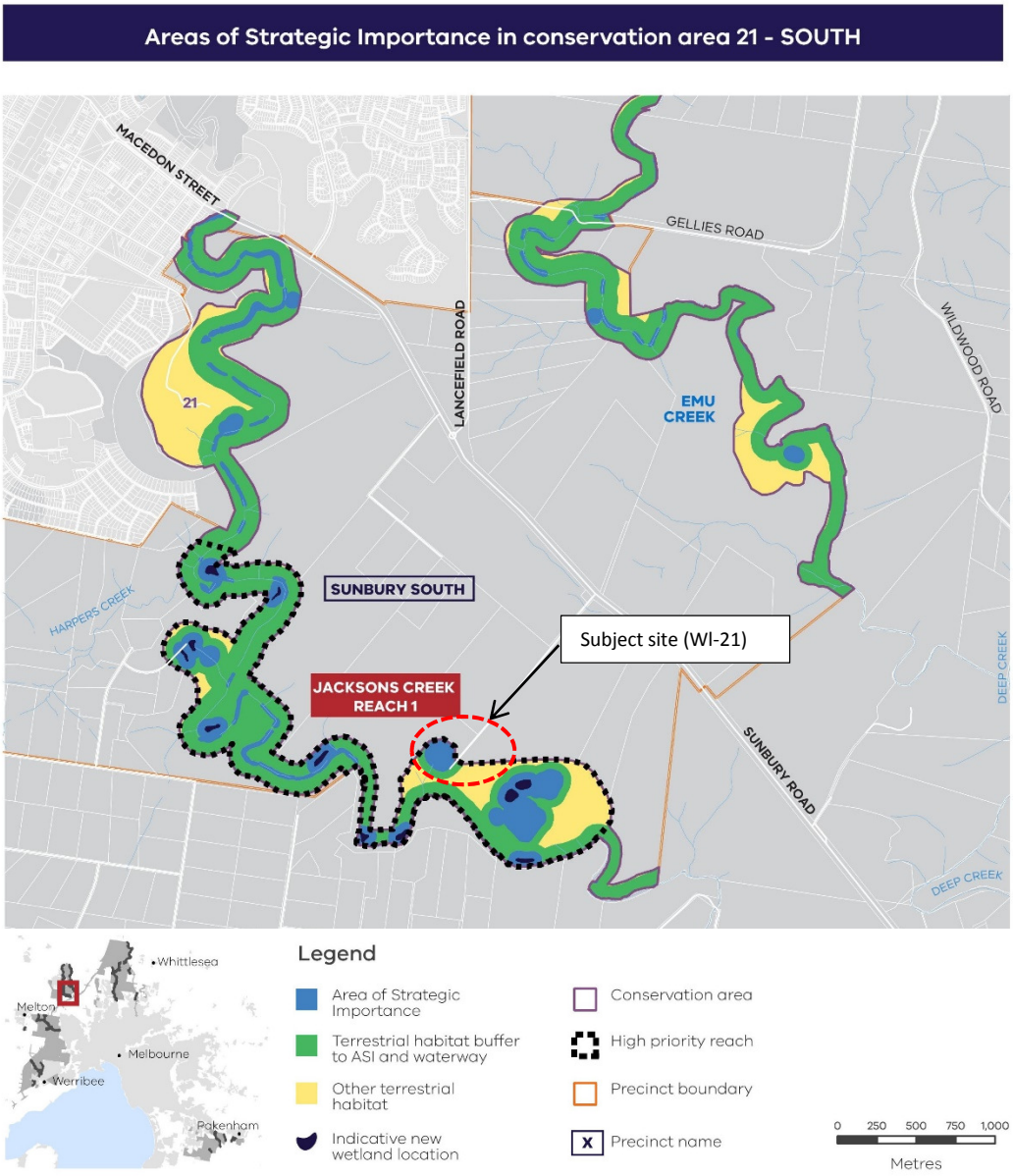


Figure 30. *GGF ASI within the vicinity of asset WI-21*

10.2 Alternative strategy and configuration

In reviewing asset WI-21 I undertook the following analysis and investigations to determine the most appropriate strategy from both a location and land budget perspective:

- Site inspection
- Consideration of topography (survey, contours), feature survey and known physical or infrastructure constraints.

- Created a MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model to establish the proposed treatment train strategy in accordance with Melbourne Water's *MUSIC Guidelines*. The model estimates the amount of pollutants the catchment produces, the performance of treatment measures and the pollutant load generated once the catchment is treated.
- Preliminary functional design in accordance with Melbourne Water's Final Draft *Design, Construction and Establishment of Constructed Wetlands: Design Manual*
- Preliminary functional design in accordance DELWP's "*Growling Grass Frog Habitat Design Standards – Melbourne Strategic Assessment (2017)"*.

Catchment hydrology

The upstream catchment of the proposed wetland is approximately 48.3 ha based on the current Melbourne Water DSS layout. Figure 31 shows the catchment plan for the proposed wetland. The existing terrain in the catchment is significantly steep.

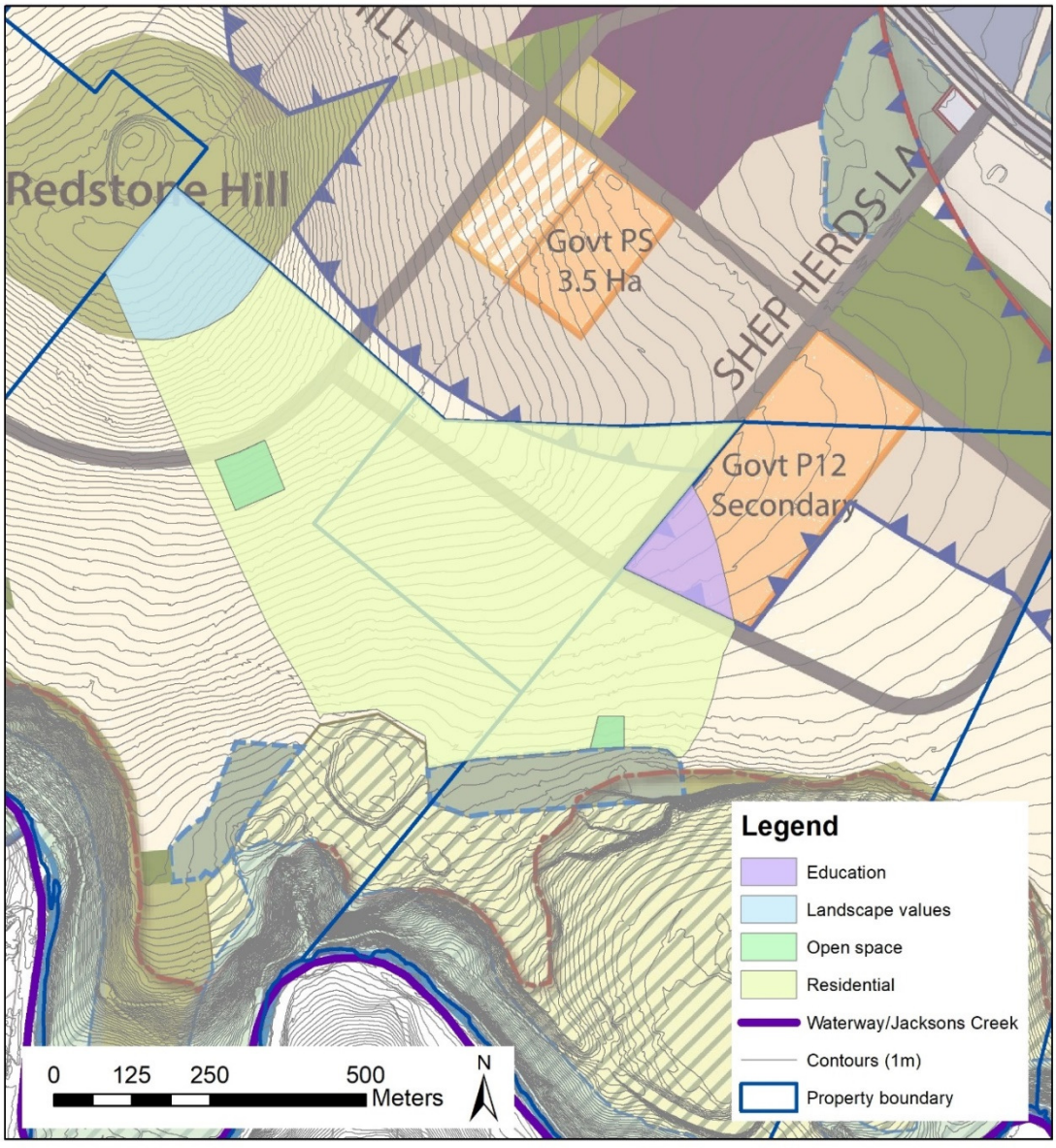


Figure 31: Catchments contributing to the proposed WI-21 asset.

GGF Habitat Design Requirements

The existing farm dam immediately to the west of asset WI-21 is included in the GGF ASI overlay. In addition, much of the land surrounding the asset is characterised as "terrestrial habitat buffer" or "other terrestrial habitat" (refer to Figure 30 above).

The stormwater treatment wetland WI-21 is intended to provide a source of treated water to the GGF habitat wetland. The proposed wetland requires modification of the existing dam to achieve its design normal water level (i.e. the water level in the GGF wetland is a constraint on water levels in the stormwater treatment wetland). Provision of suitable GGF habitat would likely require significant modification of the existing dam regardless, and lowering of the water level by deepening allows removal of the existing built-up farm dam embankment (which is to be matched to the existing surface level). The removal of the embankment is desirable from an asset management risk perspective given the unknown specifications and construction standards.

Constructed GGF habitat wetlands have design standards distinct from general stormwater treatment wetlands. This includes features specifically intended to maximise habitat benefit for the GGF, such as:

- rock piles with drop-offs to provide shelter, basking sites and escape from predators;
- a littoral zone that experiences seasonal wetting and drying cycles;
- a permanent shallow zone with dense emergent vegetation (combined with littoral zone, typically representing 30-40% of wetland area);
- a deep submerged zone with depth greater than 1.5m (typically 60-70% of wetland area).

The proposed alternative design configuration for GGF habitat wetland (refer to Figure 34) includes the above but also allows a 50m buffer to the intended development layout, in accordance with DELWP GGF habitat design standards. The modifications to the GGF wetland provides a surface area of 9000m2 at a normal water level of RL191.5. Figure 32 and Figure 33 show a schematic highlighting some of these requirements. Requirements are fully described in DELWP's *Growling Grass Frog Habitat Design Standards – Melbourne Strategic Assessment (2017)*, including wetland profiles, water source quality, land setbacks and vegetation assemblages. The functional design report provided to Melbourne Water includes further details of the proposed modifications to the GGF habitat wetland, including overview plan and longitudinal section showing edge profiles and how the stormwater treatment wetland interfaces with the GGF habitat wetland.

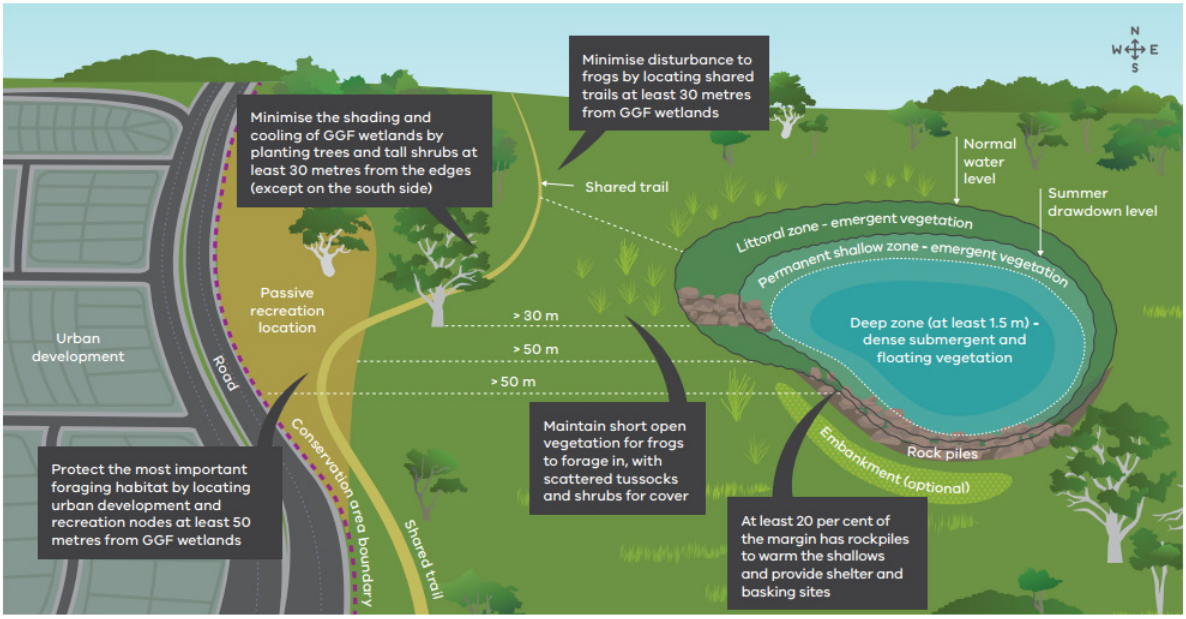
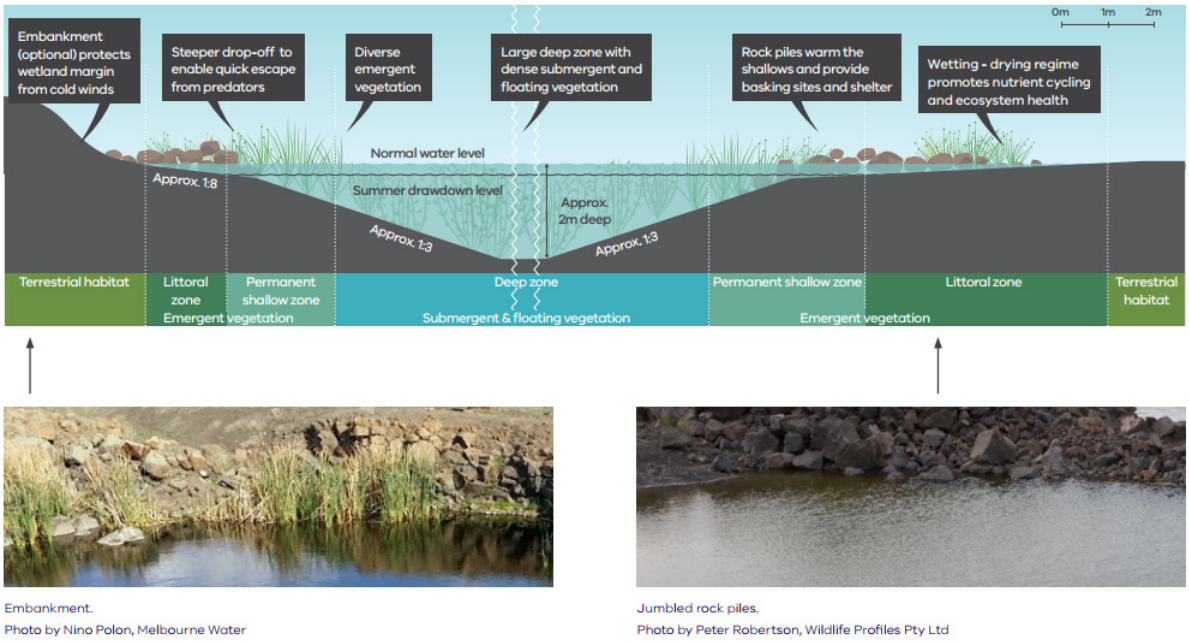


Figure 32. *GGF habitat design (DELWP, 2017)*



Embankment.
Photo by Nino Polon, Melbourne Water

Jumbled rock piles.
Photo by Peter Robertson, Wildlife Profiles Pty Ltd

Figure 33. *GGF wetland attributes (DELWP, 2017)*

Functional design

I understand that a key principle for the Redstone Hill DSS is that all stormwater is to be treated to best practice before being discharged to Jacksons Creek. These targets are:

- 70% removal of the total Gross Pollutant load
- 80% removal of total Suspended Solids (TSS)
- 45% removal of total Nitrogen (TN)
- 45% removal of total Phosphorus (TP)

Functional designs have been completed based upon Melbourne Water's current MUSIC Guidelines and draft Constructed Wetlands Manual. Full details are provided in Attachment E. With a modified GGF normal water level of RL191.5m, the normal water level for the stormwater treatment wetland (WI-21) can be set at RL191.8m. This will enable the GGF wetland to be fed by gravity from WI-21. It will also enable asset WI-21 to move further down the slope, where it can maximise the amount of upstream development for treatment and be closer to the alignment and location shown in the exhibited PSP.

The significant landscape constraints in the form of very steep grades at the proposed site lead to a large overall asset footprint for a given treatment area. Due to the natural topography of the catchment and the future subdivisional drainage layout, the most practical and feasible design approach for the wetland (WI-21) is to use an extended detention depth (EDD) of 0.5m for both macrophyte zone and sediment basin. Whilst Melbourne Water's Constructed Wetlands Manual does not prevent the use of an extended detention depth of greater than 0.35m, it requires a water level frequency analysis to be undertaken to ensure an appropriate suite of plant species (at least three) are available for the various shallow and deep macrophyte zones. The increase in EDD provides a reduction in treatment footprint, which when coupled with steep terrain, enables some significant savings in land footprint.

The configuration of the revised treatment train (wetlands and sediment basins) is provided in Table 13. Overall performance is given in Table 14, demonstrating the design meets best practice targets.

Table 17: Treatment asset parameters.

	Wetland	*Sediment Basin*
NWL area, m^2	*7,500*	*1,100*
Average depth, m	0.4	1.0
Extended detention, m	0.5	0.5
Extended detention time (hours)	72	

Table 18: Overall treatment train performance.

Parameter	**Total sources**	**Residual load**	**Percent removed (%)**
Flow (ML/yr)	137	128	6
Total Suspended Solids (kg/yr)	26000	5130	81
Total Phosphorus (kg/yr)	53	16	70
Total Nitrogen (kg/yr)	389	206	45
Gross Pollutants (kg/yr)	5060	0	100

A water level frequency analysis was undertaken to demonstrate that the proposed wetland with an extended detention depth of 500mm meets Melbourne Water's requirements with respect to plant heights and wetland depths. In summary, Melbourne Water's criteria is that there needs to be a minimum of three plant species suitable for the shallow marsh zones and three plant species suitable for the deep marsh zones. The proposed wetland exceeds this as follows:

- 7 potential plant species for the shallow marsh zones
- 7 potential plant species for the deep marsh zones.

A comparison of the proposed alternative configuration of asset Wl-21 and Melbourne Water's June revision to the DSS are shown in Figure 34. A comparison of the proposed alternative configuration of asset Wl-21 with the exhibited PSP is shown in Figure 35.

Figure 36 shows the functional layout of the alternative designs for Wl-21.

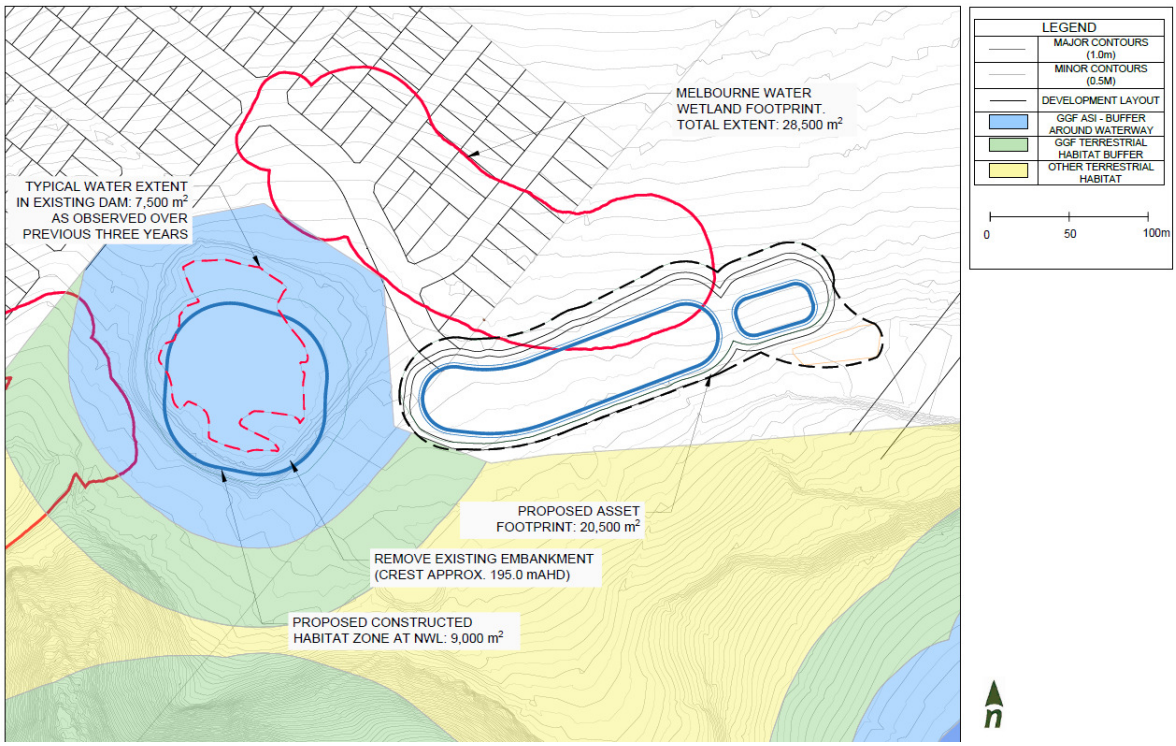


Figure 34: Wetland asset Wl-21 – Alternative configuration versus June DSS reserve

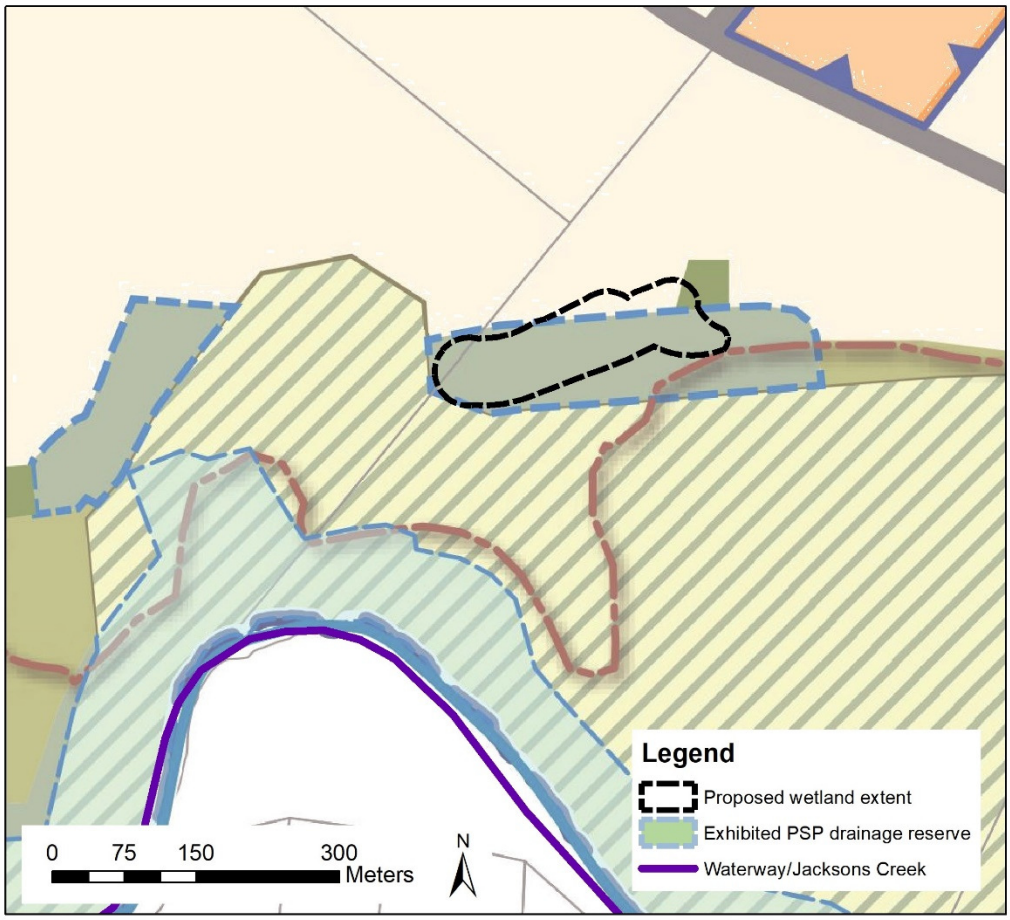


Figure 35: Wetland asset WI-21 – Alternative configuration versus exhibited PSP

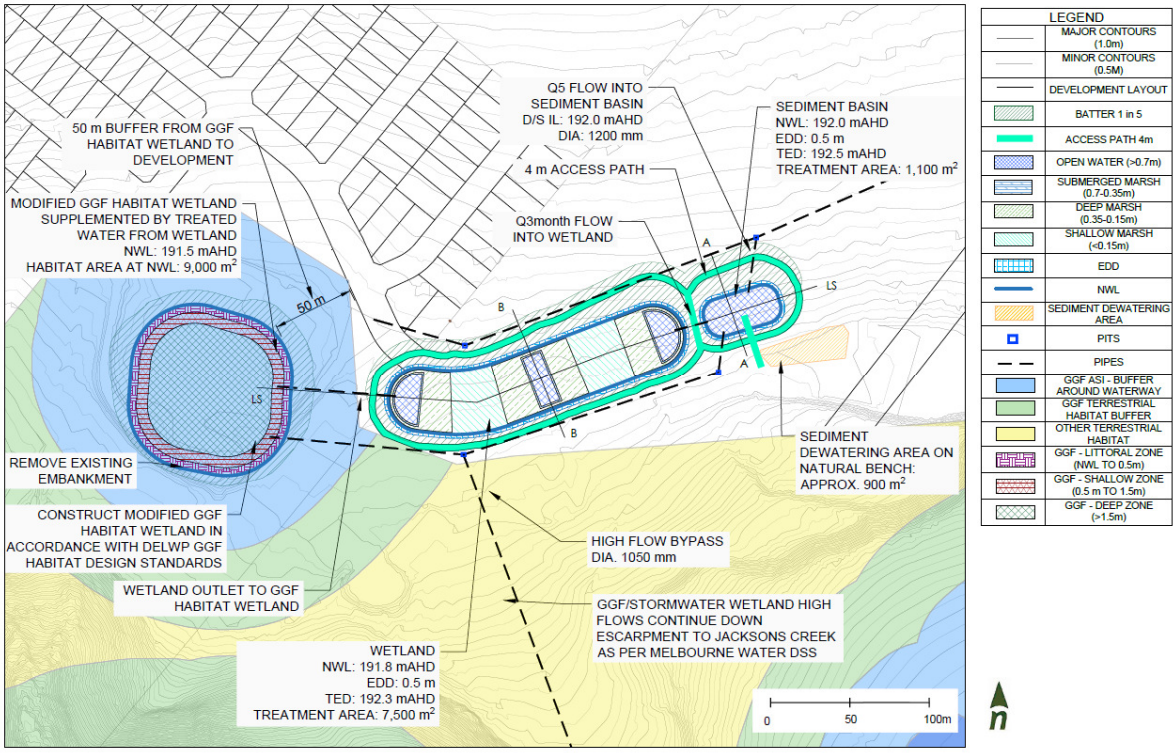


Figure 36: Functional layout of alternative configuration for WI-21

10.3 Recommendation

In my opinion the functional design for the alternative design has demonstrated that wetland Wl-21 can provide a holistic solution that:

- maximises the amount of developable land that can be serviced by the asset
- can deliver on the best practice stormwater quality targets
- can provide an improved GGF wetland habitat with a reliable source of water supply
- technically sound
- has a reduced overall footprint
- is generally consistent with the location and footprint identified in the exhibited PSP in the original DSS

The overall footprint for the Wl-21 drainage reserve proposed in the alternative design is 2.05ha compared to Melbourne Water's 2.85ha.

Given that the functional design has demonstrated that the alternative configuration is technically sound, I recommend that consideration be given to amending the PSP and Melbourne Water's Redstone Hill DSS to reflect the alternative configuration as presented in this evidence.

11 Sunbury South PSP – Redstone Hill DSS – Asset Wl-19

Villawood Properties manage the land referred to in the Sunbury South PSP as property 61, 63-69. Collectively, these properties are referred to as the "Redstone Hill" development.

Melbourne Water's Redstone Hill Development Services Scheme (DSS) has been used to inform the Sunbury South PSP. The DSS stipulates a stormwater treatment asset labelled in the PSP as asset Wl-19, which is a "wetland " referred to as WL4 in the Redstone Hill DSS (refer Figure 37 below).

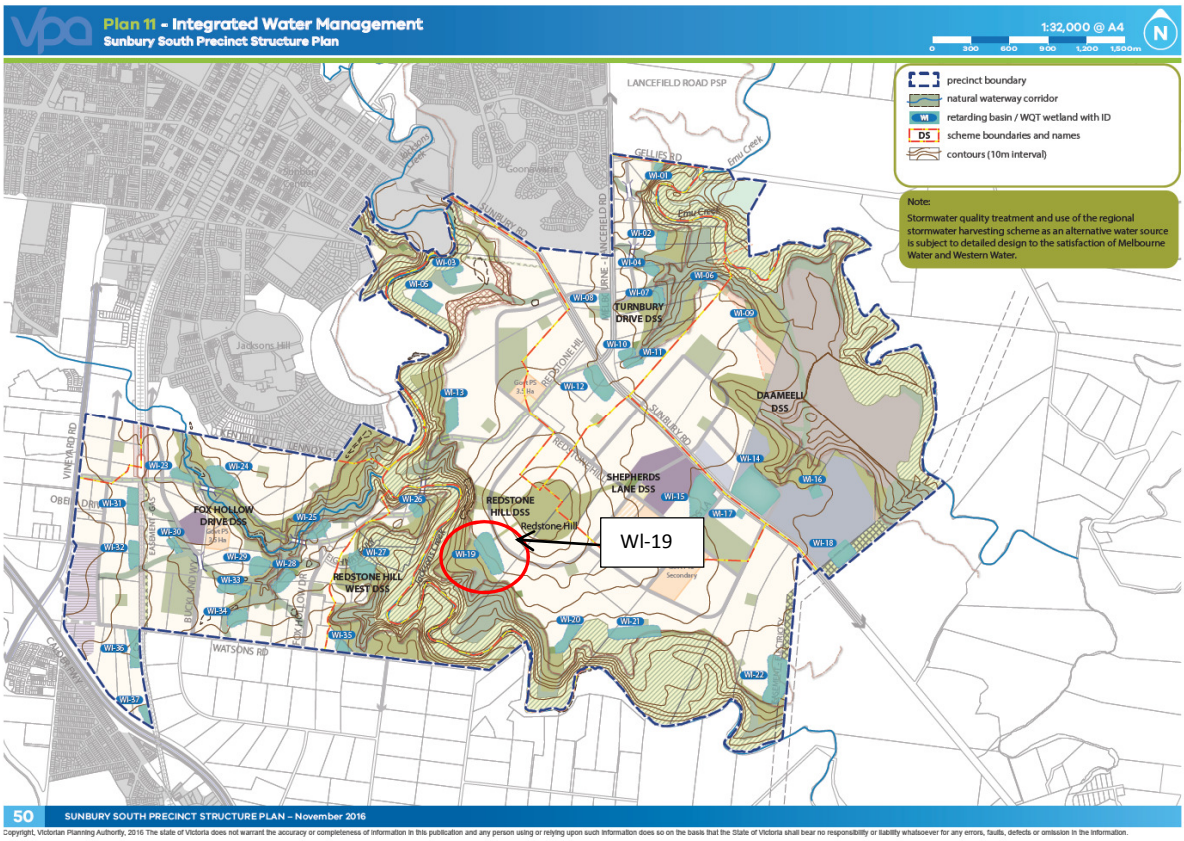


Figure 37: Location of asset Wl-19 in the Sunbury South PSP (red line)

11.1 The issue

The PSP has located wetland Wl-19 within land that could potentially be developed rather than maximising the land identified as "landscape values". The footprint is also large due to the steep natural topography.

The question that I will address is "can asset Wl-19 be feasibly moved down the slope to maximise the potential land available for development?"

11.2 Alternative strategy and configuration

In reviewing asset Wl-19 I undertook the following analysis and investigations to determine the most appropriate strategy from both a location and land budget perspective:

- Site inspection.
- Consideration of topography (survey, contours), feature survey and known physical or infrastructure constraints.
- Created a MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model to establish the proposed treatment train strategy in accordance with Melbourne Water's *MUSIC Guidelines*. The model estimates the amount of pollutants the catchment produces, the performance of treatment measures and the pollutant load generated once the catchment is treated.
- Preliminary functional design in accordance with Melbourne Water's Final Draft *Design, Construction and Establishment of Constructed Wetlands: Design Manual.*

Catchment hydrology

The upstream catchment of the proposed wetland is approximately 47.5 ha based on the current Melbourne Water DSS layout. Figure 38 shows the catchment plan for the proposed wetland. The existing topography within this catchment is steep with grades typically in the order 10% (1 in 12).

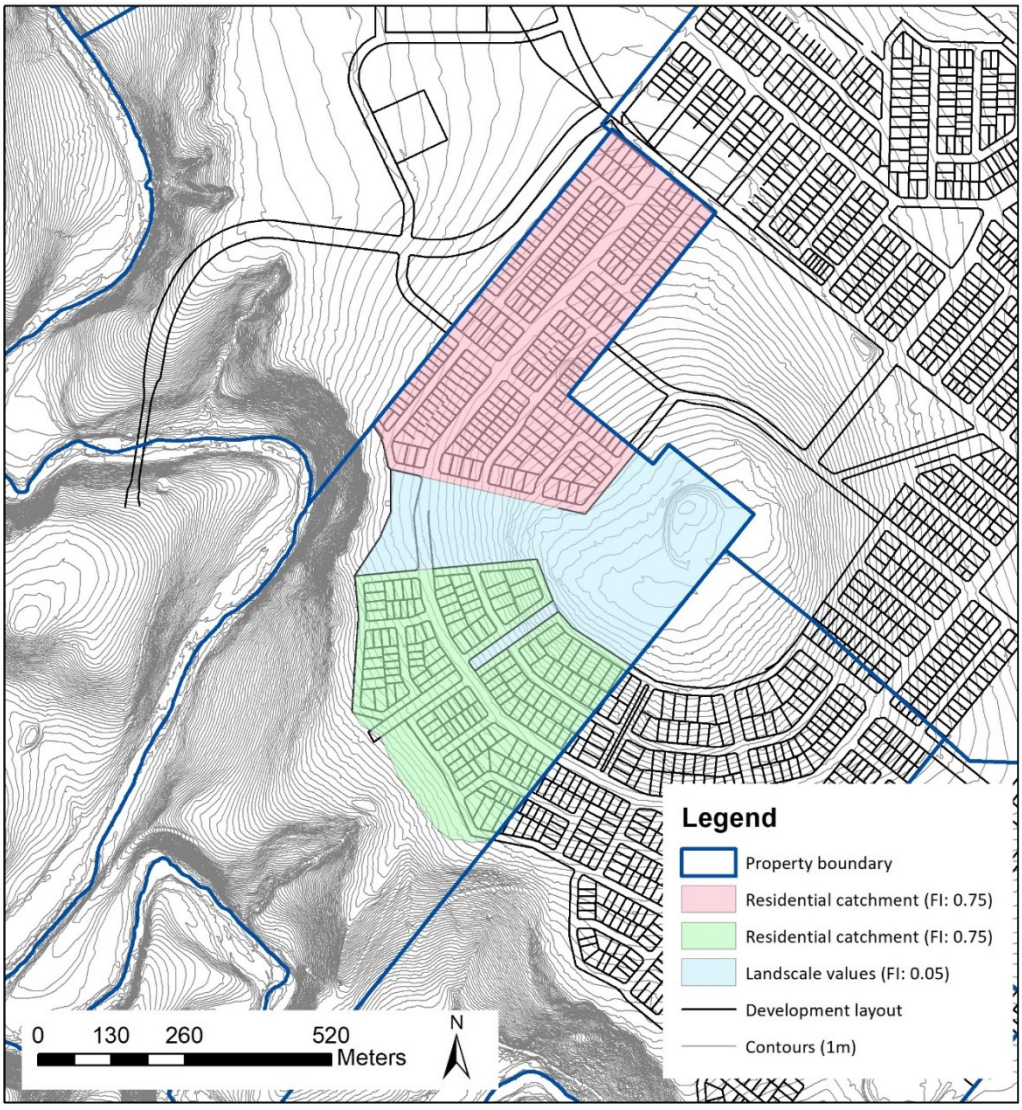


Figure 38: Catchments contributing to the proposed WI-19 asset.

Functional design

I understand that a key principle for the Redstone Hill DSS is that all stormwater is to be treated to best practice before being discharged to Jacksons Creek. These targets are:

- 70% removal of the total Gross Pollutant load
- 80% removal of total Suspended Solids (TSS)
- 45% removal of total Nitrogen (TN)
- 45% removal of total Phosphorus (TP)

Functional designs have been completed based upon Melbourne Water's current MUSIC Guidelines and draft Constructed Wetlands Manual. Full details are provided in Attachment F.

The key issue with regard to asset Wl-19 is the existing steep slopes. Slopes in the order of 8-10% remain regardless of whether the asset is located as shown in the PSP or located further downslope which leads to a large overall asset footprint for a given treatment area. Due to the natural topography of the catchment and the future subdivisional drainage layout, the most practical and feasible design approach for the wetland (Wl-19) is to use an extended detention depth (EDD) of 0.5m for both macrophyte zone and sediment basin. Whilst Melbourne Water's Constructed Wetlands Manual does not prevent the use of an extended detention depth of greater than 0.35m, it requires a water level frequency analysis to be undertaken to ensure an appropriate suite of plant species (at least three) are available for the various shallow and deep macrophyte zones. The increase in EDD provides a reduction in treatment footprint, which when coupled with steep terrain, enables some significant savings in land footprint.

Above the water surface, Melbourne Water requirements indicate that a minimum of 1(V):5(H) batter slopes must be used. In highly constrained options, batter slopes as steep as 1 in 3 could possibly be considered to minimise cut into the steep terrain, which would require "sedge planting" rather than mowable grass. Another option would be to use benching and retaining walls. These alternative approaches to managing the slope would potentially deliver significant savings, however would require discussion and agreement with Council. Given the uncertainty on this issue my functional design review has adopted the more conservative batter slopes of 1(V):5(H) to try and minimise a potentially very large total footprint.

The configuration of the revised treatment train (wetlands and sediment basins) is provided in Table 19. Overall performance is given in Table 20, demonstrating the design meets best practice targets.

Table 19: Treatment asset parameters.

	Wetland	***Sediment Basin***
NWL area, m^2	*7,000*	*700*
Average depth, m	0.4	1.0
Extended detention, m	0.5	0.5
Extended detention time (hours)	72	

Table 20: Overall treatment train performance.

Parameter	**Total sources**	**Residual load**	**Percent removed (%)**
Flow (ML/yr)	137	128	7
Total Suspended Solids (kg/yr)	26000	5130	80
Total Phosphorus (kg/yr)	53	16	70
Total Nitrogen (kg/yr)	389	206	47
Gross Pollutants (kg/yr)	5060	0	100

A water level frequency analysis was undertaken to demonstrate that the proposed wetland with an extended detention depth of 500mm meets Melbourne Water's requirements with respect to plant heights and wetland depths. In summary, Melbourne Water's criteria is that there needs to be a minimum of three plant species suitable for the shallow marsh zones and three plant species suitable for the deep marsh zones. The proposed wetland exceeds this as follows:

- 7 potential plant species for the shallow marsh zones
- 7 potential plant species for the deep marsh zones.

A comparison of the proposed alternative configuration of asset Wl-19 and the exhibited PSP (Redstone Hill DSS) in Figure 39. As highlighted in Figure 39 the overall footprint for the drainage reserve proposed in the alternative design is 2.98ha compared to Melbourne Water's 3.45ha. Of more significance is that a significant proportion of the footprint is located within the landscape values zone, which increases the potential developable land by about 3 hectares compared to the exhibited PSP.

Figure 39: Wetland asset Wl-19 – Alternative configuration versus the exhibited PSP

Figure 40 shows the functional layout of the alternative designs for Wl-19. The distance from the top of the escarpment to the limit of excavation is generally in excess of 40 metres, with only an isolated pinch point of about 15 metres near the sediment pond.

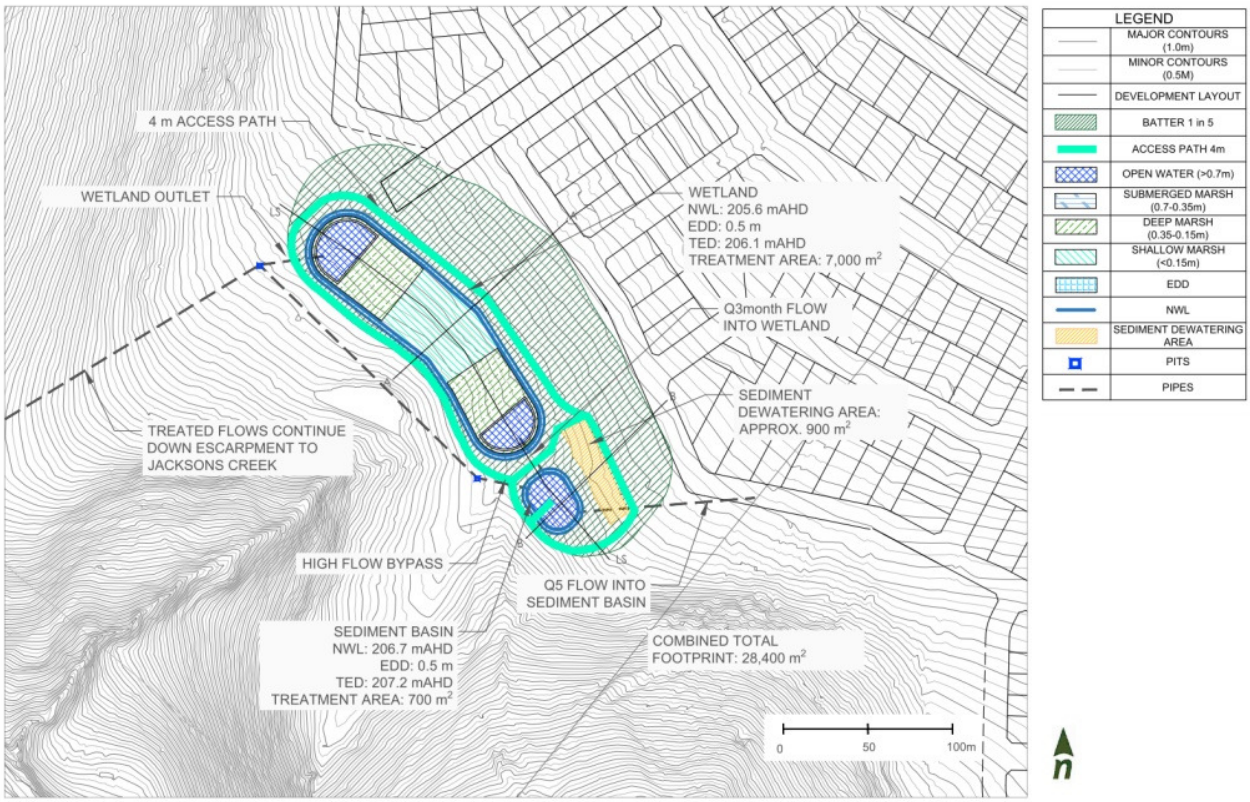


Figure 40: Functional layout of alternative configuration for Wl-19

11.3 Recommendation

In my opinion the functional design for the alternative design has demonstrated that an extended detention depth of 500mm can sufficiently reduce the treatment footprint to enable asset Wl-19 to be located further down the slope. The distance from the top of the escarpment is generally in excess of 40 metres, with only an isolated pinch point of about 15 metres. The functional design has demonstrated that all of Melbourne Water's criteria can be satisfied, including the 500mm extended detention depth. In summary the alternative configuration:

- maximises the amount of developable land that can be serviced by the asset
- can deliver on the best practice stormwater quality targets
- is technically sound
- has a reduced overall footprint and a substantial increase in developable land

The overall footprint for the Wl-19 drainage reserve proposed in the alternative design is 2.98ha compared to Melbourne Water's 3.45ha.

Given that the functional design has demonstrated that the alternative configuration is technically sound, I recommend that consideration be given to amending the PSP and Melbourne Water's Redstone Hill DSS to reflect the alternative configuration as presented in this evidence.

I would also recommend that consideration is given to the use of landscape treatments, such as planted "non-mowable" slopes of 1 in 3 or benching, that are more sympathetic to the steep natural topography. These type of treatments could further enhance the efficiency of the required land footprint.

12 Summary

In summary, my findings with respect to the appropriateness of the on the drainage assets related to the Villawood sites (identified as property nos. 1, 2 in the Lancefield Road PSP and property nos. 61, 64, 68 in the Sunbury South PSP) are provide below.

12.1 Lancefield Road PSP

Assets Wl-05a, Wl-06 and Wl-07

In my opinion the proposed alternative strategy and configuration for assets Wl05a and Wl06 provides the most appropriate outcome from an engineering feasibility perspective, having been informed by a functional design process. In contrast the current Melbourne Water DSS (and hence the exhibited PSP) is dated and does not reflect the latest agreed land use changes such as the Elizabeth Drive alignment and the reduced extent of developable land. The DSS for Wl-05a, Wl-06 and Wl-07 are based only on a high level concept design.

The alternative location for assets Wl-05a and Wl-06 (and consolidation of Wl-07) are:

- technically sound,
- have a reduced impact on the GGF conservation corridor,
- can deliver on the best practice stormwater quality targets,
- more efficient from a land budget and maintenance perspective.

As a result I recommend that the PSP and Melbourne Water's Devon Park DSS be amended to reflect the alternative configuration as presented in this evidence.

Asset Wl-05

The functional design of the alternative configuration for asset Wl-05 responds to the agreed Elizabeth Drive alignment and allows the asset to be sited sympathetically to natural topography and therefore optimise the potential land budget footprint for the drainage reserve. However in my opinion the analysis showed that the proposed alternative configuration provides a marginal land budget efficiency gain (ie 8%) compared to the exhibited PSP.

However the alternative configuration for asset Wl-05 is more consistent with enabling the objectives and vision for the proposed Salesian campus to be realised.
Given that the functional design has demonstrated that the alternative configuration is technically sound, I recommend that consideration be given to amending the PSP and Melbourne Water's Devon Park DSS to reflect the alternative configuration as presented in this evidence.

Assets Wl-01, Wl-02, Wl-03, Wl-04 and Wl-08

Recent functional design work from Melbourne Water has resulted in land budget footprints that are up to 54% larger than those shown in the exhibited PSP. I have not proposed alternative locations for these key DSS assets. Therefore in my opinion the preparation of alternative functional designs for such complex systems is not warranted. What is relevant is to review the assumptions and design parameters that have been adopted in the Melbourne Water functional designs to determine if there are any opportunities to minimise the "land take". The above information was requested of Melbourne Water (ie functional design plans and functional design reports) but it had not been received at the time of writing this evidence report. It is possible that the proposed footprints are appropriate, however it is not possible to make an informed opinion regarding the "reasonableness" of these complex systems without the detail of functional design information that they were based upon.

Asset Wl-15

In my opinion the functional design for the alternative design has demonstrated that the wetland and retarding basin can adequately fit within the proposed 96A permit plan boundary. This alternative design is simply a slight reconfiguration of the Melbourne Water DSS arrangement in order to respond to the urban design and subdivisional layout. The alternative design has been informed by a functional design, which provides more detailed analysis and investigation than the concept design undertaken for Melbourne Water's.

The alternative configuration for asset WI-15 is:

- technically sound
- has a reduced overall footprint
- can deliver on the best practice stormwater quality targets
- achieves required flow attenuation
- accommodates Villawood's proposed 96A permit boundary; and
- is more efficient from a land budget perspective.

The overall footprint for the WL-15 drainage reserve proposed in the alternative design is 5.13ha compared to Melbourne Water's 5.325ha. It is worth noting that the Wl-15 asset is not contained within the 96A permit area. However a small portion of the northern drainage reserve boundary is defined by the 96A permit application. As a result there is still some flexibility, via a future permit application, to further define the western drainage reserve boundary of the proposed asset.

As a result I believe that the 96A permit plan should be acceptable from a drainage perspective.

Asset Wl-12

In my opinion the functional design for the alternative design has demonstrated that the wetland and retarding basin can adequately fit within the proposed 96A permit plan boundary. This alternative design identified some "land footprint" saving by adopting an extended detention depth (EDD) of 500mm compared to Melbourne Water's typical value of 350mm. Given the topographic constraints and demonstration that the Melbourne Water's requirements can be met, I believe that the alternative approach for this site is appropriate. In addition to the EDD change the functional design re-configured the Melbourne Water DSS arrangement in order to respond to the urban design and subdivisional layout. The alternative design has been informed by a functional design, which provides more detailed analysis and investigation than the concept design undertaken for Melbourne Water's.

The alternative configuration for asset WI-12 is:

- technically sound
- has a reduced overall footprint
- can deliver on the best practice stormwater quality targets
- achieves required flow attenuation
- accommodates Villawood's proposed 96A permit boundary
- is more efficient from a land budget perspective
- achieves an approximately similar percentage split of the drainage reserve on each landholder as in the original DSS

The overall footprint for the Wl-12 drainage reserve proposed in the alternative design is 2.91ha compared to Melbourne Water's 3.49ha. Of this 1.285ha is proposed to be located within property 61 (Villawood) compared to 1.644ha based on Melbourne Water's DSS.

As a result I believe that the 96A permit plan should be acceptable from a drainage perspective.

Asset Wl-21

In my opinion the functional design for the alternative design has demonstrated that wetland Wl-21 can provide a holistic solution that:

- maximises the amount of developable land that can be serviced by the asset
- can deliver on the best practice stormwater quality targets
- can provide an improved GGF wetland habitat with a reliable source of water supply
- technically sound
- has a reduced overall footprint
- is generally consistent with the location and footprint identified in the exhibited PSP in the original DSS

The overall footprint for the Wl-21 drainage reserve proposed in the alternative design is 2.05ha compared to Melbourne Water's 2.85ha.

Given that the functional design has demonstrated that the alternative configuration is technically sound, I recommend that consideration be given to amending the PSP and Melbourne Water's Redstone Hill DSS to reflect the alternative configuration as presented in this evidence.

Asset Wl-19

In my opinion the functional design for the alternative design has demonstrated that an extended detention depth of 500mm can sufficiently reduce the treatment footprint to enable asset Wl-19 to be located further down the slope. The distance from the top of the escarpment is generally in excess of 40 metres, with only an isolated pinch point of about 15 metres. The functional design has demonstrated that all of Melbourne Water's criteria can be satisfied, including the 500mm extended detention depth. In summary the alternative configuration:

- maximises the amount of developable land that can be serviced by the asset
- can deliver on the best practice stormwater quality targets
- is technically sound
- has a reduced overall footprint and a substantial increase in developable land

The overall footprint for the Wl-19 drainage reserve proposed in the alternative design is 2.98ha compared to Melbourne Water's 3.45ha.

Given that the functional design has demonstrated that the alternative configuration is technically sound, I recommend that consideration be given to amending the PSP and Melbourne Water's Redstone Hill DSS to reflect the alternative configuration as presented in this evidence.

I would also recommend that consideration is given to the use of landscape treatments, such as planted "non-mowable" slopes of 1 in 3 or benching, that are more sympathetic to the steep natural topography. These type of treatments could further enhance the efficiency of the required land footprint.

I have made all the enquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.