Melton Planning Scheme Amendment C146 & C147

Expert Witness report provided to Planning Panels Victoria

Drainage Evidence (Property 67 and 68)

Prepared for ID Taylors Road Pty Ltd

Prepared by Jonathon McLean

November 2016

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 – ID Taylors Road Pty Ltd (**ID**) – to address the issues associated with future residential development on the subject site.

I have been instructed by Tom Ellicott from Norton Rose Fulbright to provide expert evidence advice on the hydrological and drainage issues related to the ID sites (identified as property nos. 67 and 68 in the Kororoit Precinct Structure Plan) taking into account:

- the exhibited C146 and C147 documents, background reports and submissions

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

- the width of the waterway corridor and extent of Seasonal Herbaceous Wetland (SHW) to be retained on 961 Taylors Road (referred to as Wl23 on the PSP);

- the alignment, width, area and functional design (including the provision of any retaining walls) for the drainage reserve referred to as Wl24 in the PSP;

This report responds directly to the above issue by providing a summary of the investigations, assumptions and assessments that have been undertaken.

3 Information / Documentation

In preparing this evidence Jonathon McLean has had regard to:

Reports:

- Kororoit Precinct Structure Plan – MPA (Public exhibition June 2016).
- Plumpton and Kororoit Background Report (Public Exhibition June 2016).
- Whole of Water Cycle Assessment: Kororoit and Plumpton (June 2015)

Other Information:

- Melbourne Water's Sinclair Road DSS 4106 Scheme plan
- Site Inspections
- Aerial Photography
- Constructed Waterways in New Urban Developments – Melbourne Water (2013)
- Waterway Corridors, Guidelines for greenfield development zones within the Port Phillip and Westernport Region – Melbourne Water
- Australian Rainfall & Runoff (1997) – Engineers Australia
- Urban Stormwater Best Practice Environmental Management Guidelines (1999)

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 subject sites for this report covers the landholdings directly owned by ID (property no 67 and 68). These landholdings are also known as 905 Taylors Road and 961 Taylors Road. The site is bound by Taylors Road to the north and Kororoit Creek to the south (refer to Figure 1).

The subject site is traversed by a minor tributary of the Kororoit Creek, which generally flows in a south easterly direction west. The topography of the site is characterised by relatively gentle grades with slopes around 1- 2%.

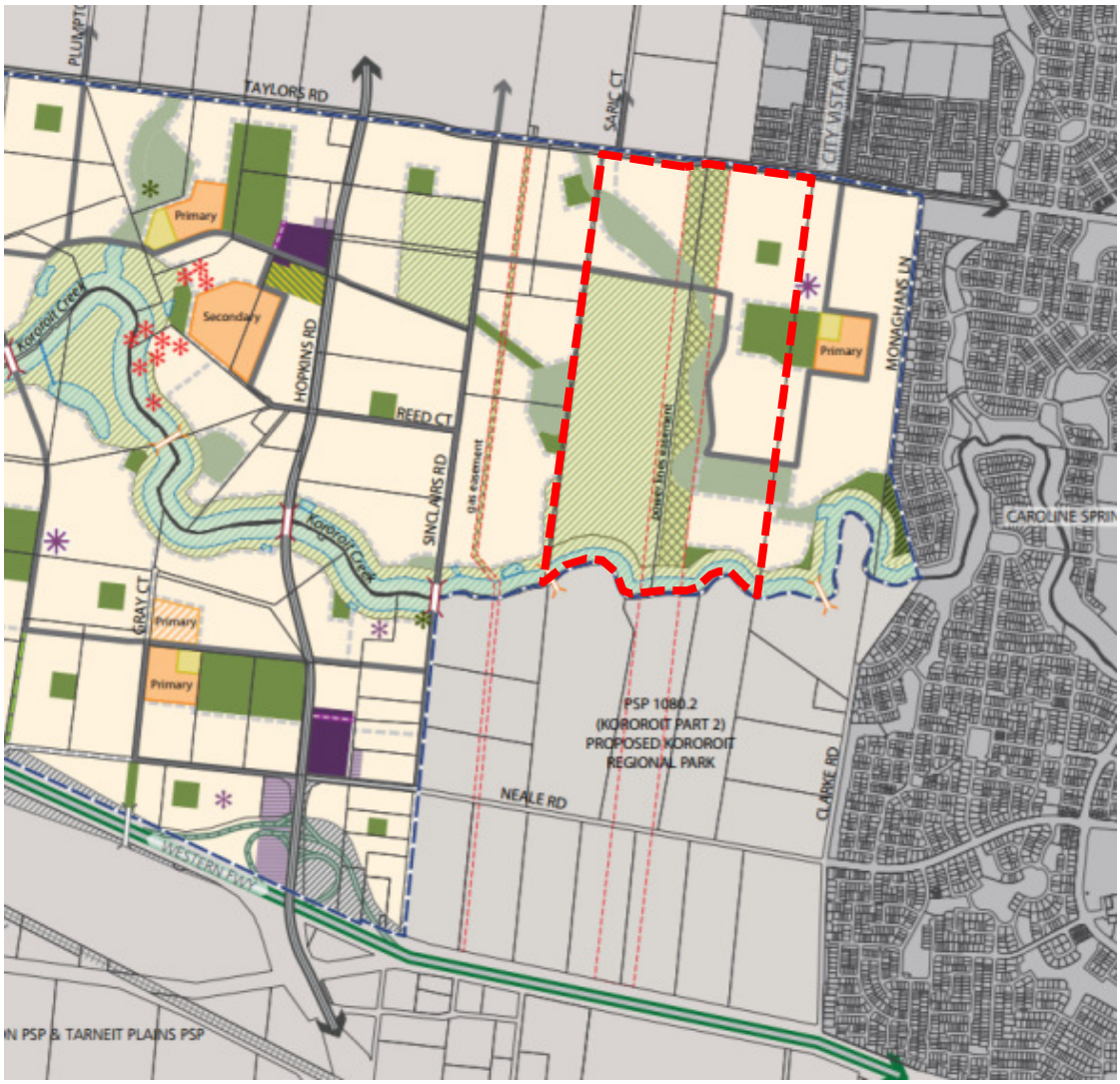


Figure 1: Location of subject sites (red line)

4.1 Stormwater Quantity – Assumptions

The following design rainfall parameters were adopted for Plumpton 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	18.60
12hr 2yr	3.67
72hr 2yr	0.95
1hr 50yr	40.49
12hr 50yr	7.06
72hr 50yr	1.96
Skew	0.35
F2	4.3
F50	14.92
Zone	1

A hydrologic model (RORB) was utilised for the catchment analysis and assessment. The following rainfall loss models were adopted for developed conditions (Table 2).

Table 2: RORB parameters for developed conditions model

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

To reflect ultimate development conditions the following standard Melbourne Water fraction impervious values were used as a guide (Figure 2). The proposed PSP has identified this section of the catchment as predominately future residential.

Zone	Zone Code	Brief Description/Examples	Normal Range	Typical Value
Residential Zones:				
Residential 1 & 2 Zone	R1Z	Moderate range of densities. (Allotment size 800m² – 4000m²)	0.40 - 0.50	0.45
	R2Z	Normal densities. (Allotment size 500m² – 800m²)	0.50 - 0.70	0.60
		Medium densities. (Allotment size 350m² – 500m²)	0.70 - 0.80	0.75
		High densities. (Allotment size <350m²)	0.80 - 0.95	0.85
Low Density Residential Zone	LDRZ	Low densities (0.4 ha min.)	0.10 - 0.30	0.20
Mixed Use Zone	MUZ	Mix of residential, commercial, industrial and hospitals.	0.60 - 0.90	0.70
Township Zone	TZ	Small townships with no specific zoning structures.	0.40 - 0.70	0.55
Environmental Rural Zone	ERZ	Rural areas with specific environmental considerations.	0.05 - 0.20	0.10

Figure 2: 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 simulation period for stormwater treatment modelling and concept designs.

4.3 Waterway Corridor – Assumptions

In accordance with Melbourne Water's Waterway Corridor Guidelines and the Constructed Waterways Manual (draft).

5 Width of the waterway corridor and extent of Seasonal Herbaceous Wetland (SHW) to be retained

5.1 The issue

The exhibited PSP shows a waterway corridor through 961 Taylors Road (property 67 in the PSP) of up to 130 metres wide. Based on investigations and design by Alluvium I believe the waterway corridor shown in the PSP should be reduced and amended.

5.2 Background

An ephemeral watercourse flows through the property. Under existing/rural conditions the depression swells to a relatively wide floodplain (refer to Figure 3). The waterway is discontinuous but has been identified in previous investigations as having the semblance of a shallow chain of ponds through the subject site. Melbourne Water has indicated that the presence of shallow pool aquatic habitat, grassland vegetation and basalt boulders along the drainage line may provide habitat during dry times. The vegetation has been mapped by Rakali as "seasonal herbaceous wetlands" but has not been included in DELWP's Biodiversity Conservation Strategy.

Due to the existing vegetation and geomorphic values within this section of the waterway, Melbourne Water's initial approach was to retain the physical form of the corridor. This was reflected in the exhibited PSP, which has a waterway corridor reservation of up to 130 metres wide.

Figure 3: Existing conditions

5.3 Investigation summary

Following the PSP exhibition Alluvium met with Melbourne Water regarding the waterway corridor. Melbourne Water advised that the waterway corridor requirements were likely to be refined following further investigations and functional analysis. Based upon the outcomes of these meetings with Melbourne Water, two options were highlighted as possible options to manage the geomorphologic and vegetation values of the waterway. These options comprised the following:

1. Option 1: Retain the existing intact waterway in its natural form to protect the geomorphologic and vegetation values of the waterway. The corridor width would be defined based on technical investigations.

2. Option 2: A 60 metre corridor width with a fully constructed waterway that is designed in such a way so as to re-create niches (i.e. benches/in-channel floodplain areas) where the SHW vegetation species can be planted (i.e. re-vegetation approach). This fully constructed system would represent an improvement on the base-case constructed waterway that is sympathetic to the local waterway values, but that does not intend to preserve them in their current form.

Details of this investigation are provided in Appendix A. However in summary I found:

- Option 1 was not suitable for the following reasons:
  - A significant constraint that threatens the feasibility of Option 1 is the location of the proposed connector road in the Kororoit Precinct Structure Plan (PSP). Overlaying the PSP plan on the existing aerial photo shows that the geomorphic values associated with the retention of the waterway would essentially be lost because:
    - The most downstream pool would be completely destroyed due to the east-west collector road, which goes straight through the middle of this asset
    - The middle pool, which is the largest, would be significantly under threat to disturbance and loss as the future road embankment is located on the edge of the pool bank
    - The upper pool is actually located outside of the waterway corridor suggested for retention in the exhibited PSP plan.
  - The future physical form, appearance and function of the waterway as it transitions from a constructed waterway to its “natural state” and vice versa is a concern. Whilst from a hydraulic and engineering function perspective an underground bypass pipeline can be constructed to take the low flows parallel to the waterway, the physical appearance of the waterway will look odd and be difficult to understand by the general community as it will appear that the waterway terminates and disappears.
  - The implementation of Option 1 will result in significant fill being imposed upon the development of 961 Taylors Road due to the need to provide 100 year flood protection and freeboard.
  - Option 1 would need to follow the valley floor, which does not align with the exhibited PSP corridor.

- Option 2 was suitable for the following reasons:

  - The functional design process for Option 2 demonstrated that it is a feasible and sustainable system. The 60 metre constructed waterway corridor provides the opportunity to re-create geomorphology and vegetation values associated with the region.
  - From a practical point of view the constructed waterway option allows the alignment to match in with the proposed waterway corridor upstream, as shown on the PSP. This can be achieved by transitioning from the 60 metre wide corridor to the 45 metre wide corridor in the upper western portion of the 961 Taylors Road site.
  - No fill is required for Option 2.

5.4 Recommendation

I believe that Option 2 for the waterway corridor through property 67 should be adopted and the PSP amended accordingly. Option 2 provides a feasible and sustainable system to re-create geomorphology and vegetation values associated with the region (refer to Figure 4).

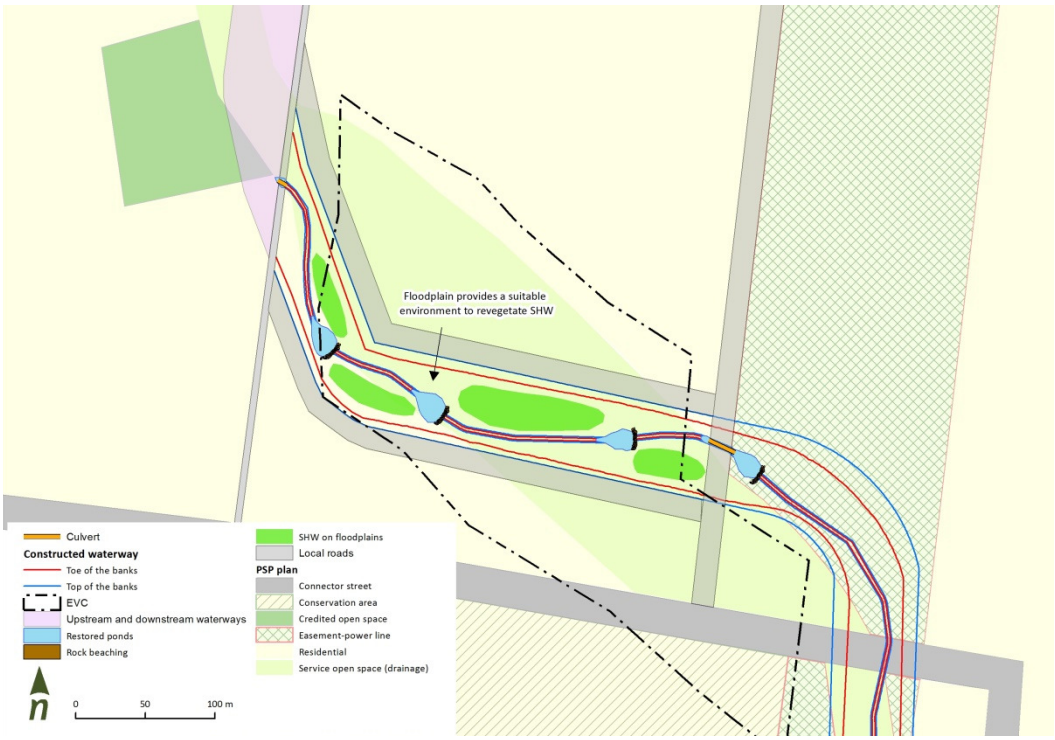


Figure 4: Recommended waterway corridor (Option 2)

Melbourne Water has considered and reviewed the recommended waterway corridor (Option 2) and provided their in-principle support. Refer to email extract below from James Hodgens (Melbourne Water) on the 5/9/16:

"Melbourne Water, in principle, supports Option 2 for the constructed waterway for the N11 subject to further detailed design at the development stage. Our Service Delivery team has accepted this proposal for ongoing maintenance purposes once the asset is delivered to Melbourne Water after construction. We will advise the VPA of this agreement to adjust the waterway reserve to reflect option 2 in the PSP and DS Scheme in this example."

Whilst the general waterway corridor is 60 metres wide, I also believe that the PSP should include the following words to clarify the transition in waterway corridor width between property 66 and 67:

"WI23: A 60 metre wide constructed waterway with restored chain of ponds and revegetated Seasonal Herbaceous Wetland benches, except for a transition section (from 45 metres to 60 metres) in the upper reach of the waterway corridor. The transition zone extends from the western title boundary of property 67 to the northern extent of the most upstream revegetated seasonal herbaceous wetland bench."

6 Drainage reserve Wl24

6.1 The issue

On the 20/9/16 Melbourne Water (James Hodgens) advised the following:

Earlier this year Melbourne Water provided previous in principle approval to the Alluvium's alternative waterway, retarding basin, wetland and drainage outfall design proposal (including the protection of the geomorphology of the outfall). However this was subject to further functional and detailed designs with any proposed retaining walls included as part of the design would not be maintained by Melbourne Water if proposed and Council's approval to maintain these future assets is required.

If the current Alluvium proposed retarding basin wetland drainage outfall proposed requires further confirmation of the detail by the developers we believe the detail requested is beyond the PSP concept which can no longer provide the detail that the developers wish and they must prove their design, land areas required for these assets if they wish to include these details in the PSP.

Melbourne Water supports a functional design/further design to be completed for the proposed waterways, retarding basin/wetland and drainage outfall through Id land to discharge flows into Kororoit Creek. This will also confirm the land areas required for the PSP and be valuable in the protection of the existing geomorphologic forms.

6.2 Background

Melbourne Water's scheme includes a wetland/retarding basin (Wl24 in the PSP) that straddles the 905 Taylors Road site and the adjoining downstream landholder (855 Taylors Road). Melbourne Water advised that the objective of Wl24 was to treat urban development south of Taylors Road as upstream scheme wetlands were all planned to meet best practice for their respective catchments.

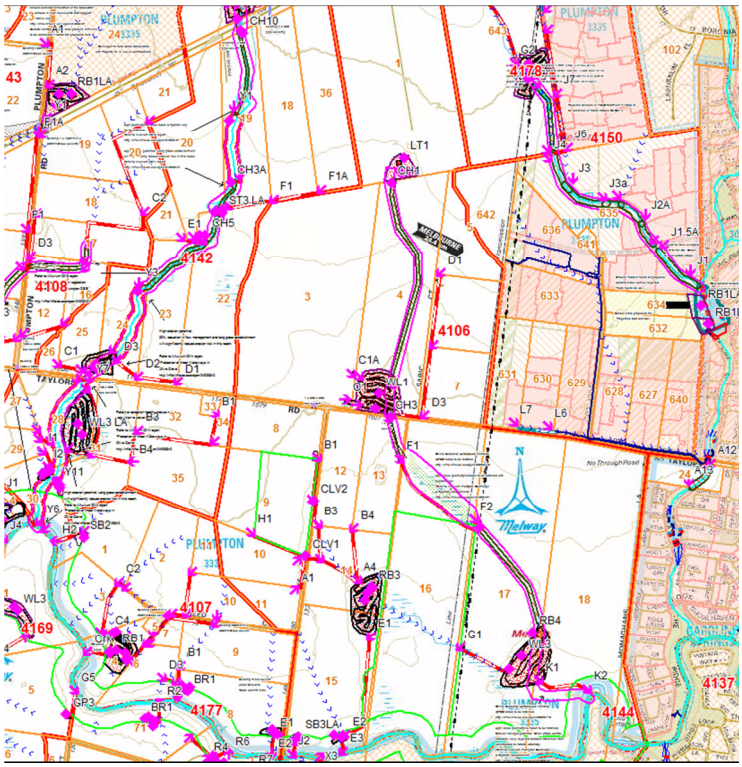


Figure 5: Current Melbourne Water scheme layout

Based upon work undertaken by Alluvium/ID the exhibited PSP has now located the waterway corridor within the powerline easement and created a rectangular drainage reserve for the wetland/retarding basin. The latest proposed layout significantly improves:

- The urban design layout
- The bus route linkage
- The efficiency and connectivity of the shared path infrastructure
- The activation of the powerline easement for a multi-purpose community outcome
- The implementation and management of an asset across property boundaries

Following Melbourne Water's 20/9/16 email, Alluvium undertook a functional design (refer to Appendix B) of the Wl24 asset to provide evidence that Melbourne Water's requirements for stormwater treatment and flow retardation could be met within the proposed drainage reserve footprint. Based upon existing surface conditions there is about 2.8 metres of natural fall from the west end to the east end of the proposed Wl24 reserve. As a result Melbourne Water advised that the major concern was whether the reserve footprint was larger enough for the proposed assets. In particular they advised that they would not maintain any retaining walls.

6.3 Investigation summary

The stormwater quality treatment and retardation requirements have been modelled in accordance with best practice and Melbourne Water guidelines.

Based upon the 3-dimensional earthwork modelling undertaken for the functional design of the wetland and retarding basin, the maximum batter within the drainage reserve is 1 in 6 (which is within Melbourne Water's and Council's requirements for batter slopes). There are no retaining wall structures within the drainage reserve. However towards the western end of the reserve the adjoining road reserve and allotments have been "benched" into the existing surface to manage the surface level differentials. This includes the use of some small retaining walls (less than 1 metre) within the front of the residential allotments (refer to Figure 6). The functional design plans are included in Appendix B.

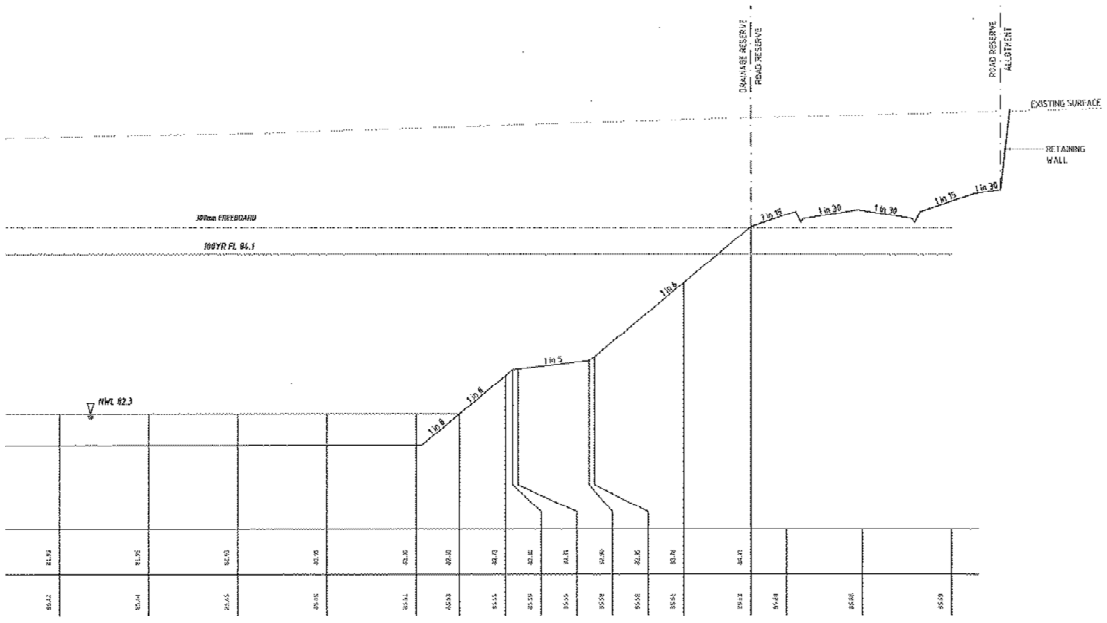


Figure 6: Typical cross section through Wl24 reserve (including retaining wall in residential allotment)

This functional design provides an urban design outcome that not only meets the water quality and quantity requirements but does so through efficient use of space. There are no retaining walls that will require Melbourne Water or Council to maintain. Where retaining walls are used, they are located at the front of the allotments and will be in the ownership of the private landowner. These retaining walls do not provide a role in the hydraulic or water quality function of the drainage reserve. In fact they are located more than 600mm above the flood level. Their value is in reducing the amount of "wasteful" batter land that would otherwise be consumed (up to 12-15 metres in width) in the PSP. The use of retaining walls (either at the front or rear of blocks) within private allotments is not uncommon and is often used in residential subdivisions to manage the slope across blocks (refer to Figure 7).

Figure 7: Example of a retaining wall in the front of a residential allotment

6.4 Recommendation

Alluvium's functional design assessment of Wl24 for ID (property 68), demonstrated that the total (developable) land budget required for asset Wl24 was 5.3 hectares. The split across the two landholdings was of the order of 1.4 hectares on property 69 and 4.0 hectares on property 68.
It appears that the shape and configuration of the drainage reserve in the exhibited PSP has generally been informed by the Alluvium investigations. However upon closer examination of the land budget tables and "Plan 10" it appears that the PSP has taken the 5.3 hectare drainage requirement and "shuffled" the module westwards to extend into the transmission line easement. This "shuffling" appears to be the reason why the developable land budget has reduced to 4.90ha, due to 0.4-0.5ha being located within the transmission easement. However this "westward shuffling" is not practical or feasible for the following reasons:

- Due to topographical constraints, the elevation in the transmission line easement is too high to make this area effective
- A road reserve is required along the western boundary of property 68 (as shown on Plan 3 in the PSP), which would divide and fragment the Wl24 asset. This fragmentation would significantly reduce the effectiveness and function Wl24 asset, with much of the area being taken up with batters.

Based on the above, I believe that the PSP be amended to show the following:

- A land budget for Wl24 in the order of 4.0 hectares on property 68 and 1.4 hectares on property 69.

I believe the functional design has demonstrated that the wetland and retarding basin requirements can adequately fit within the proposed Wl24 drainage reserve. The use of some small retaining walls within private allotments to manage the level differential is an appropriate and sound urban design outcome.

7 Summary

In summary, my findings are as follows:

I believe that Option 2 for the waterway corridor through property 67 should be adopted and the PSP amended accordingly. Option 2 provides a feasible and sustainable system to re-create geomorphology and vegetation values associated with the region (refer to Figure 4).

Whilst the general waterway corridor is 60 metres wide, I also believe that the PSP should include the following words to clarify the transition in waterway corridor width between property 66 and 67:

"WI23: A 60 metre wide constructed waterway with restored chain of ponds and revegetated Seasonal Herbaceous Wetland benches, except for a transition section (from 45 metres to 60 metres) in the upper reach of the waterway corridor. The transition zone extends from the western title boundary of property 67 to the northern extent of the most upstream revegetated seasonal herbaceous wetland bench."

Based on the above, I believe that the PSP be amended to show the following:

- A land budget for Wl24 in the order of 4.0 hectares on property 68 and 1.4 hectares on property 69.

I believe the functional design has demonstrated that the wetland and retarding basin requirements can adequately fit within the proposed Wl24 drainage reserve. The use of some small retaining walls within private allotments to manage the level differential is an appropriate and sound urban design outcome.

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.

Appendix A

Alluvium report “N11 Waterway Corridor Options” (17 Aug 2016)

Appendix B

Alluvium Functional Design for WI24 (Oct 2016)

Memo

Subject	N11 Waterway Corridor Options
Distribution	ID_Land and Melbourne Water
Date	17 August 2016
Project	961 Taylors Road, Plumpton

Alluvium Consulting Australia (Alluvium) has been engaged by ID_Land, in conjunction with Melbourne Water, to investigate the possible waterway corridor options, for a reach known as "N11", through the property at 961 Taylors Road, Plumpton. This document outlines the methodology and the outcome of this investigation.

1 Background

The site known as 961 Taylors Road, Plumpton is located within Melbourne Water's Sinclair Road Development Services Scheme (DSS) and the Kororoit PSP. An ephemeral watercourse flows through the property. Under existing/rural conditions the depression swells to a relatively wide floodplain.

The waterway is discontinuous but has been identified in previous investigations as having the semblance of a shallow chain of ponds through the subject site. Melbourne Water has indicated that the presence of shallow pool aquatic habitat, grassland vegetation and basalt boulders along the drainage line may provide habitat during dry times. The vegetation has been mapped by Rakali as "seasonal herbaceous wetlands" but has not been included in DELWP's Biodiversity Conservation Strategy.

Due to the existing vegetation and geomorphic values within this section of the waterway, Melbourne Water's initial approach was to retain the physical form of the corridor. This was reflected in the exhibited PSP, which has a waterway corridor reservation of up to 130 metres, however Melbourne Water had identified that this was likely to be refined following further investigations and functional analysis.

Based upon the outcomes of meetings with Melbourne Water, two options were highlighted as possible options to manage the geomorphologic and vegetation values of the waterway. These options comprise:

1. Option 1: Retain the existing intact waterway in its natural form to protect the geomorphologic and vegetation values of the waterway. The corridor width is to be defined based on technical investigations.

2. Option 2: A 60 metre corridor width with a fully constructed waterway that is designed in such a way so as to re-create niches (i.e. benches/in-channel floodplain areas) where the SHW vegetation species can be planted (i.e. re-vegetation approach). This fully constructed system would represent an improvement on the base-case constructed waterway that is sympathetic to the local waterway values, but that does not intend to preserve them in their current form.

The outcome of this investigation is presented in the following sections.

2 Hydrology and Hydraulic modelling

Hydrological calculations were undertaken using a RORB model that was originally prepared by Melbourne Water for the Sinclair Road DSS. The Sinclairs Road catchment is located within the northern growth zone and the land use is proposed to change to predominately urban residential. Approximately 230 hectares of urbanised catchment will enter the 961 Taylors Road site (refer to Figure 1).

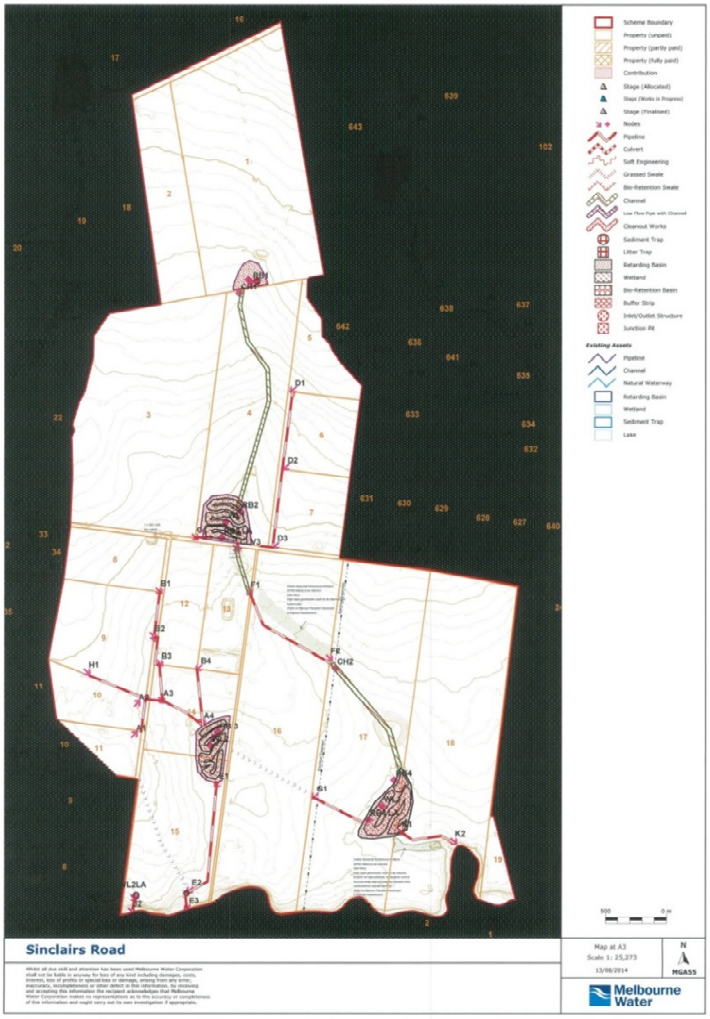


Figure 1. *Catchment plan*

Peak flow data was obtained from the RORB model and used for hydraulic modelling of the catchment for both existing and future urbanised scenarios. The ultimate development scenario includes a number of upstream retarding basins to attenuate design flows.

The design flow to size the low flow channel in option 2 was defined by the 6-month ARI. The 3-month ARI flow was also estimated to size the diversion pipe for Option 1, which will be described in detail in the following sections. The calculated peak flows are presented in Table 1.

Table 1. Calculated peak flows

ARI	3-month	6-month	2-year	50-year	100-year
Peak flow (m3/s)	0.8	1.5	3.1	9.8	11.3

A hydraulic model (HEC-RAS) was developed to assess the hydraulic condition of the options. The purpose of this modelling was to determine the extent of different flows and the hydraulic parameters such as water depth, velocity and stream power. The hydraulic parameters were compared to the reference values presented in industry accepted guidelines to minimise the risk of erosion for the waterway and chain of ponds.

Figure 2 shows the existing conditions scenario. As indicated by the contours, the low point and "valley floor" of the waterway is not captured by the proposed waterway corridor in the exhibited PSP. One of the "chain of ponds" is also outside the proposed waterway corridor with another located in the PSP east-west connector road rserve. Therefore if the intention of the proposed corridor is to retain the existing physical form and vegetation, the alignment of the proposed waterway reservation does not adequately achieve this objective.

Figure 2. *Existing conditions*

The summary of hydraulic results is presented in Table 2.

Table 2. Summary of hydraulic results for option 1 and 2

Option	ARI	Flow (m3/s)	Water depth (m)	velocity (m/s)	Channel stream power (N/m2)
Option 1	2	3.1	0.4	0.5	7.6
	50	9.8	0.55	0.7	23
Option 2	2	3.1	0.45	1.15	33
	50	9.8	0.71	1.7	95.2
Reference value-urban stream	2	3.1	NA	1.5	30
	50	9.8	NA	2.5	100

Therefore as highlighted in Table 2, Alluvium's designs for both Option 1 and Option 2 provide confidence that the systems will be stable with minimum risk of erosion.

3 Option assessment:

3.1 Option 1:

The Option 1 corridor width was determined based on the extent of the current 2-year ARI flood. This decision was made based upon the characteristics associated with the "chain of ponds" morphology, particularly their fragility to fast moving flows. That is they should be protected against regular fast moving flows. The intent of this option is for the floodplain to be retained intact for smaller flood events, which have a higher chance of occurrence, whilst for the bigger flood events the key objective is flood protection with the chain of ponds physical form being protected with rocks or similar engineering methods. Figure 3 shows different flood extents under existing conditions.

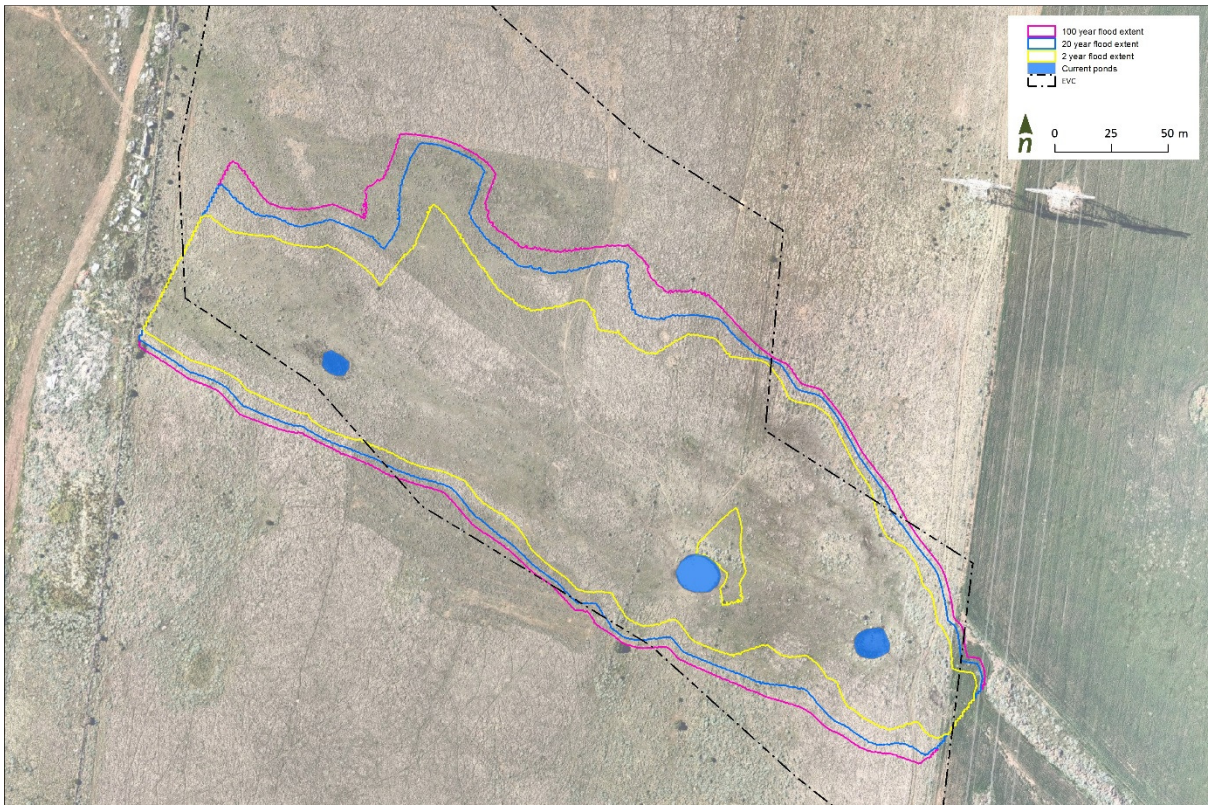


Figure 3. *Flood extents for different flows under existing condition*

The other major consideration in the assessment of this option was the ephemeral characteristics of the chain of ponds and SHW vegetation. The long term integrity and function of the shallow aquatic pools and vegetation due to the changes in the urban hydrology and catchment physical form is an issue. Under existing conditions these pools and vegetation potentially receive both surface and subsurface inflows from the localised catchment. This will disappear following urbanisation as catchment surfaces are sealed and subdivisional drainage is at a depth that will bypass the existing depression. The frequent flows caused by urbanisation could be detrimental for both the chain of ponds physical form and SHW vegetation. Therefore, an underground bypass pipe was considered to take flows up to the 3-month ARI around the reach before re-entering the constructed waterway further downstream in 905 Taylors Road.

Option 1 would have a constructed waterway upstream and downstream of the 961 Taylors Road site, whilst in-between the existing waterway landform is retained. The future physical form, appearance and function of the waterway as it transitions from a constructed waterway to its "natural state" and vice versa is a concern.

This is highlighted via a longitudinal section of the potential waterway bed (Figure 4). The Option 1 approach will require a constructed waterway upstream that is at least 2 metres below the existing invert level of the waterway. At the interface with the 961 Taylors Road property a step-up or "reverse chute/grade control" structure will be required. An upstream pond could be constructed at the interface and be used as the diversion pipe intake point. Whilst from a hydraulic and engineering function perspective an underground bypass pipeline can be constructed to take the low flows parallel to the waterway, the physical appearance of the waterway will look odd and be difficult to understand by the general community as it will appear that the waterway terminates and disappears.

The other element of this option is a rock chute at the end of the reach. The rock chute structure is required to safely transfer water from the relatively higher level intact waterway within the study area to the downstream constructed waterway which is approximately located 1 metre below the intact waterway.

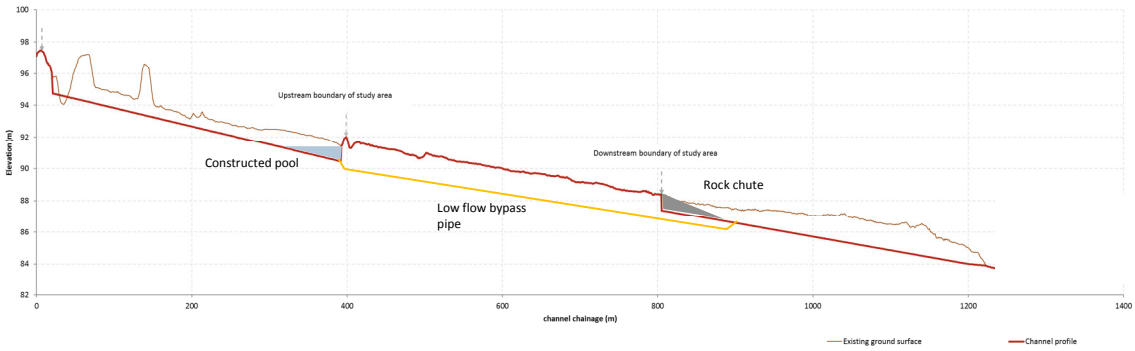


Figure 4. *The channel profile for option 1*

A significant constraint that threatens the feasibility for this option is the location of the proposed local roads in the Kororoit Precinct Structure Plan (PSP). Overlaying the PSP plan on the existing aerial photo shows that the geomorphic values associated with the retention of the waterway would essentially be lost as follows:

- The most downstream pool would be completely destroyed due to the east-west collector road, which goes straight through the middle of this asset
- The middle pool, which is the largest, would be significantly under threat to disturbance and loss as the future road embankment is located on the edge of the pool bank
- The upper pool is actually located outside of the waterway corridor suggested for retention in the exhibited PSP plan.

As shown on Figure 5, the implementation of Option 1 will result in significant fill being imposed upon the development of 961 Taylors Road due to the need to provide 100 year flood protection and freeboard.

The functional layout plans for Option 1 are located in Appendix 1.

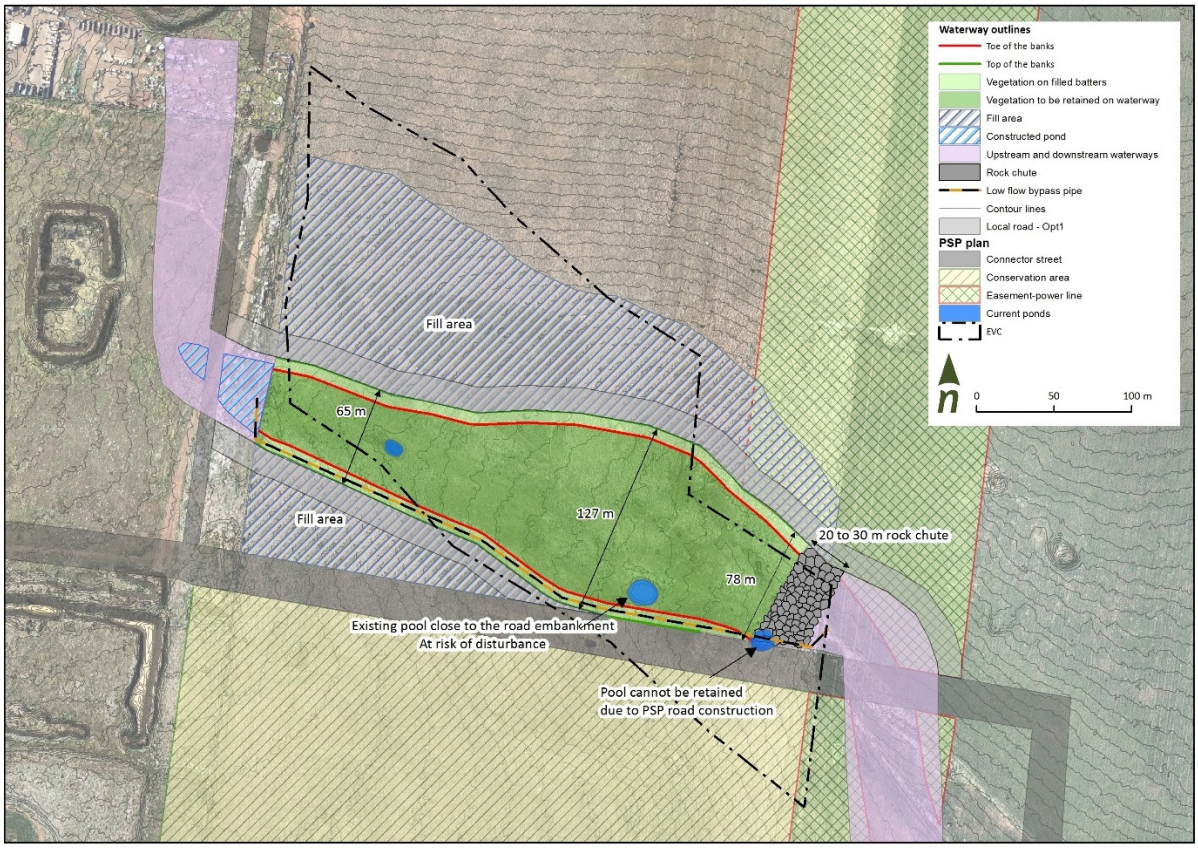


Figure 5. *The position of the Kororoit PSP road network in relation to the "chain of ponds" (Option 1)*

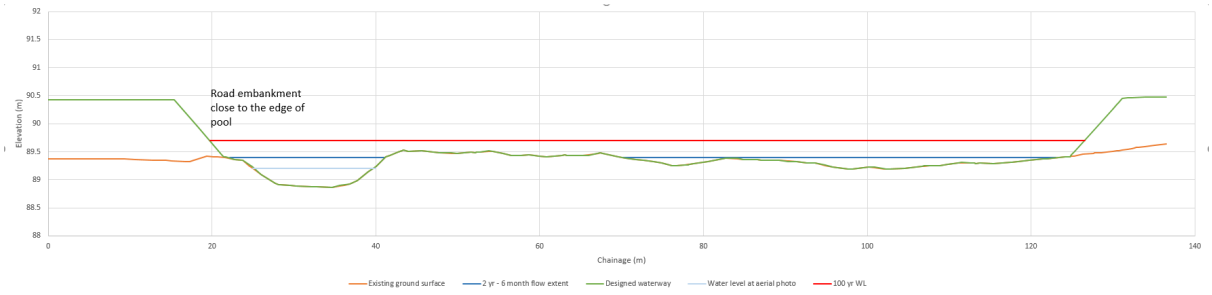


Figure 6. *A cross section of the designed waterway for option 1*

4 Option 2

This option involves a 60 metre corridor width with a fully constructed waterway that is designed in such a way so as to re-create niches (i.e. benches/in-channel floodplain areas) where the SHW vegetation species can be planted (i.e. re-vegetation approach). This fully constructed system would represent an improvement on the base-case constructed waterway that is sympathetic to the local waterway values, but that does not intend to preserve them in their current form.

The key issue with Option 2 relates to the feasibility of "re-creating" a profile that would enable the re-vegetation of SHW's. Alluvium discussed the possibility of this approach with Damien Cook from Rakali, who is a highly regarded expert in the area of seasonal herbaceous wetlands. Damien advised that the re-vegetation of SHW's in a re-constructed form is possible. Damien cited the successful project that he was involved with at the Waterways development over ten years ago as an example (see Figures 7). In the Waterways example a series of narrow and linear SHW's were constructed, typically 5-10 metres wide and about 40 metres long. The key design criteria for this approach is as follows:

- Wetting and drying of the SHW's is essential
- Shallow inundation depths of 100-200mm
- The ideal hydrologic regime involves inundation during a wet period with drying-out over summer

Figure 7. *Photos of a constructed and revegetated SHW (photos supplied by Damien Cook from Rakali)*

Alluvium has integrated the design principles for constructed waterways with the design criteria for SHW's restoration to inform the layout for Option 2 (refer to Figure 8). This approach re-creates the values associated with the original land form, namely a chain of pools and seasonal herbaceous wetland vegetation. The functional design of the constructed waterway has been modelled in 12d, to demonstrate the earthworks and landforming required for this option. In summary the key design elements are as follows:

- The constructed waterway is a compound channel with a low flow channel with enough capacity to convey flow up to the 6-month ARI flows (this is consistent with the Constructed Waterway Design Manual).
- The low flow channel meanders across the base of the waterway, creating benches of varying width

- On line pools and riffles create a “choke point” in the system, which passively floods and drowns the upstream waterway and floodplain benches. The trigger point for this “passive back-flooding” is between a 3-6 month ARI
- The benches create the opportunity to support the creation of linear SHW’s. These shallow (100-200mm depth) vegetation zones are typically 10 metres wide and 40 metres long, which is similar to those created at the successful Waterways site
- Figure 9 shows the typical arrangement and hydrologic regime during dry times and during a wet period.
- The SHW depressions within the benches are discontinuous and the mode for water entering these areas is through downstream “drownout”. This type of functional operation will eliminate the risk of a waterway avulsion (ie the low flow channel changing course).
- The 100 year flood level and freeboard is contained within the waterway corridor and does not impose any fill on the surrounding development

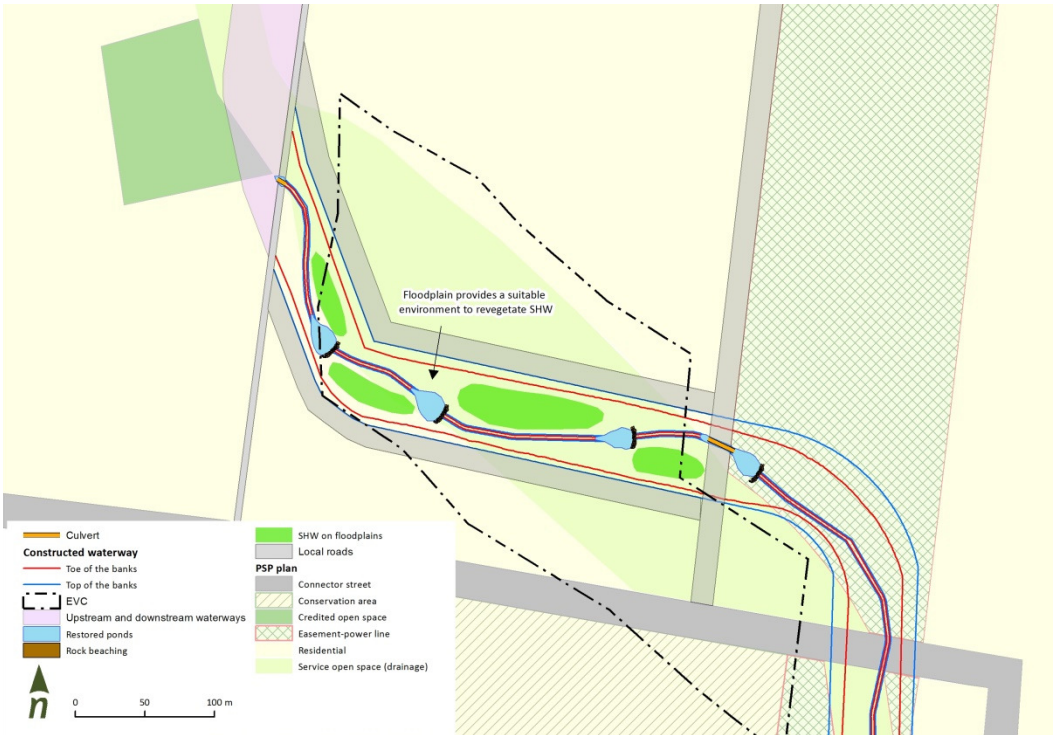


Figure 8. *Option 2 layout*

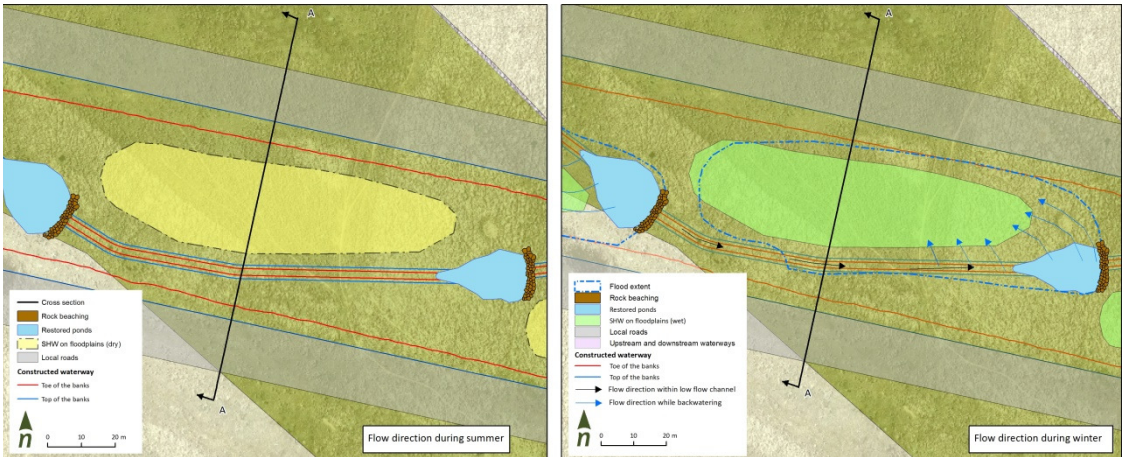


Figure 9. *Hydrologic regime during dry (left) and wet (right) periods*

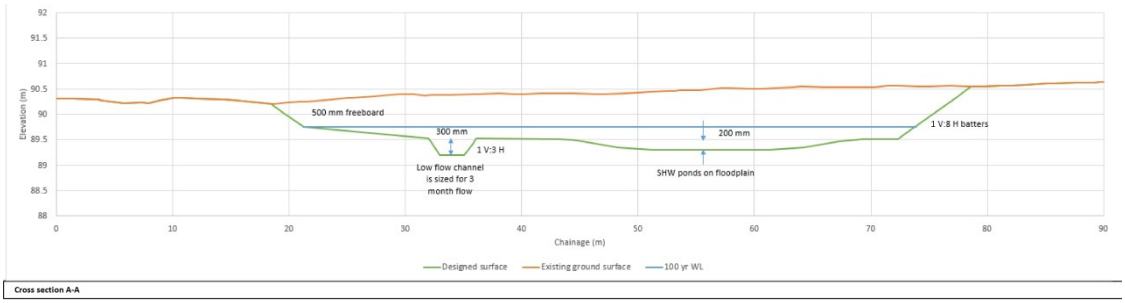


Figure 10. *Typical section through the Option 2 constructed waterway corridor.*

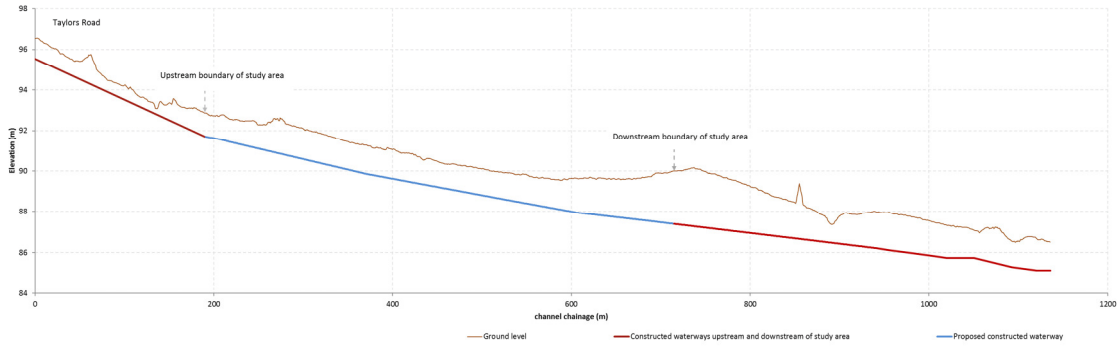


Figure 11. *Longitudinal section through the Option 2 constructed waterway corridor.*

The functional design process for Option 2 demonstrated that it is a feasible and sustainable system. The 60 metre constructed waterway corridor provides the opportunity to re-create geomporphology and vegetation values associated with the region.

From a practical point of view the constructed waterway option allows the alignment to match in with the proposed waterway corridor upstream, as shown on the PSP. In contrast Option 1 would need to follow the valley floor, which does not align with the exhibited PSP corridor.

The functional layout plans for Option 2 are located in Appendix 1.

5 Recommendation

Based upon our investigations and analysis, Alluvium recommends that Option 2 be adopted for the following reasons:

- A significant constraint that threatens the feasibility of Option 1 is the location of the proposed connector road in the Kororoit Precinct Structure Plan (PSP). Overlaying the PSP plan on the existing aerial photo shows that the geomorphic values associated with the retention of the waterway would essentially be lost as follows:
    - The most downstream pool would be completely destroyed due to the east-west collector road, which goes straight through the middle of this asset
    - The middle pool, which is the largest, would be significantly under threat to disturbance and loss as the future road embankment is located on the edge of the pool bank
    - The upper pool is actually located outside of the waterway corridor suggested for retention in the exhibited PSP plan.
- The future physical form, appearance and function of the waterway as it transitions from a constructed waterway to its "natural state" and vice versa is a concern. Whilst from a hydraulic and engineering function perspective an underground bypass pipeline can be constructed to take the low flows parallel to the waterway, the physical appearance of the waterway will look odd and be difficult to understand by the general community as it will appear that the waterway terminates and disappears.
- The implementation of Option 1 will result in significant fill being imposed upon the development of 961 Taylors Road due to the need to provide 100 year flood protection and freeboard. No fill is required for Option 2.
- Following discussions with Damien Cook from Rakali, the option of creating benches for the revegetation of SHW's in a constructed waterway corridor was considered feasible.
- The functional design process for Option 2 demonstrated that it is a feasible and sustainable system. The 60 metre constructed waterway corridor provides the opportunity to re-create geomporphology and vegetation values associated with the region.
- From a practical point of view the constructed waterway option allows the alignment to match in with the proposed waterway corridor upstream, as shown on the PSP. In contrast Option 1 would need to follow the valley floor, which does not align with the exhibited PSP corridor.

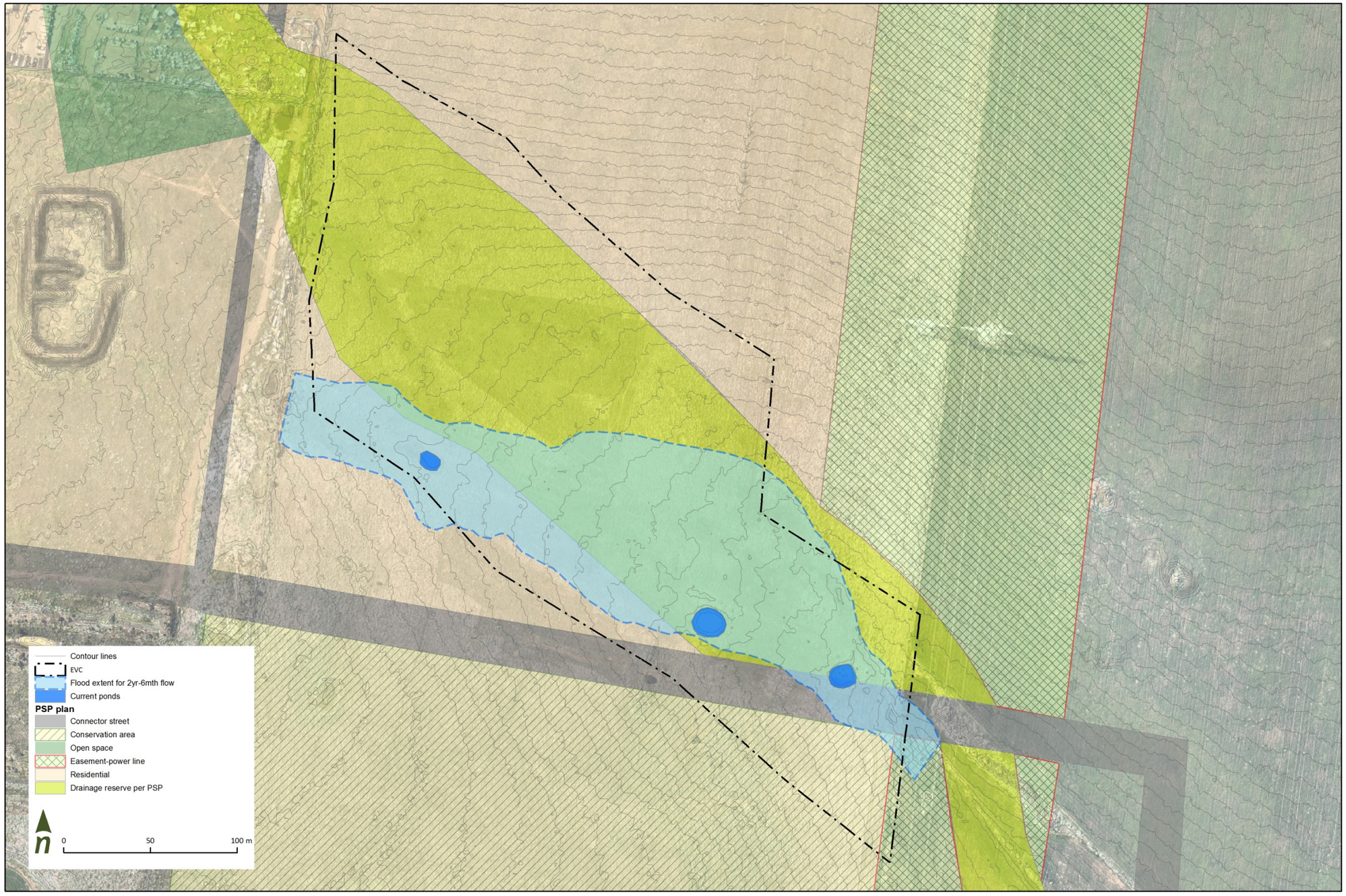
Appendix 1

Option 1 and Option 2

Functional Plans

961 Taylors Road, Plumpton.

Base map



961 Taylors Road, Plumpton.

Option 1: Retaining the current waterway in its natural form to preserve the highest value extent of SHW and the geomorphic valueable features "chain of ponds" - Page 1

Hydrology:

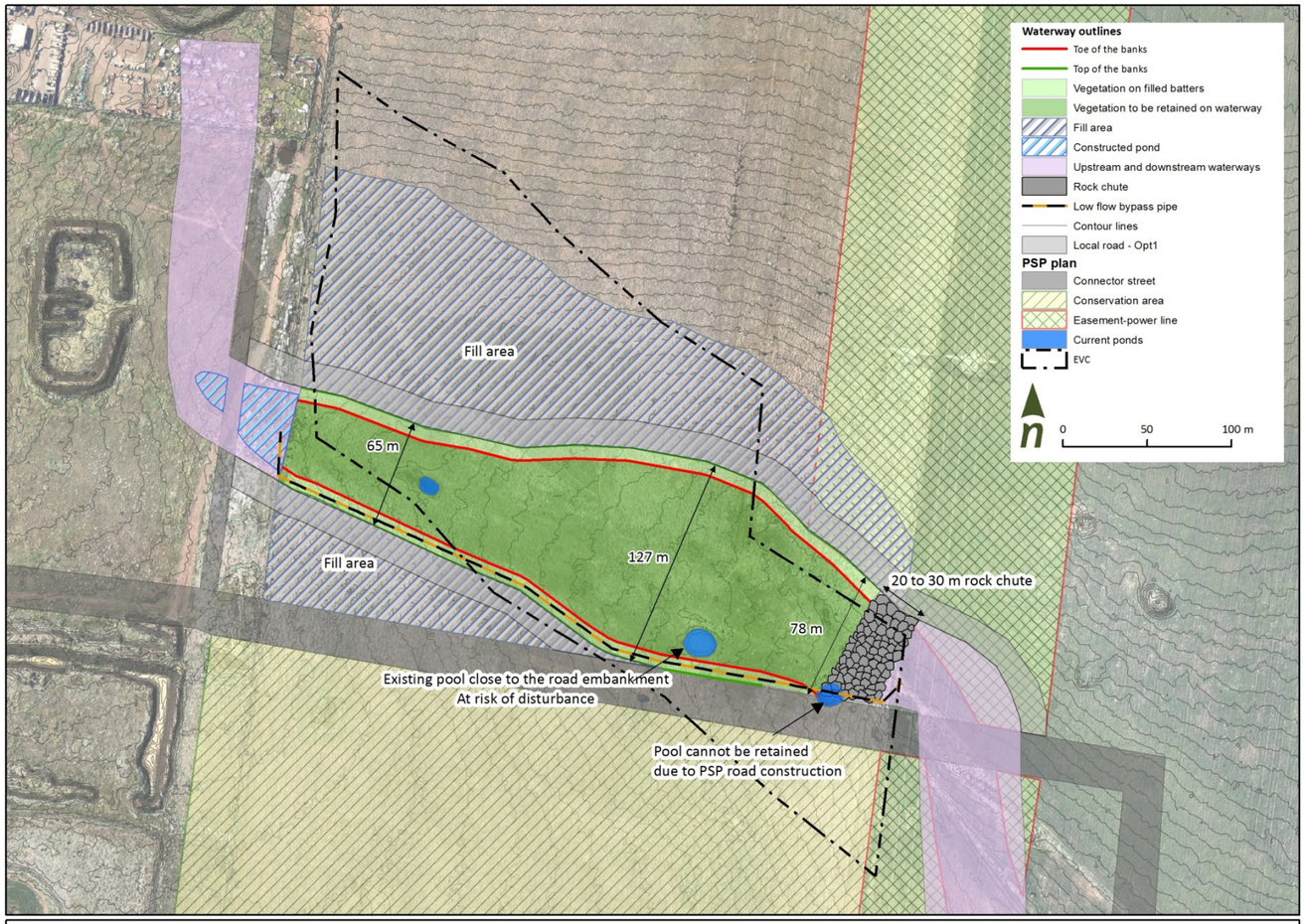
Flows information are based upon the supplied RORB model by Melbourne Water. This model represents developed condition with retarding structures in place. The following table is the summary of flows for selected storm events.

ARIs	3 month	6 month	2 yr	50 yr	100 yr
Flows	0.8	1.5	3.1	9.8	11.3

Hydraulic:

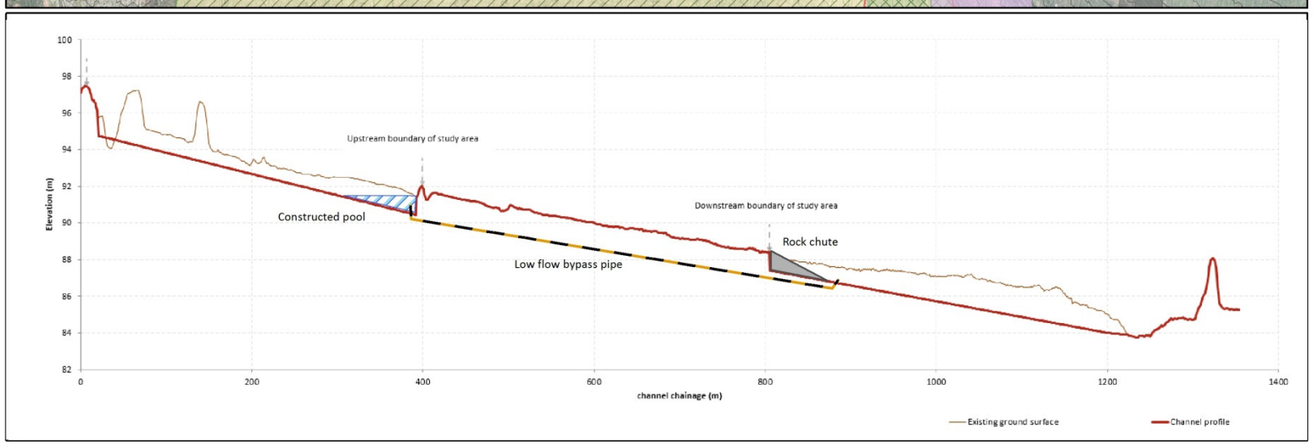
A 1D hydraulic modelling was undertaken to assess the hydraulic imapcts of the designed waterway on valuable chain of ponds and SHW. the following table shows the hydraulic condition of designed waterway against reference values.

ARIs	Average channel	Reference values
2 year	4.3	35
50 year	13.3	100



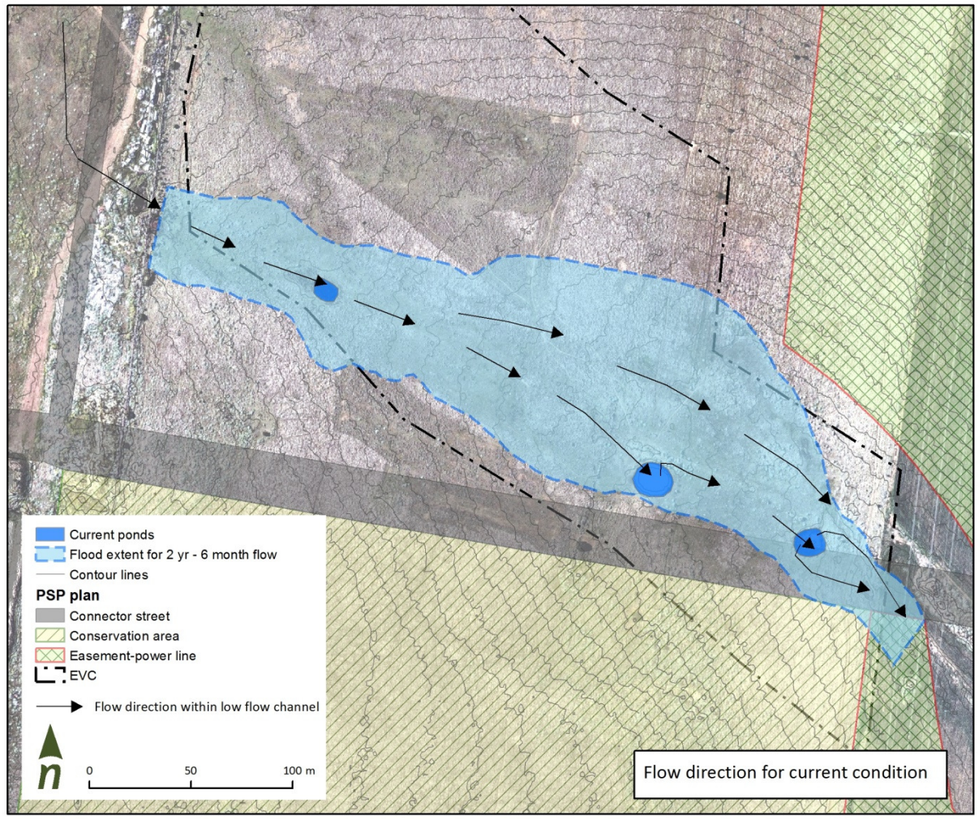
A photo of the downstream pond

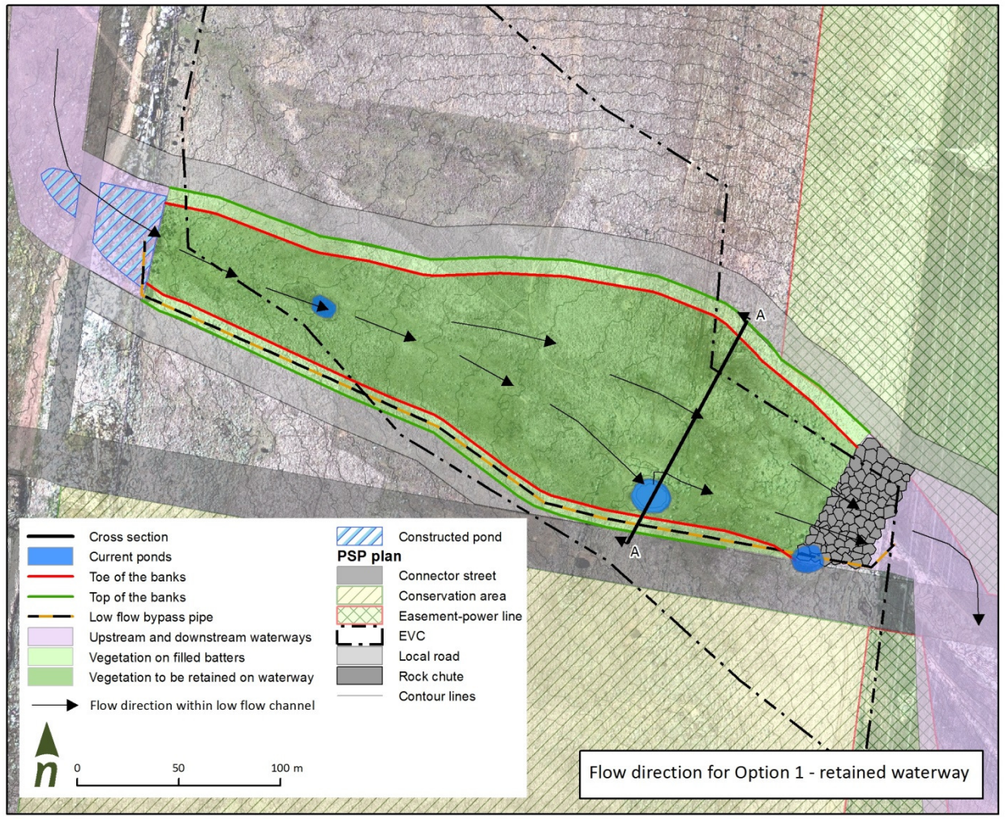
Seasonal herbaceous wetland (note: image not from this site)

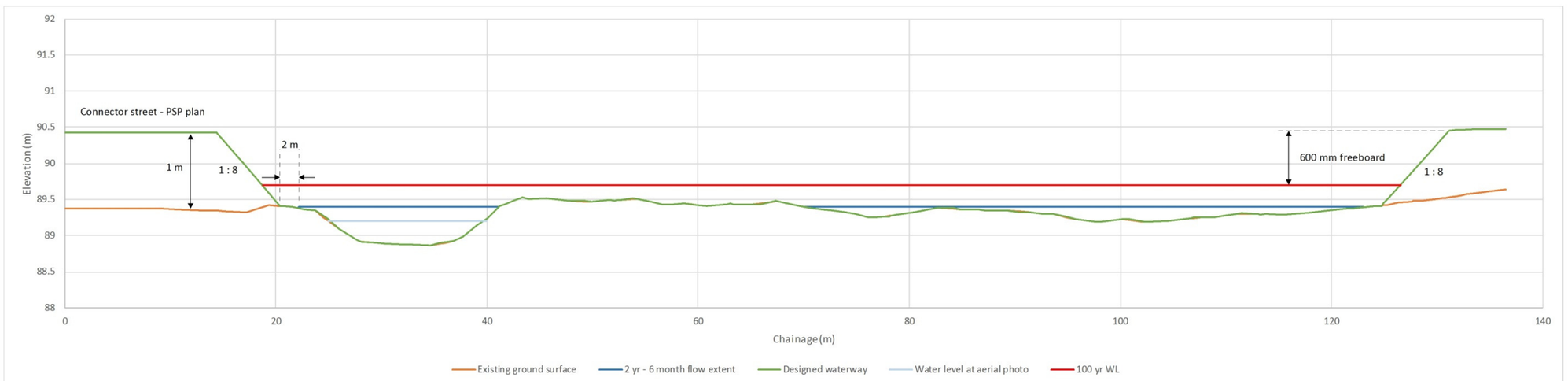


961 Taylors Road, Plumpton.

Option 1: Retaining the current waterway in its natural form to preserve the highest value extent of SHW and the geomorphic valueable features "chain of ponds" - Page 2







Typical cross section A-A

961 Taylors Road, Plumpton.

Option 2: 60 m constructed waterway with restored chain of ponds and revegetated Seasonal Herbaceous Wetlands (SHW) plant - Page 1

alluvium

Hydrology:

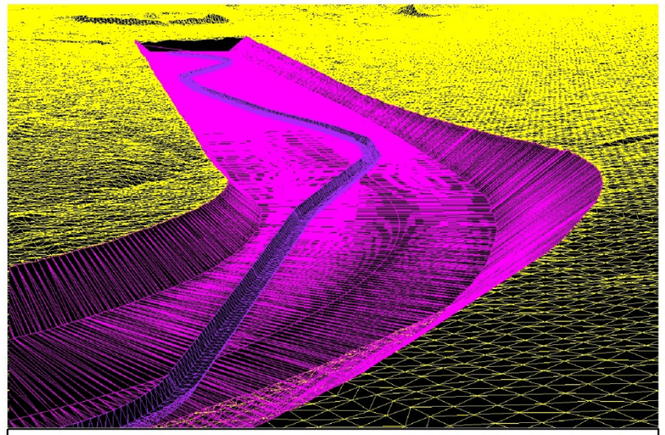
Flows information are based upon the supplied RORB model by Melbourne Water. This model represents developed condition with retarding structures in place. The following table is the summary of flows for selected storm events.

ARIs	3 month	6 month	2 yr	50 yr	100 yr
Flows	0.8	1.5	3.1	9.8	11.3

Hydraulic:

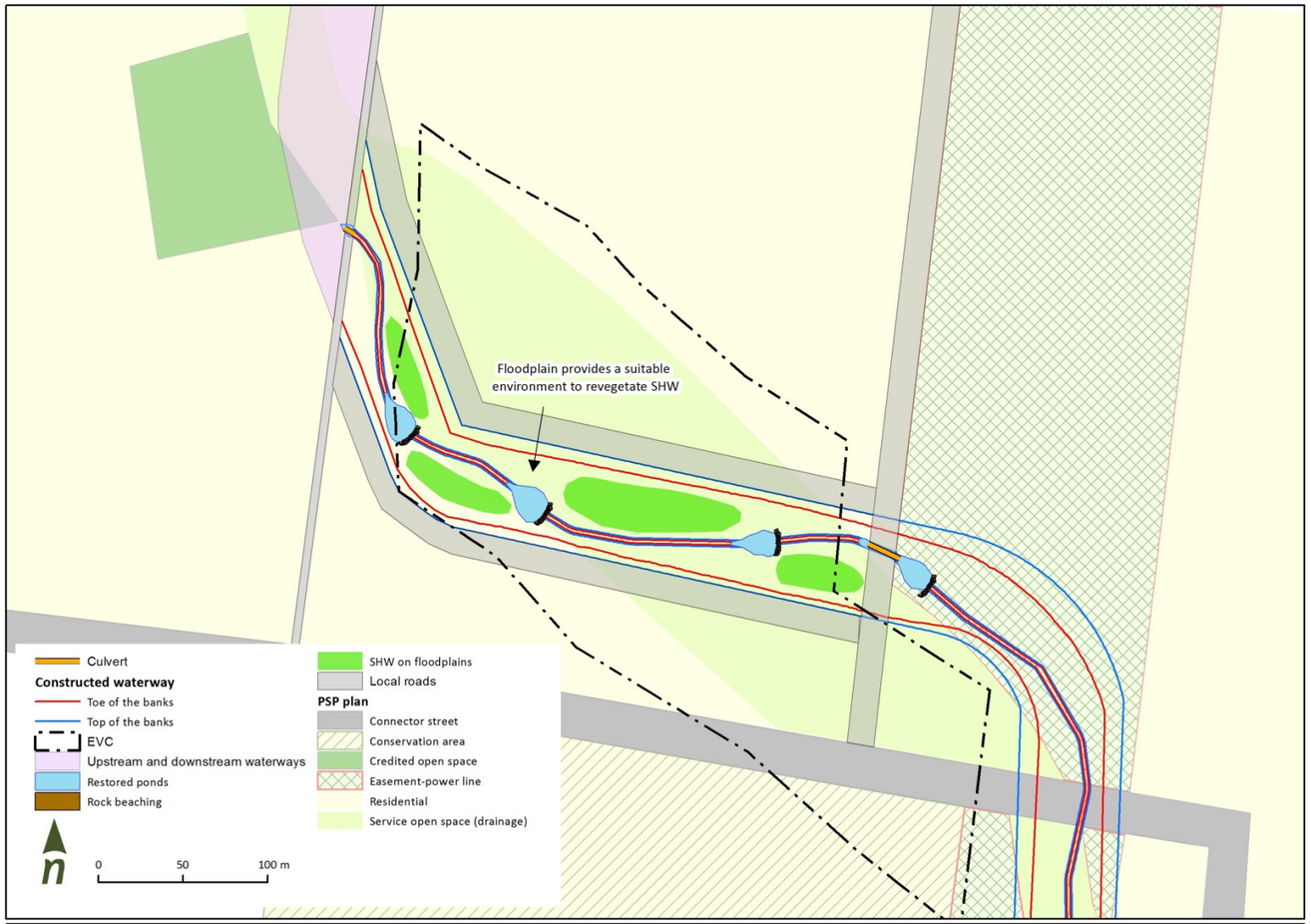
A 1D hydraulic modelling was undertaken to assess the hydraulic imapcts of the designed waterway on valuable chain of ponds and SHW. the following table shows the hydraulic condition of designed waterway against reference values.

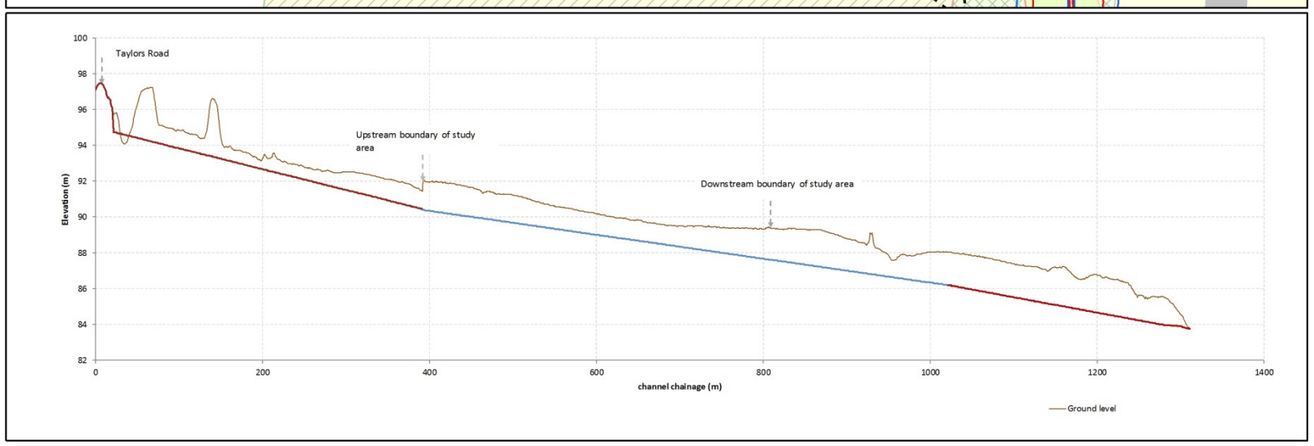
	Stream power (N/m2)	
ARIs	Average channel	Reference values
2 year	29	35
50 year	53	100



3D view of designed channel in 12D

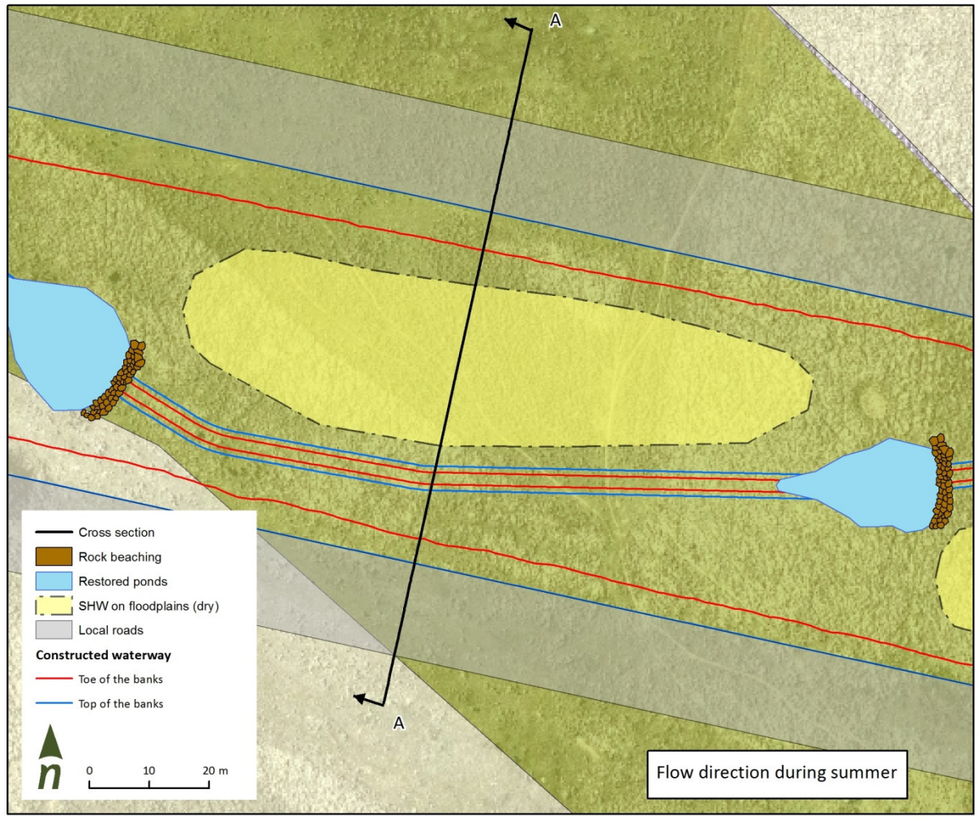
Seasonal herbaceous wetland (note: image not from this site)

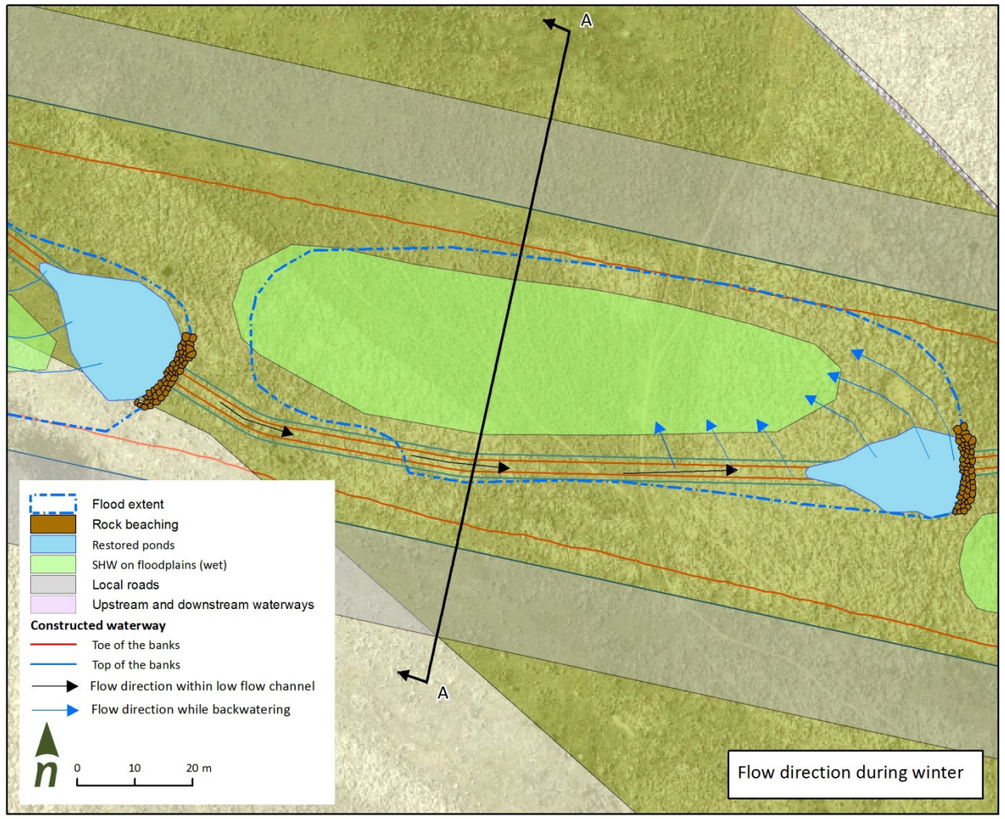


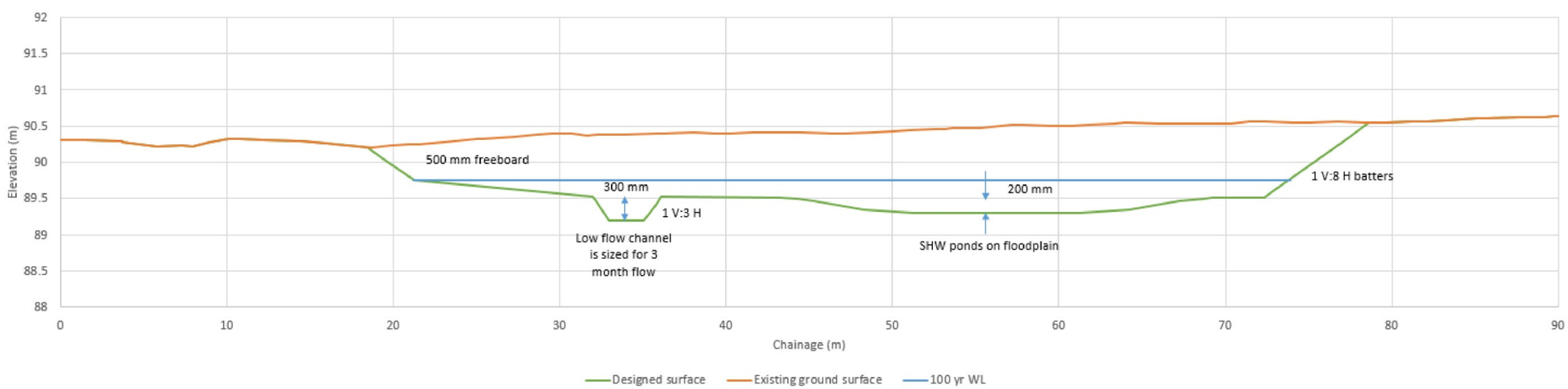


961 Taylors Road, Plumpton.

Option 2: 60 m constructed waterway with restored chain of ponds and revegetated Seasonal Herbaceous Wetlands (SHW) plant - Page 2







Cross section A-A

Memo

Subject	Layout Revision including waterway corridor and wetland/basin reserve
Distribution	Jeff Garvey (ID_Land)
Date	22 February 2016
Project	905 Taylors Road, Plumpton

1 Introduction

This memo is provided as a follow up to the meeting with Melbourne Water on the 19 February 2016, regarding a revised development plan layout for 905 Taylors Road, Plumpton. ID_Land advised that following recent discussions with Council and the MPA, the needs and alignment of the connector/collector bus route through the site has changed. As a result this has required a "re-think" of the urban design layout, which includes a revised location and alignment for the constructed water corridor and the wetland/retarding basin reserve (see Figure 1). The proposed layout has located the waterway corridor within the powerline easement and created a rectangular drainage reserve for the wetland/retarding basin. In comparison the previous layout showed the waterway corridor along a diagonal alignment with an awkward triangular reserve that was straddled across the title boundary to the east (see Figure 2). The latest proposed layout significantly improves:

- The urban design layout
- The bus route linkage
- The efficiency and connectivity of the shared path infrastructure
- The activation of the powerline easement for a multi-purpose community outcome
- The implementation and management of an asset across property boundaries

The focus of this document is to provide a summary of the relevant information with respect to stormwater management and the constructed waterway corridor.

2 Melbourne Water Scheme Requirements

- Sinclair Road Developer Services Scheme (DSS)
- With respect to 905 Taylors Road, the DSS requires the following key assets (see Figure 3):
  - Constructed waterway
  - Stormwater treatment wetland (WL3)
  - Retarding basin (RB4)

- Melbourne Water supplied the following DSS information for the subject site:
  - The RORB model for the catchment (ie Sinclairs Rd RBWL3 sizing (2 outlets).catg) and the parameter file
  - The RORB sub-area catchment plan
  - That the critical peak outflows to Kororoit Creek were determined by considering the whole of the Kororoit Creek catchment and the principle of all new DSSs in this catchment, including Sinclairs Rd, being designed to discharge pre-developed flows to Kororoit Creek
  - A pdf version of the Sinclair Road DSS plan, including the proposed layout configuration

Figure 1 – Proposed layout

Figure 2 – Previous layout

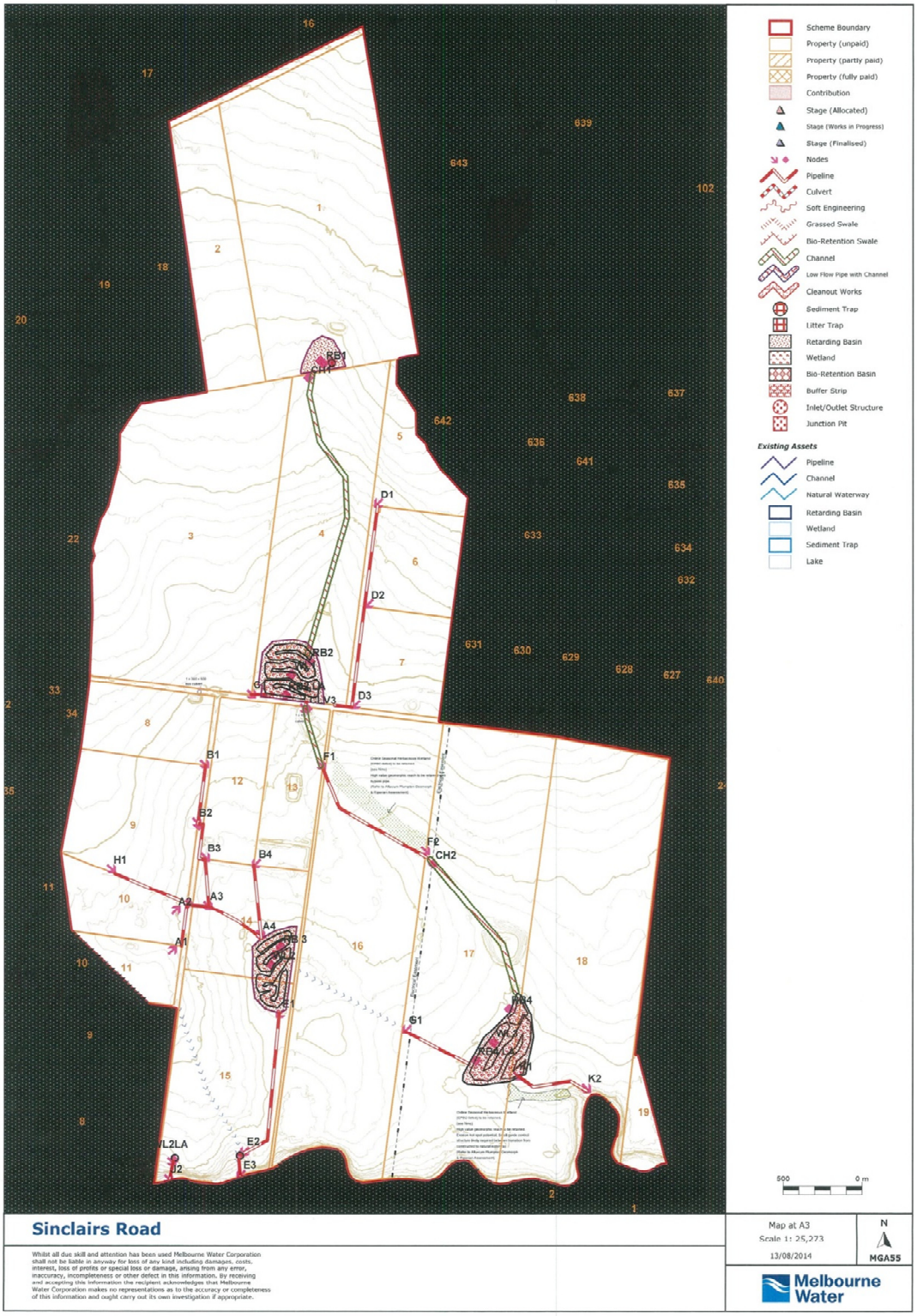


Figure 3 – DSS layout

- And advice that the developer will need to develop their own MUSIC model to support the RB/wetland sizing and treatment. The premise is that all other upstream DSS wetlands will be sized to treat the incoming catchment to best practice

- Based upon the supplied the RORB model, the key retarding basin design requirements are as follows:
  - Critical peak storm duration is 9 hours
  - The peak 100 year outflow from the basin is 11.60 cumecs
  - The peak 100 year storage volume in the retarding basin is 63,300 cubic metres.

3 Constructed Waterway

The scheme has identified a constructed waterway through the subject site. Alluvium has previously undertaken a Hec-Ras analysis as part of a concept/functional design analysis of the waterway.

Based on the Hec-Ras analysis for the constructed waterway, the 100 year hydraulic width varies between 20-24m. Therefore, based on Melbourne Water's "Waterway Corridor Guidelines", the core riparian zone width is 30 m, and the minimum required waterway corridor width is 45 m (assuming active edges on both sides).

The alignment of the proposed constructed waterway corridor has been modified to that shown in the draft PSP plan. The reason for the change in alignment stems from the needs and alignment of the connector/collector bus route through the site. As a result this has required a "re-think" of the urban design layout, which includes a revised location and alignment for the constructed water corridor within the powerline easement to enable a practical and feasible interface with an urban design layout.

The proposed alignment of the constructed waterway has been oriented to maximise the use of the powerline easement. The key design information for the waterway is as follows (see Figure 4):

- A minimum 50 metre waterway corridor width is provided, however the use of the powerline easement enables the corridor width to expand and vary along its length. Corridor widths of 70-85 metres will enable a range of different batter slopes and benching within the constructed waterway, which will enhance both the health, biodiversity and liveability aspects of the waterway. Such diversity would not have been possible with the previous layout.
- The proposed corridor enhances the opportunity for a meandering "pilot channel", which will minimise the need for rock chutes as grade control measures along the waterway. The length of the pilot channel will be about 1020 metres. With an upstream invert level of 87.5 and a downstream invert level 83, the longitudinal grade of the waterway is 1 in 228. Using this profile the shear stress and velocities within the waterway are relatively low and will therefore support a vegetated system, which is the preferred outcome.
- Whilst the proposed waterway corridor will need to "cut" through some additional high ground, the extent of this cut is not severe or significantly long. The majority of the constructed waterway will be about 1.5-2 metres deep, except where the depth to invert at the localised rise will increase to 3.5-4 metres deep. However at this location the waterway corridor is 70 metres wide.
- BPD advised that based upon past experience in this region any rock would be "rippable" by standard excavators.
- The proposed waterway corridor aligns well with the existing overland flow path/valley floor that comes from the west across the conservation reserve. The proposed layout will therefore deliver a superior flood management outcome that the previous layout which relied upon the overland flows being conveyed through residential streets.
- The edge of the proposed waterway corridor is at least 20 metres from an existing or future powerline transmission tower.
- A road reserve will be provided along the alignment of the existing valley floor to convey local overland flows from subdivision

Point	IL	NS	Depth (m)
1	87.5	89	1.5
2	86.11	87.5	1.4
3	85.1	89.1	4.0
4	84.32	86.8	2.28

Figure 5 – Constructed waterway information

4 Wetland / Retarding Basin

A MUSIC model of the overall catchment was established. Generic treatment nodes (ie 80% removal of TSS, 45% removal of TP and TN) were used to represent the performance of other DSS wetlands in the model to ensure that the hydrology into the proposed wetland at 905 Taylors Road was appropriately represented.

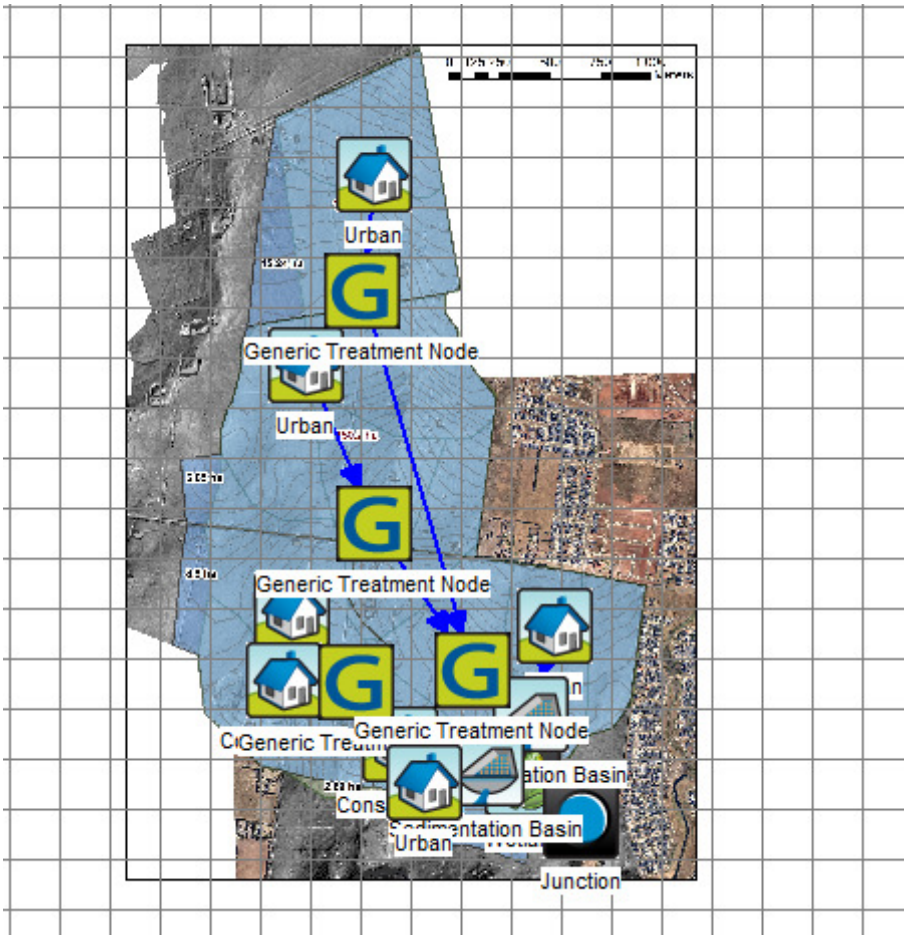


Figure 5 – MUSIC model

Scheme asset WL3 (wetland) is located within the 905 Taylors Rd site. The objective of this wetland is to treat the urban catchment downstream of WL1 and WL2 to meet the best practice targets. The required treatment train is as follows:

- The wetland is a dual feed system, as it will accept catchment flows from the north and west.
- The proposed water level of the wetland is RL81.5, whilst the sediment pond water levels are expected to be RL82.5m.
- As a result two sediment ponds are provided. Predominately “untreated low flows” from the urban catchment will discharge to the sediment basin, rather than the constructed waterway.
- A low flow pipe diversion (900mm) will be provided at the constructed waterway/sediment pond interface. This pipe will divert low flows in the constructed waterway, that have already been treated in upstream wetlands, around the proposed WL3 wetland.
- The surface area of the proposed wetland WL3 is 2.86ha
- The reserve area includes an allowance for a sediment drying area for each basin.

Retarding basin

- Previous RORB modelling from Alluvium has identified that the scheme objective to limit the 100 year developed flow to 11.60 cumecs can be achieved with a retarding basin storage of 63,300m3.

- The 100 year flood level is estimated to be RL 82.8m.

- Based upon previous 12d functional design of the wetland and retarding basin, Alluvium has identified that the total encumbered footprint to contain this asset would be about 5.3 hectares. This includes the use of some hard edge/retaining wall treatment above the 100 year flood level and access track to reduce the extent of encumbered land that would need to be acquired by the scheme. The use of the hard edge/retaining walls is similar for the previous or proposed option.

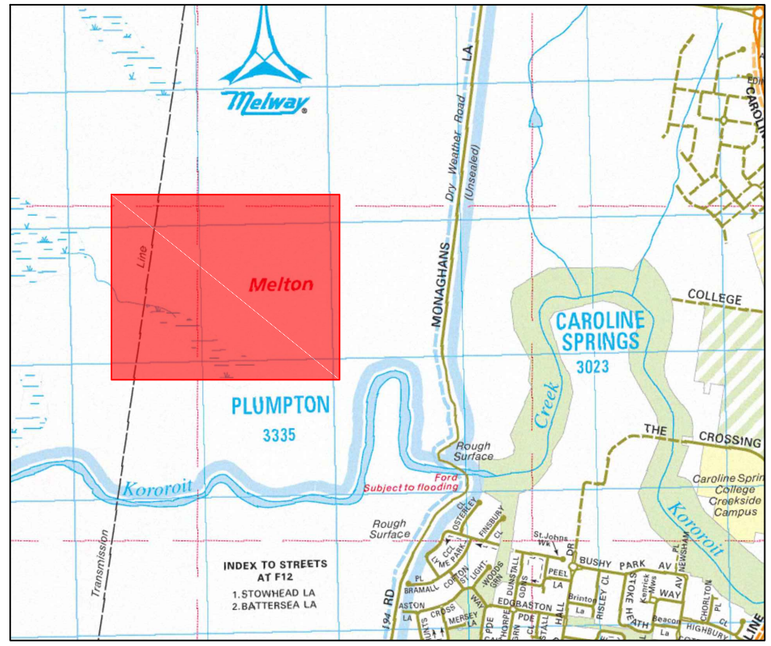
- On the most recent draft PSP plan seen by Alluvium (), the land budget for the wetland and retarding basin appeared to be about 4.9 hectares. The proposed ID_Land layout allows 5.3 hectares, of which 3.96 hectares is on ID_Land and 1.34 hectares on the property to the east (Lawport). This is the same area take for both properties when compared to the previous layout. BPD are the civil engineers for both ID_Land and Lawport and advised that the "more rectangular" arrangement of the proposed layout was preferred.

- The proposed layout has created a rectangular drainage reserve for the wetland/retarding basin in comparison to the previous layout showed the waterway corridor along a diagonal alignment with an awkward triangular reserve that was straddled across the title boundary to the east. Therefore the proposed layout is superior from an implementation and asset management perspective.

ID_Land

855/905 Taylors Road

Wetland and retarding basin -
Preliminary functional design design



LOCATION MAP
MELWAYS 2007

LEGEND
- WETLAND POOL
- WETLAND MARSH
- SEDIMENT POND
- SEDIMENT DRYING ZONE
- ACCESS TRACK
- CONSTRUCTED WATERWAY
- EMBANKMENT
- SPILLWAY

REV	DESCRIPTION	APP'D	DATE
A	PRELIMINARY ISSUE - FUNCTIONAL DESIGN	J.MCL	20.10.16

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Property Management Company
12/484 St Kilda Rd
Melbourne Vic 3004
Ph: (03) 9867 4700

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Alluvium Consulting Australia Pty. Ltd.
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Lvl 1, 105-115 Dover Street
Cremorne Vic 3121
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DESIGNED:	DRAWN:	CHECKED:	APPROVED:	PROJECT No:
J. MCLEAN	K. STANHOPE	J. MCLEAN	J. MCLEAN	P114050

ID_LAND
855/905 TAYLORS ROAD WL/RB

REVISION:	SHEET No.:	ORIGINAL SIZE:	SCALE:
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		DATUM: m AHD (MGA z55)	

REV	DESCRIPTION	APP'D	DATE
A	PRELIMINARY ISSUE - FUNCTIONAL DESIGN	J.MCL	20.10.16

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J. MCLEAN	K. STANHOPE	J. MCLEAN	J. MCLEAN	P114050

ID_LAND
855/905 TAYLORS ROAD WL/RB

CONCEPTUAL AT LOW FLOW

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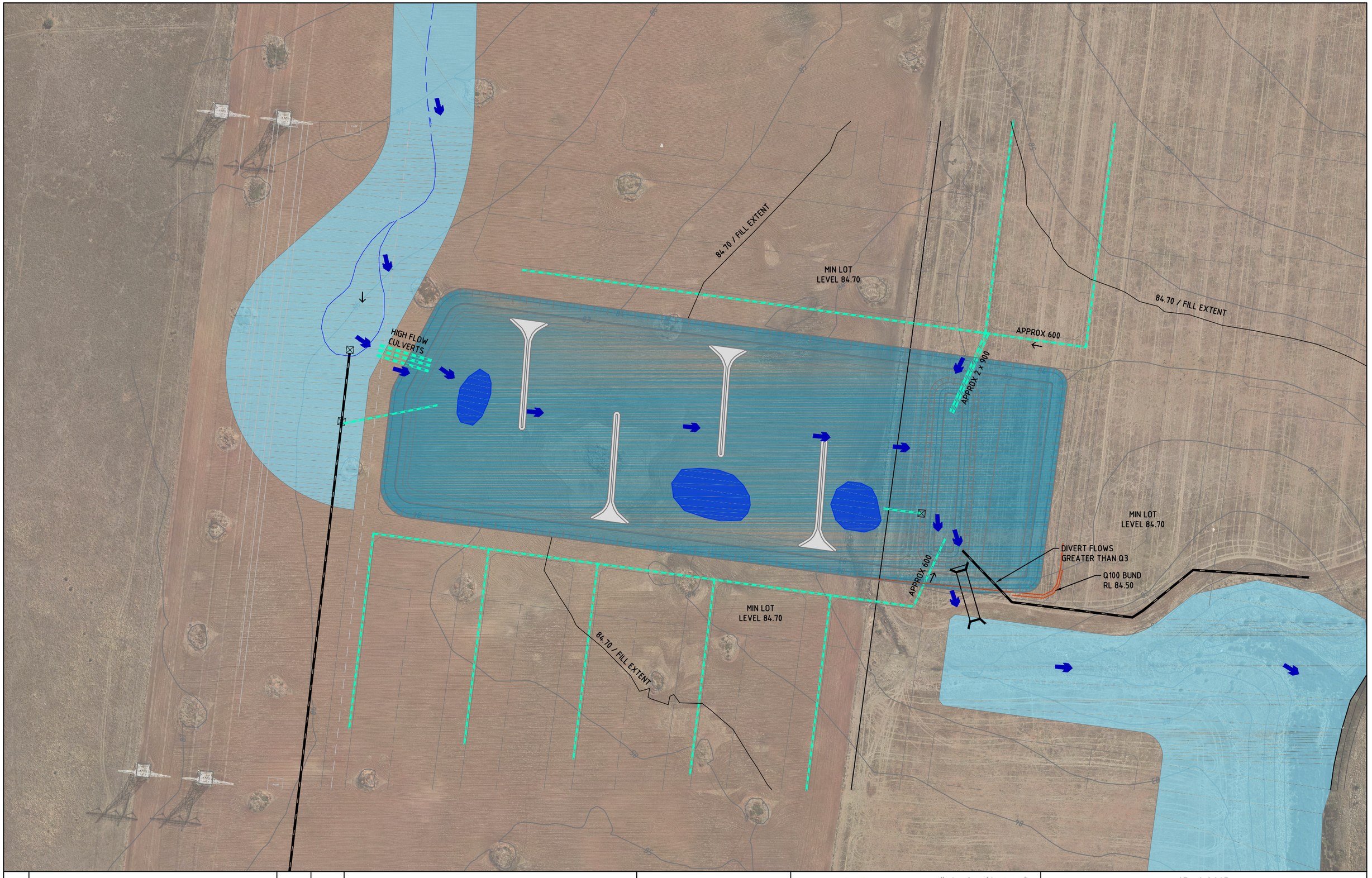

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ID_LAND
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ID_LAND
855/905 TAYLORS ROAD WL/RB

CONCEPTUAL AT HIGH FLOW

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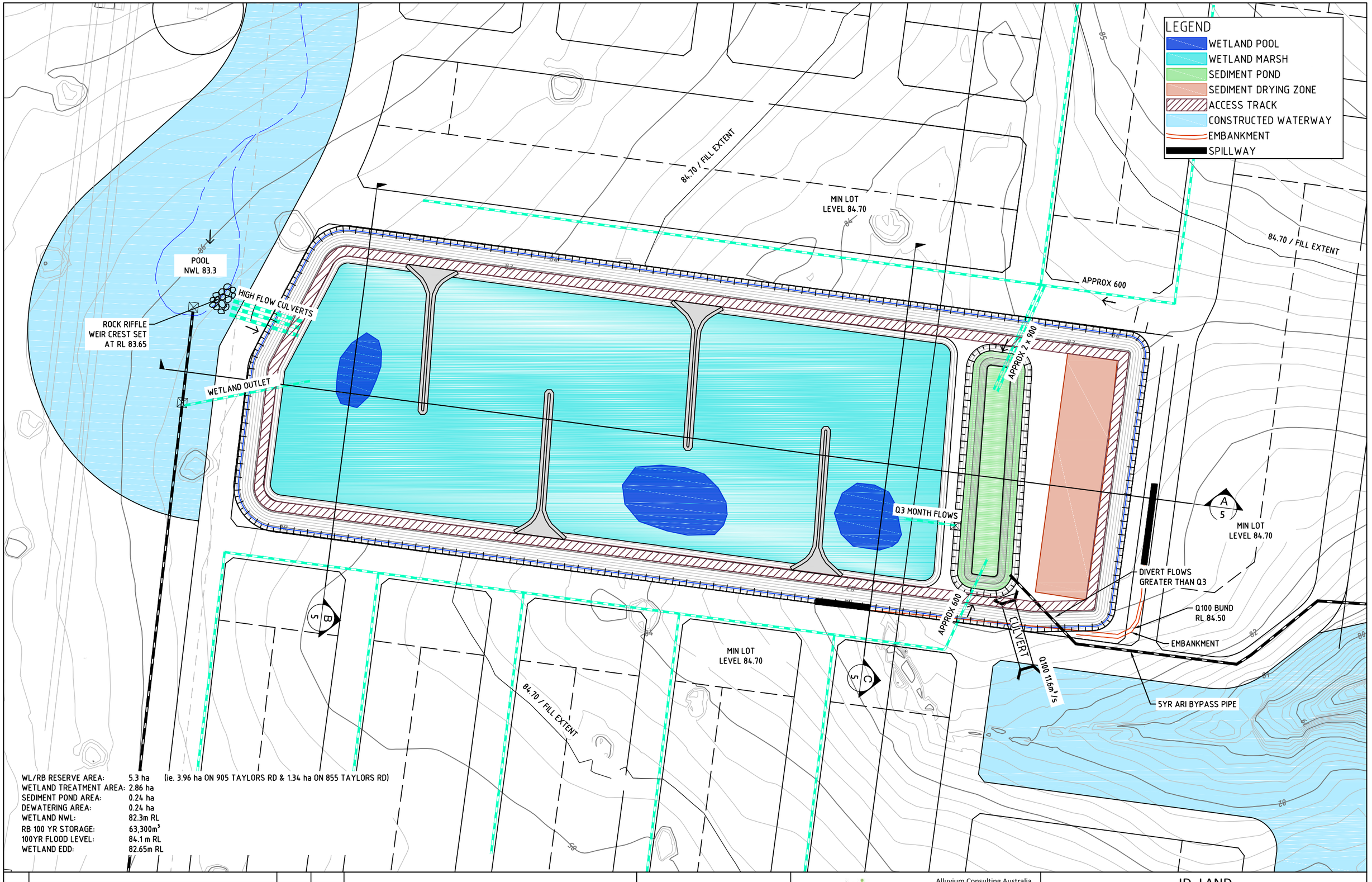
DATUM: m AHD (MGA z55)

0 10 20 40 60m



WL/RB RESERVE AREA:	5.3 ha (ie. 3.96 ha ON 905 TAYLORS RD & 1.34 ha ON 855 TAYLORS RD)
WETLAND TREATMENT AREA:	2.86 ha
SEDIMENT POND AREA:	0.24 ha
DEWATERING AREA:	0.24 ha
WETLAND NWL:	82.3m RL
RB 100 YR STORAGE:	63,300m³
100YR FLOOD LEVEL:	84.1 m RL
WETLAND EDD:	82.65m RL

REV	DESCRIPTION	APP'D	DATE
A	PRELIMINARY ISSUE - FUNCTIONAL DESIGN	J.MCL	20.10.16

ID_LAND
Property Management Company
12/484 St Kilda Rd
Melbourne Vic 3004
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Lvl 1, 105-115 Dover Street
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DESIGNED:	DRAWN:	CHECKED:	APPROVED:	PROJECT No:
J. MCLEAN	K. STANHOPE	J. MCLEAN	J. MCLEAN	P114050

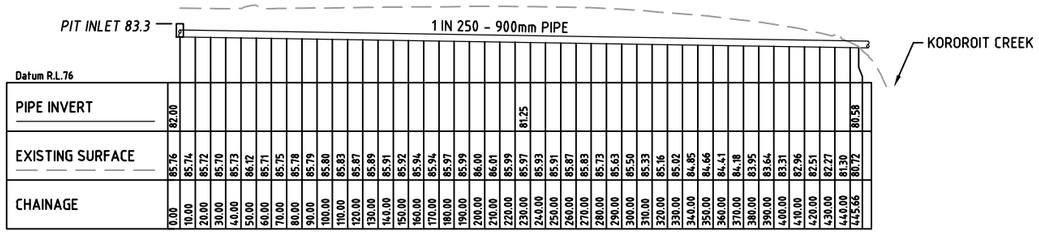
ID_LAND
855/905 TAYLORS ROAD WL/RB

WETLAND FUNCTIONAL DESIGN

REVISION:	SHEET No.:	ORIGINAL SIZE:	SCALE:
A	4	A3	1:1500

DATUM: m AHD (MGA z55)

0 10 20 40m



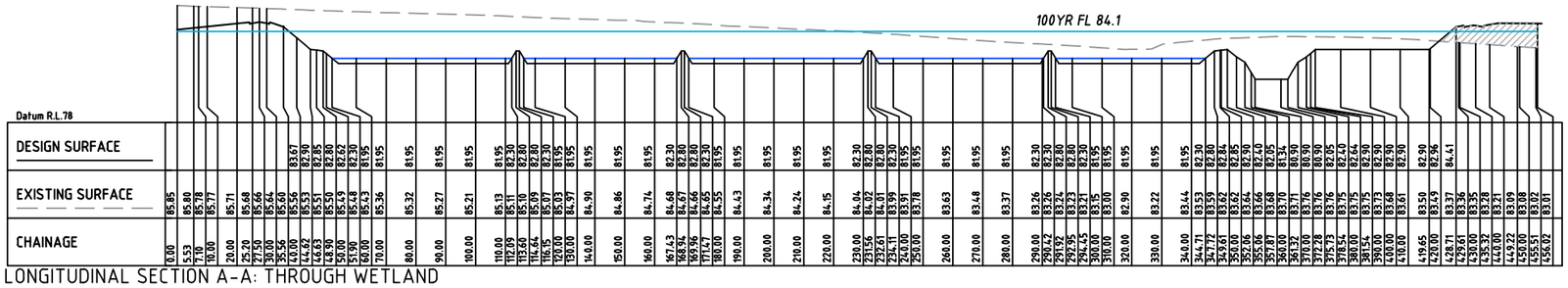
Datum R.L.76

CHAINAGE	EXISTING SURFACE	PIPE INVERT
0.00	85.76	82.00
10.00	85.74	
20.00	85.72	
30.00	85.70	
40.00	85.73	
50.00	86.12	
60.00	85.71	
70.00	85.75	
80.00	85.78	
90.00	85.79	
100.00	85.80	
110.00	85.83	
120.00	85.87	
130.00	85.89	
140.00	85.91	
150.00	85.92	
160.00	85.94	
170.00	85.94	
180.00	85.97	
190.00	85.99	
200.00	86.00	
210.00	86.01	
220.00	85.99	
230.00	85.97	81.25
240.00	85.93	
250.00	85.91	
260.00	85.87	
270.00	85.83	
280.00	85.73	
290.00	85.63	
300.00	85.50	
310.00	85.33	
320.00	85.16	
330.00	85.02	
340.00	84.85	
350.00	84.66	
360.00	84.41	
370.00	84.18	
380.00	83.95	
390.00	83.64	
400.00	83.31	
410.00	82.96	
420.00	82.51	
430.00	82.27	
440.00	81.30	
445.566	80.772	80.58

LONGITUDINAL SECTION - LOW FLOW DIVERSION PIPE TO KORORAIT CREEK

HORIZONTAL SCALE 1:4000

VERTICLE SCALE 1:800



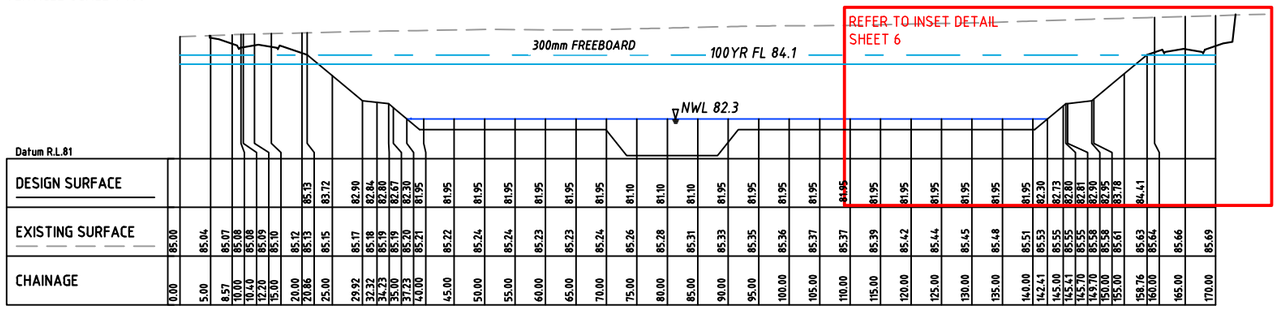
Datum R.L.78

CHAINAGE	EXISTING SURFACE	DESIGN SURFACE
0.00	85.85	
5.53	85.80	
7.10	85.78	
10.00	85.77	
20.00	85.71	
25.20	85.68	
27.50	85.66	
30.00	85.64	
35.56	85.60	
40.00	85.56	83.67
44.42	85.53	82.80
47.43	85.51	82.30
48.90	85.50	82.62
50.00	85.49	82.30
51.90	85.48	81.95
60.00	85.43	
70.00	85.36	81.95
80.00	85.32	81.95
90.00	85.27	81.95
100.00	85.21	81.95
110.00	85.13	81.95
112.00	85.11	82.30
113.07	85.10	82.30
114.64	85.09	82.30
116.15	85.07	82.30
120.00	85.03	81.95
130.00	84.97	81.95
140.00	84.90	81.95
150.00	84.86	81.95
160.00	84.74	81.95
167.43	84.68	82.30
168.94	84.67	82.80
169.96	84.66	82.80
171.47	84.65	82.30
180.00	84.55	81.95
190.00	84.43	81.95
200.00	84.34	81.95
210.00	84.24	81.95
220.00	84.15	81.95
230.00	84.04	82.30
231.56	84.02	82.80
232.61	83.99	82.30
234.11	83.91	81.95
240.00	83.91	81.95
250.00	83.78	81.95
260.00	83.63	81.95
270.00	83.48	81.95
280.00	83.37	81.95
290.00	83.26	82.30
290.42	83.26	82.80
291.95	83.24	82.30
293.95	83.23	82.80
294.45	83.21	82.30
300.00	83.15	81.95
310.00	83.00	81.95
320.00	82.90	81.95
330.00	83.22	81.95
340.00	83.44	81.95
344.71	83.53	82.30
347.72	83.59	82.80
349.65	83.62	82.30
350.00	83.62	82.26
352.06	83.64	82.90
355.06	83.66	82.40
357.87	83.68	82.05
360.00	83.70	81.34
361.32	83.71	80.90
367.20	83.76	80.90
370.00	83.76	82.15
375.73	83.76	82.40
378.54	83.75	82.64
380.00	83.75	82.90
381.54	83.75	82.90
390.00	83.73	82.90
400.00	83.68	82.90
410.00	83.61	82.90
419.65	83.50	82.90
420.00	83.49	82.96
428.71	83.37	84.41
429.61	83.36	
430.00	83.35	
435.32	83.28	
437.00	83.21	
441.922	83.09	
450.00	83.08	
455.51	83.02	
456.92	83.01	

LONGITUDINAL SECTION A-A: THROUGH WETLAND

HORIZONTAL SCALE 1:2000

VERTICLE SCALE 1:400



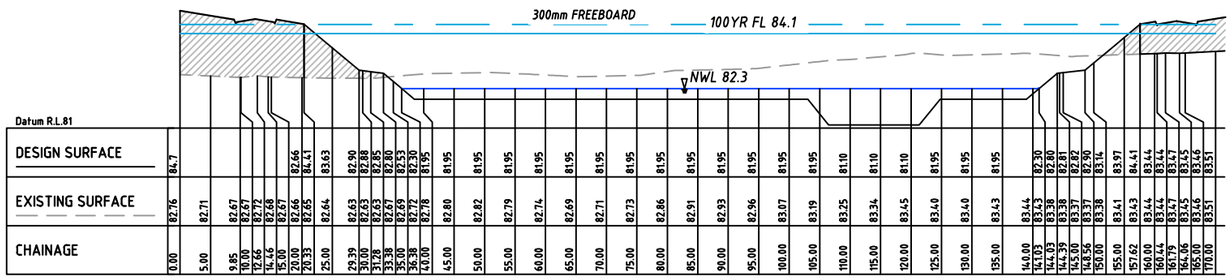
Datum R.L.81

CHAINAGE	EXISTING SURFACE	DESIGN SURFACE
0.00	85.00	
5.00	85.04	
8.57	85.07	
10.00	85.08	
10.44	85.08	
12.20	85.09	
15.00	85.10	
20.00	85.12	85.13
20.86	85.13	83.72
25.00	85.15	82.90
29.92	85.17	82.84
32.32	85.18	82.80
34.23	85.19	82.67
37.23	85.20	82.30
40.00	85.21	81.95
45.00	85.22	81.95
50.00	85.24	81.95
55.00	85.24	81.95
60.00	85.23	81.95
65.00	85.23	81.95
70.00	85.24	81.95
75.00	85.26	81.95
80.00	85.28	81.10
85.00	85.31	81.10
90.00	85.33	81.10
95.00	85.35	81.95
100.00	85.36	81.95
105.00	85.37	81.95
110.00	85.37	81.95
115.00	85.39	81.95
120.00	85.42	81.95
125.00	85.44	81.95
130.00	85.45	81.95
135.00	85.48	81.95
140.00	85.51	81.95
142.41	85.53	82.30
145.00	85.55	82.73
145.41	85.55	82.80
145.70	85.55	82.67
147.70	85.57	82.30
150.00	85.58	82.95
155.00	85.61	83.78
158.76	85.63	84.41
160.00	85.64	
165.00	85.66	
170.00	85.69	

CROSS SECTION B-B

HORIZONTAL SCALE 1:1000

VERTICLE SCALE 1:200



Datum R.L.81

CHAINAGE	EXISTING SURFACE	DESIGN SURFACE
0.00	82.76	84.7
5.00	82.71	
9.85	82.67	
10.00	82.67	
12.66	82.72	
14.46	82.68	
15.00	82.67	
20.00	82.66	82.66
20.33	82.65	84.41
25.00	82.64	83.63
29.39	82.63	82.90
30.00	82.63	82.80
31.28	82.63	82.85
33.38	82.67	82.80
35.00	82.69	82.53
36.38	82.72	82.30
40.00	82.78	81.95
45.00	82.80	81.95
50.00	82.82	81.95
55.00	82.79	81.95
60.00	82.74	81.95
65.00	82.69	81.95
70.00	82.71	81.95
75.00	82.73	81.95
80.00	82.86	81.95
85.00	82.91	81.95
90.00	82.93	81.95
95.00	82.96	81.95
100.00	83.07	81.95
105.00	83.19	81.95
110.00	83.25	81.10
115.00	83.34	81.10
120.00	83.45	81.10
125.00	83.40	81.95
130.00	83.40	81.95
135.00	83.43	81.95
140.00	83.44	81.95
141.73	83.43	82.30
144.03	83.38	82.80
144.39	83.38	82.81
145.00	83.37	82.82
148.56	83.37	82.90
150.00	83.38	83.14
155.00	83.41	83.97
157.62	83.43	84.41
160.00	83.44	83.44
160.44	83.44	83.44
161.79	83.47	83.47
164.06	83.45	83.45
165.00	83.46	83.46
170.00	83.51	83.51

CROSS SECTION C-C

HORIZONTAL SCALE 1:1000

VERTICLE SCALE 1:200

HORIZONTAL SCALE @ A3 1:4000 — 0 40 80 120m / 20

VERTICAL SCALE @ A3 1:800 — 0 8 16 24m / 4

HORIZONTAL SCALE @ A3 1:2000 — 0 20 40 60m / 10

VERTICAL SCALE @ A3 1:400 — 0 4 8 12m / 2

HORIZONTAL SCALE @ A3 1:1000 — 0 10 20 30m / 5

VERTICAL SCALE @ A3 1:200 — 0 2 4 6m / 1

REV	DESCRIPTION	APP'D	DATE
A	PRELIMINARY ISSUE - FUNCTIONAL DESIGN	J.MCL	20.10.16

ID_LAND

Property Management Company
12/484 St Kilda Rd
Melbourne Vic 3004
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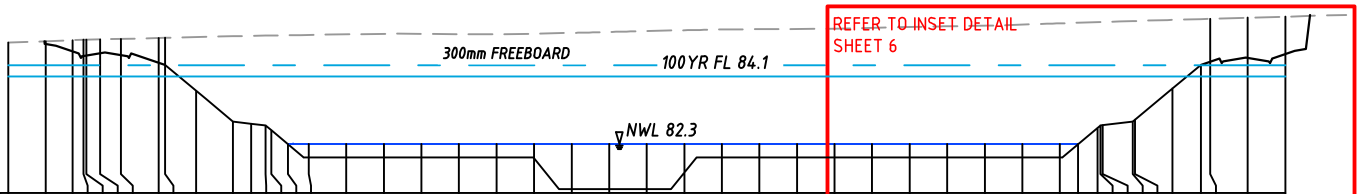
DESIGNED:	DRAWN:	CHECKED:	APPROVED:	PROJECT No:
J. MCLEAN	K. STANHOPE	J. MCLEAN	J. MCLEAN	P114050

ID_LAND
855/905 TAYLORS ROAD WL/RB

SECTIONS

REVISION:	SHEET No.:	ORIGINAL SIZE:	SCALE:
A	5	A3	AS SHOWN

DATUM: m AHD (MGA z55)

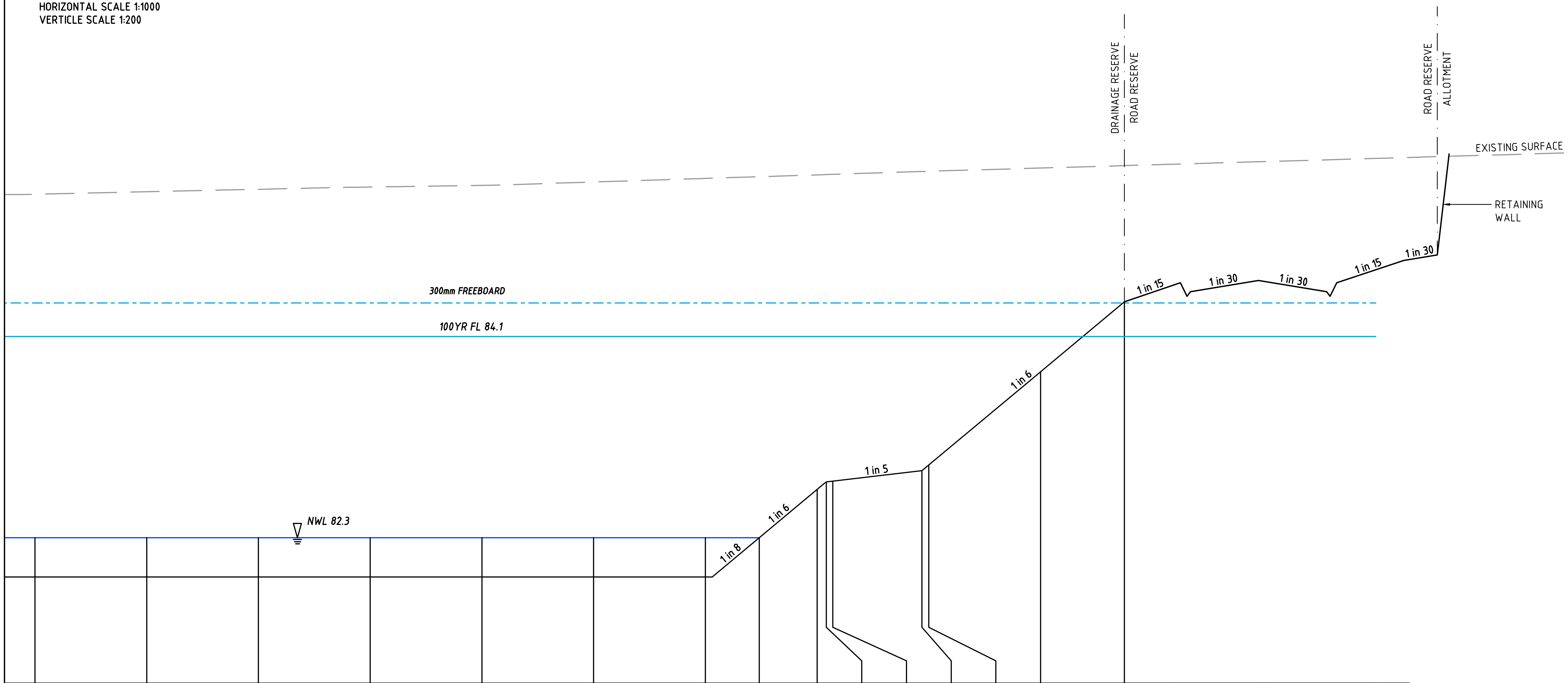


DESIGN SURFACE									85.13	83.72	82.90	82.84	82.80	82.67	82.30	81.95
EXISTING SURFACE	85.00	85.04	85.07	85.08	85.08	85.09	85.10	85.12	85.13	85.15	85.17	85.18	85.19	85.19	85.20	85.21
CHAINAGE	0.00	5.00	8.57	10.00	10.40	12.20	15.00	20.00	20.86	25.00	29.92	32.32	34.23	35.00	37.23	40.00

DESIGN SURFACE	81.95	81.95	81.95	81.95	81.95	81.95	81.10	81.10	81.10	81.95	81.95	81.95	81.95	81.95	81.95	81.95
EXISTING SURFACE	85.22	85.24	85.24	85.23	85.23	85.24	85.26	85.28	85.31	85.33	85.35	85.36	85.37	85.37	85.39	85.42
CHAINAGE	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00	105.00	110.00	115.00	120.00

DESIGN SURFACE	81.95	81.95	81.95	81.95	82.30	82.73	82.80	82.81	82.90	82.95	83.78	84.41			
EXISTING SURFACE	85.44	85.45	85.48	85.51	85.53	85.55	85.55	85.55	85.58	85.58	85.61	85.63	85.64	85.66	85.69
CHAINAGE	125.00	130.00	135.00	140.00	142.41	145.00	145.41	145.70	149.70	150.00	155.00	158.76	160.00	165.00	170.00

CROSS SECTION B-B
HORIZONTAL SCALE 1:1000
VERTICLE SCALE 1:200



81.95	81.95	81.95	81.95	81.95	81.95	81.95	82.30	82.73	82.80	82.81	82.90	82.95	83.78	84.41			
85.37	85.39	85.42	85.44	85.45	85.48	85.51	85.53	85.55	85.55	85.55	85.58	85.58	85.61	85.63	85.64	85.66	85.69
110.00	115.00	120.00	125.00	130.00	135.00	140.00	142.41	145.00	145.41	145.70	149.70	150.00	155.00	158.76	160.00	165.00	170.00

REV	DESCRIPTION	APP'D	DATE
A	PRELIMINARY ISSUE - FUNCTIONAL DESIGN	J.MCL	20.10.16

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DESIGNED:	DRAWN:	CHECKED:	APPROVED:	PROJECT No:
J. MCLEAN	K. STANHOPE	J. MCLEAN	J. MCLEAN	P114050

ID_LAND
855/905 TAYLORS ROAD WL/RB

SECTION B-B DETAIL

REVISION:	SHEET No.:	ORIGINAL SIZE: A3	SCALE: AS SHOWN
A	6	DATUM: m AHD (MGA z55)	