Expert Opinion on

Drainage Issues

Amendment GC28 to the Whittlesea and Mitchell Planning Schemes

Report Author:	Warwick Bishop
Report Prepared for:	DFC (Woodstock) Pty Ltd
Instructed by:	HWL Ebsworth Lawyers
Report Date:	9 May 2016

1. REPORT AUTHOR

Warwick Bishop

Senior Principal Engineer, Director
Water Technology Pty Ltd
15 Business Park Drive
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Qualifications:

- B.E. (Hons), University of Melbourne, 1993
- MEngSci, Monash University, 2000

Affiliations:

- Charter Member, Institution of Engineers, Australia
- Chair, Engineers Australia, Victorian Water Engineering Branch Committee
- Member, International Association for Hydraulic Research
- Member, Australian Water Association
- Member, River Basin Management Society
- Member, Stormwater Victoria

Experience

I am a Director of Water Technology and have over 20 years' experience in hydrologic and hydraulic investigations, specialising in the development and application of rural and urban hydrodynamic models and their application to flooding, drainage, water quality, sediment transport and environmental values. I also have extensive experience in coastal and estuary modelling including wave, current, oil spill and coastal vulnerability investigations. I have worked extensively in the Murray Darling Basin, principally on environmental hydraulic investigations for the Living Murray Program. I was recently involved in the revision of Australian Rainfall and Runoff, with particular focus on the application of 2D hydraulic models to flooding in urban and rural areas. In 2011 I worked in the Flood Intelligence Unit of SES during the January floods and have provided advice to Catchment Management Authorities over the subsequent period.

2. STATEMENT OF EXPERTISE

With my qualifications and experience, I believe that I am well qualified to provide an expert opinion regarding drainage issues related to Amendment GC28 to the Whittlesea and Mitchell Planning Schemes.

3. SCOPE OF THIS REPORT

In relation to Amendment GC28 to the Whittlesea and Mitchell Planning Schemes, I have been requested to:

1. Prepare evidence in relation to drainage issues relating to the client's land as a result of the Amendment.
2. Focus on the neighbour's submission 27 concerning drainage.

4. BASIS OF THIS REPORT

This report is based on:

- Information provided to me by HWL Ebsworth as a download link associated with the instruction letter dated 8 April 2016, including:
    1. Amendment GC28 Explanatory Report
    2. Donnybrook/Woodstock Precinct Structure Plan (MPA), November 2015
    3. Exhibited Amendments
    4. Donnybrook Post Contact Heritage Assessment, August 2013
    5. Environmental, Hydrological & Geotechnical Assessment, June 2013
    6. PSP Background Report, November 2015
    7. PSP Newsletter, November 2015
    8. Road, Intersection and Culvert/Bridge Design, October 2015
    9. Growling Grass Frog Habitat Assessment and Mapping, March 2014
    10. Whole of Water Cycle Assessment, June 2014
    11. Land Owner Plan
    12. Woodstock West Drainage and Servicing – Overall Scheme Plan, April 2015
    13. Preliminary Woodstock Drainage and Services Plan, December 2015
    14. DFC (Donnybrook) Pty Ltd Submissions, December 2015
    15. Donnybrook Springs Developments: Response to Proposed Donnybrook/Woodstock Precinct Structure Plan, Dec 2015
    16. Lockerbie East Drainage Scheme review, Pat Condina and Associates, October 2015
- Melbourne Water (2007), Principles for Provision of Waterway and Drainage Services for Urban Growth
- MPA Submission to Panel, April 2016
- DPM Donnybrook/Woodstock PSP and Lockerbie East DSS Drainage Memo, April 2016
- Water Technology Memo on modelling of the Donnybrook development for DPM, July 2014.
- PSP 25 and 26 Drainage Strategy, Alluvium for GAA, October 2012

My report has been prepared in accordance with Planning Panels Victoria's "Guide to Expert Evidence".

5. INTRODUCTION

Amendment GC28 to the Whittlesea and Mitchell Planning Schemes has been prepared by the Metropolitan Planning Authority (MPA) in collaboration with the City of Whittlesea and Mitchell Shire Council. The MPA as worked extensively with Council, developers, land owners and State agencies to resolve issues arising from submissions. This process has specifically involved Melbourne Water in relation to drainage issues.

The proposed drainage infrastructure for the Donnybrook and Woodstock Precinct Structure Plan (PSP) is defined by the Melbourne Water Lockerbie East Development Services Scheme (DSS). This DSS has been developed and modified in parallel with the PSP and plans for the orderly provision of drainage infrastructure that will ensure urban development meets appropriate standards for flood protection, water quality treatment and waterway health and amenity.

Development Services Schemes are produced in accordance with the "Principles for Provision of Waterway and Drainage Services for Urban Growth", published by Melbourne Water in 2007. This document describes 16 principles that govern the way in which each DSS is formulated.

6. SUBJECT SITE

6.1 Donnybrook and Woodstock PSP area

The subject site is located approximately 35 km north of Melbourne and is approximately 2 km east of the Hume Freeway. The total area is approximately 1786 ha and is bounded by the Melbourne-Sydney Railway line to the west, the proposed future Outer Metropolitan Ring Road to the north and east and Donnybrook Road to the south. The combined PSP area is shown in Figure 6-1. Figure 6-2 shows the existing corridors of Merri and Darebin Creeks and flood extents for the drainage depression through the middle of the Donnybrook area which forms a tributary of Merri Creek, flowing from a local catchment east to west.

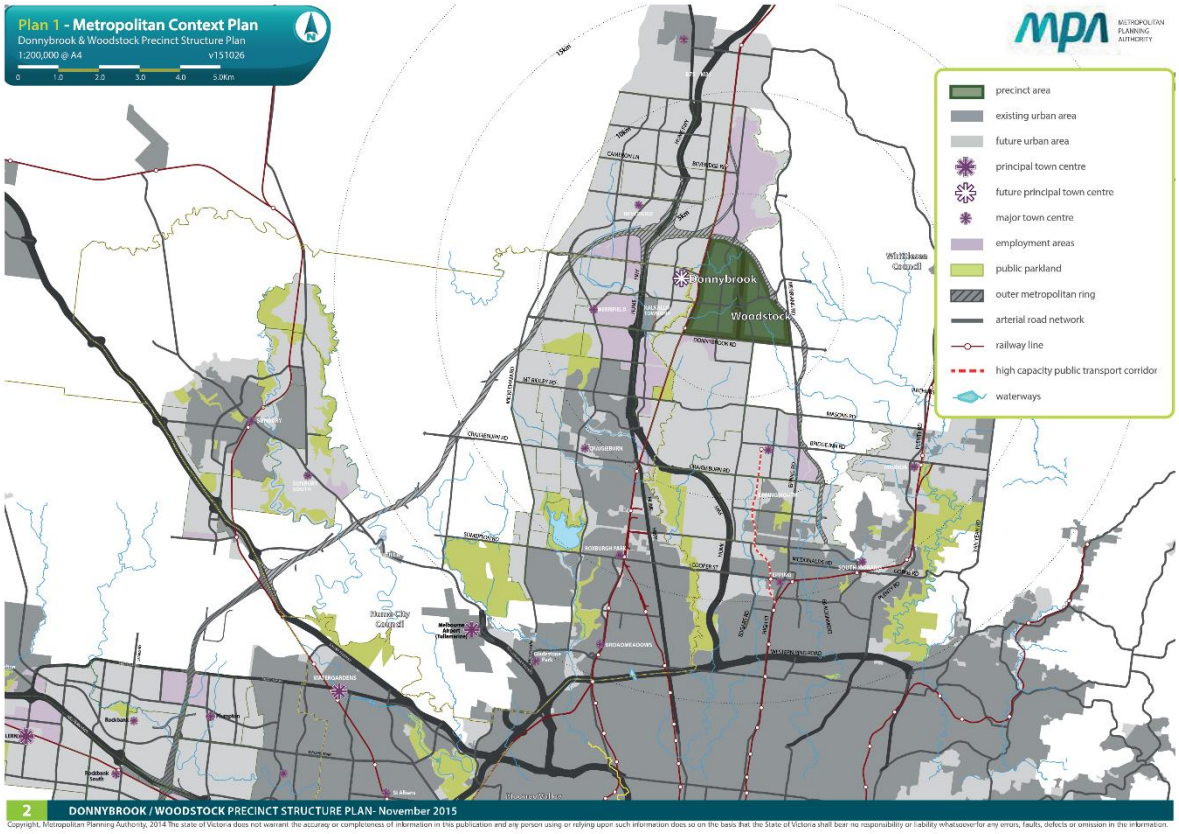

Figure 6-1 PSP Locality (Source: MPA PSP, Nov. 2015)

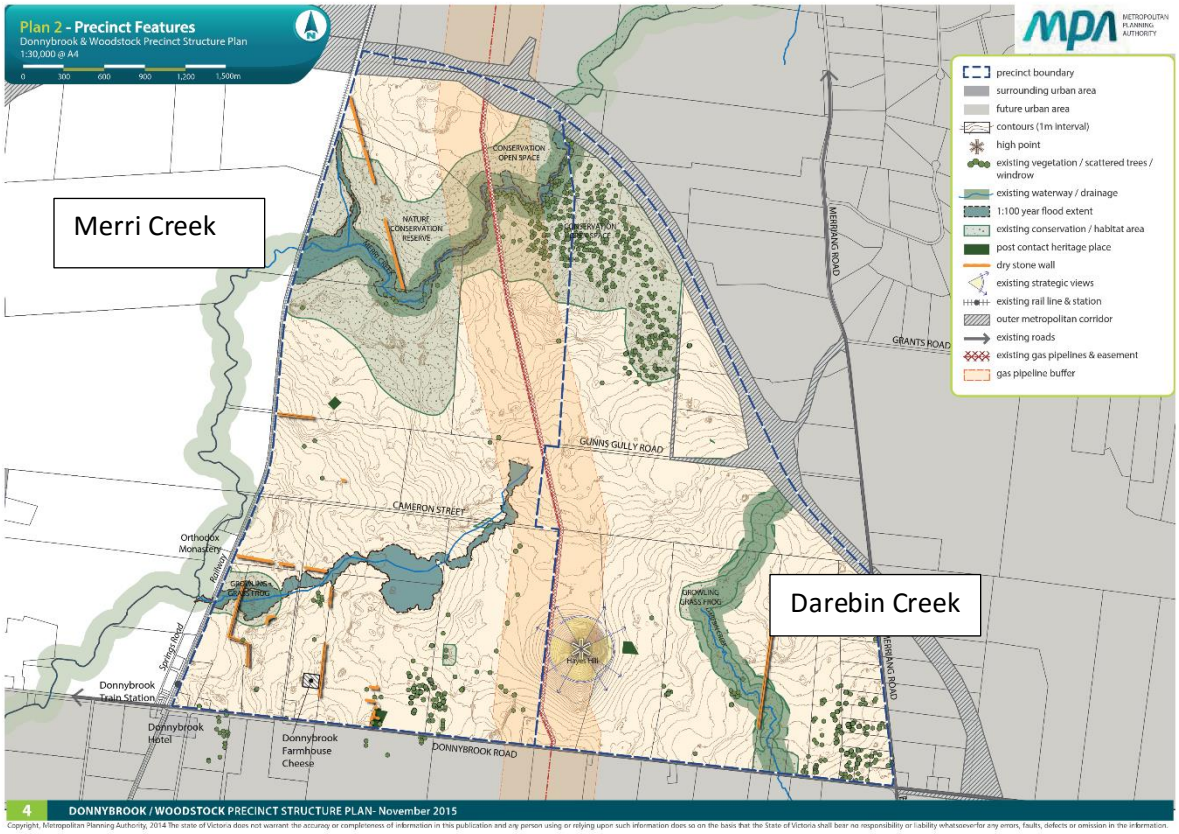

Figure 6-2 PSP features (Source: MPA PSP, Nov. 2015)

6.2 DFC (Donnybrook) Land

The DFC land consists of two areas known as Peppercorn Hill and Donnybrae as shown in Figure 6-3. Peppercorn Hill is situated within the Woodstock PSP area and Donnybrae is situated within the Donnybrook PSP area.

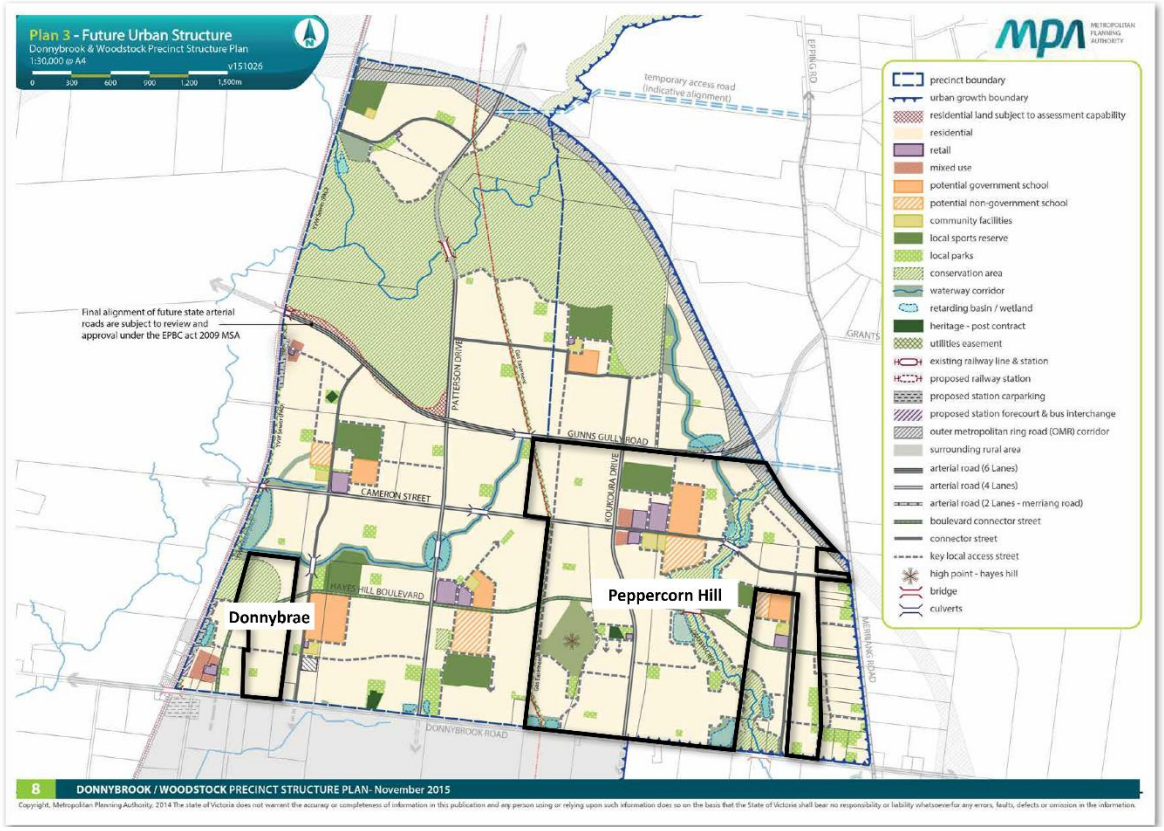

Figure 6-3 DFC Land within PSP, Peppercorn Hill and Donnybrae (Source: DFC submission to PSP, Dec. 2015)

7. EXISTING DRAINAGE CHARACTERISTICS

7.1 Site Topography

The site topography is shown in Figure 7-1. This figure is based on LIDAR aerial survey, which is the most accurate broad-scale ground level information available and is widely utilised for flood mapping and waterway assessment purposes. The LIDAR survey typically has a vertical accuracy of around +/- 150 mm and is appropriate for the delineation of catchment boundaries and interpretation of existing surface water characteristics. Figure 7-1 illustrates the broad topographical features of the area. Some points to note are:

- Merri Creek waterway runs through the northern section and then along the west side of the area
- Darebin Creek waterway originates and flows through the east side of the area
- There is a ridge line that runs north-south and divides the area between the Merri Creek and Darebin Creek catchments. This ridge is located approximately along the boundary between the Donnybrook and Woodstock PSPs.
- The topography over the area is generally flat, sloping from north to south with the highest elevations being around 280 m AHD in the north-east of the area and at Hayes Hill in the south, which is a locally prominent volcanic dome that rises around 35 m above the surrounding volcanic plain. The lowest elevations are around 220 m AHD in the south-east and south-west corners of the combined PSP area.

- The Melbourne-Sydney railway line runs along the west boundary of the PSP and forms a hydraulic barrier to surface flows. There are

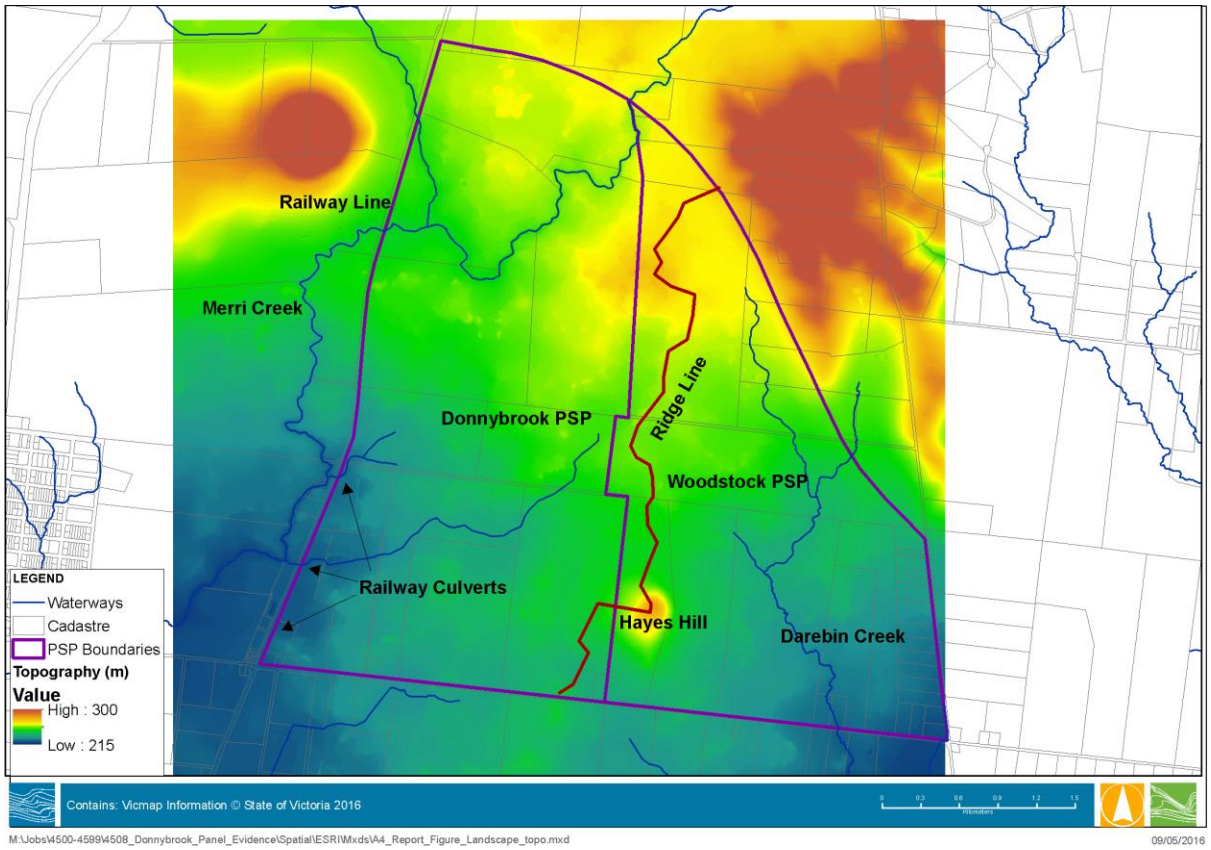

Figure 7-1 Lidar based topography of the site (Source: DELWP)

7.2 Merri Creek and Darebin Creek Catchments

As described above, the PSP area currently drains on the west side to Merri Creek and on the east side to Darebin Creek. Merri Creek has a substantial catchment upstream and is a significant waterway before it passes through the PSP area. Part of the northern section of the Woodstock PSP essentially forms the headwaters of Darebin Creek and hence it is a smaller natural waterway than Merri Creek in the vicinity of the PSP.

7.3 Internal Drainage Catchments

The PSP area is divided into a number of natural drainage catchments, however there are no obvious or significant internal waterways. There are a number of catchments, less than 100 Ha in area, that drain to the east and south. There are 2 larger catchments on the west as shown in Figure 7-2. The northern Merri Creek tributary catchment has an area of approximately 260 ha and the southern Merri Creek tributary catchment has an area of approximately 300 ha. These catchments both drain to the northern and middle culvert crossings on the main railway line to the west.

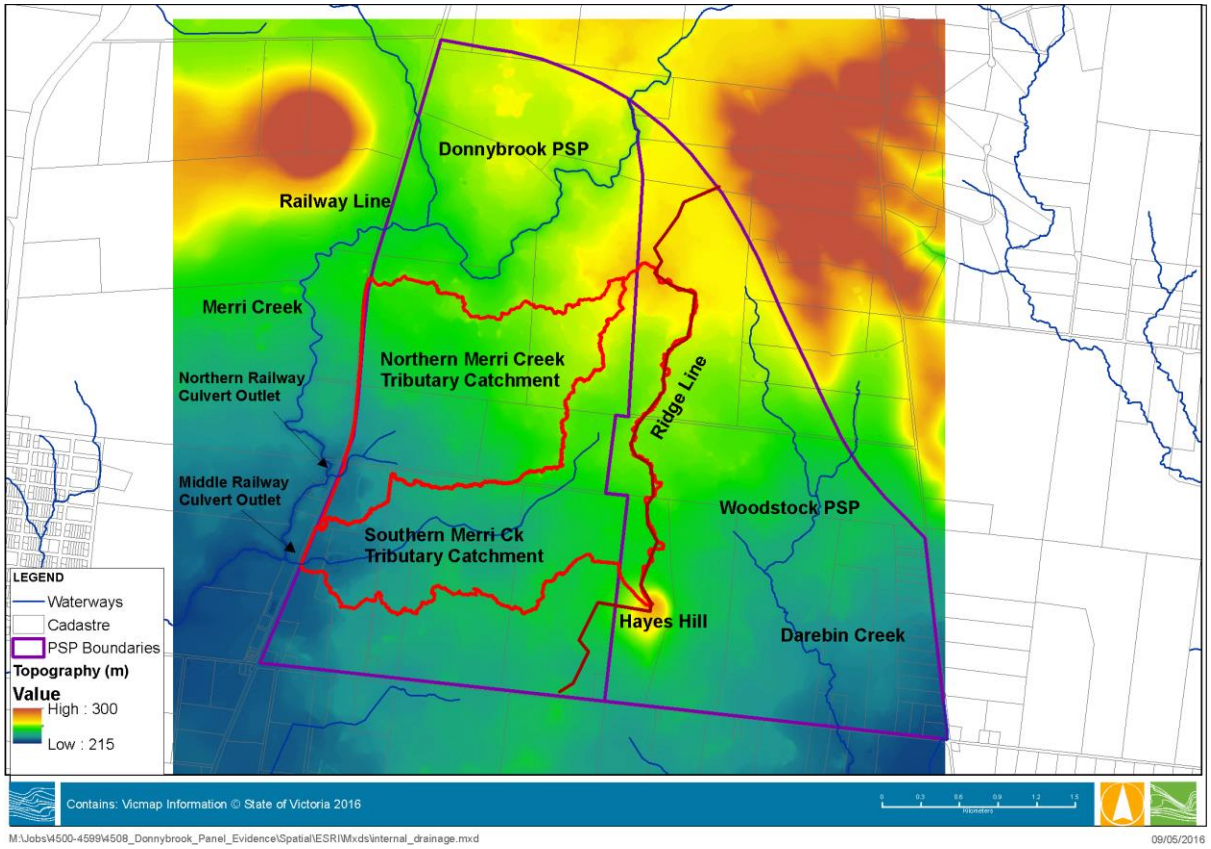

Figure 7-2 Merri Creek, Internal Drainage Catchments

8. PROPOSED DRAINAGE SOLUTION FOR PSP

8.1 Lockerbie East Development Services Scheme and PSP

The Lockerbie East Development Services Scheme provides the concept design for drainage infrastructure to be implemented as part of the PSP. This DSS has been developed by Melbourne Water since around 2014 and to date has not been finalised or published on Melbourne Water's Drainage Scheme web site. The current scheme components are reflected in the Integrated Water Management Plan 14 of the PSP as shown in Figure 8-1 below. This includes the waterway reserve and basin works but not the pipe components. In general, the piped drainage scheme components do not have a significant impact on the planning process in terms of land use and development layout.

The scheme consists of a number of sediment basins, wetlands, retarding basins and constructed waterways to provide the necessary water management measures to mitigate the impact of urban development on water quality and quantity, whilst providing amenity and maintaining ecological values.

Figure 8-1 PSP Water Management setup

Most of the catchments within the PSP are able to be managed with end-of-catchment retarding basin and/or wetland treatments. This applies to the Darebin Creek/Woodstock PSP area in particular. Water management on the west side, flowing into Merri Creek is less straight forward. The following points should be noted:

- The Melbourne-Sydney Railway Line forms a hydraulic barrier to flows from east to west
- Outflows from the catchments draining to the west are restricted in location and flow capacity by the existing railway culverts.
- At present it has been assumed that the existing flow capacity of the culverts will be utilised rather than upgrading the railway culverts.
- Calculations by Water Technology (2015) show that the southern-most railway culvert has the least flow capacity (just over 1 m^3/s), followed by the middle culvert (2.5 m^3/s) and the northern-most crossing has by far the greatest flow capacity (12.5 m^3/s).
- The northern-most railway culvert has a much higher elevation (approximately 2.5 m above the middle culvert).
- Due to the presence of the railway there is no overland flow path and hence culvert blockage will need to be considered along with the consequence of design floods greater than 1% Annual Exceedence Probability (AEP), also described as the 100 year Average Recurrence Interval (ARI) flood.
- There is a significant conservation and biodiversity zone to be set aside, primarily for Growling Grass Frog habitat on the course of the southern Merri Creek tributary as shown in Figure 6-2. This impacts the waterway and retarding basin arrangement as it is not desirable to have the frog habitat online as part of a treatment wetland or retarding basin. Hence any water quality treatment and retarding function needs to be broadly separate from the frog habitat area.

- In their 2012 study for nearby PSP 25 and 26, Alluvium found that retarding local catchment outflows could potentially have a detrimental impact on peak flood flows in Merri Creek downstream, due to the timing of flood peaks. Their analysis suggested that by delaying the peak runoff from the PSP areas, they would then coincide with the flood hydrograph peak from the much larger upstream catchment as illustrated in Figure 8-2.

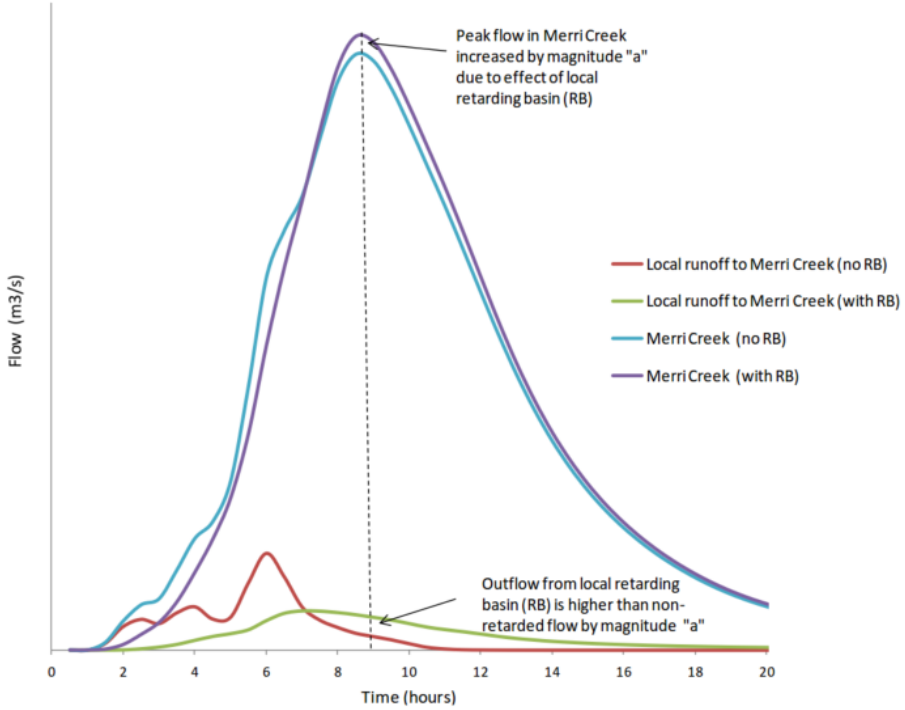

Figure 8-2 Illustration of the effect of local retarding basins on the hydrology of the Merri Creek system, PSP 25 and 26 (Figure 11 from Alluvium 2012)

8.2 Review of presently proposed surface water management features

In response to the constraints outlined above, the current DSS arrangement has the following attributes:

- A retarding basin (RBWL-2) approximately 1.5 km east of the middle railway culvert outlet.
- A channel that broadly follows the southern tributary overland flow path but is diverted to the north to connect into a retarding basin (RBWL-1) adjacent to the railway before discharging to the norther railway culvert.
- A constructed waterway channel connecting RBWL-2 to RBWL-1

In the process of arriving at this solution a number of iterations of alternative retarding basin configurations have been tested (Water Technology 2015 and DPM 2016).

Through these investigations it was found that:

- Splitting the retarding function between storages at railway culvert 1 (north) and 2 (middle) led to a greater overall storage volume and retarding basin area. This is not in line with Melbourne Water DSS principles of providing the most efficient and cost effective drainage solution.
- The difference in elevation between the northern and middle railway culvert outlets means that a linear storage basin that engages both outlets is not feasible. The northern structure has an elevation of 225.8 m AHD and the middle structure an elevation of 223.25 m AHD. This

is a difference of approximately 2.5 m. A combined basin would need to be much greater than 2.5 m deep at the southern end to be effective. This would require high banks and potentially trigger significant dam-break safety risk assessment and costly design specifications.

- The additional retarding basin to the east was highly effective in reducing overall peak catchment outflows and results in an overall reduction in storage volume and RB area for the scheme.

Based on a detailed review of the material I have been provided, I believe the present DSS response is an appropriate and effective hydraulic solution for the PSP.

Due to the relatively flat terrain and poorly defined valley to the west of RBWL-2, the exact alignment of the main east-west waterway could be adjusted in some areas, however I do not consider that the alignment could move any further south than is presently the case. Figure 8-3 below illustrates that the present alignment is as far south as would be feasible in order to be able to discharge to the northern railway culvert. Any distance to the south (left on the section matching the red arrow), would result in a drop away to lower ground that would not be practical. As the intention of the DSS is to discharge both the northern and southern Merri Creek tributary catchments to the northern railway culvert, moving the channel south would hinder this task.

There have been some concerns raised in relation to the alignment of the east-west waterway and retarding basins RBWL-1 and RBWL-2. I will address these in the following section. It is noted that DPM have proposed an alternative to the east-west waterway by piping this flow underground. I consider this to be a feasible technical solution, however the waterway and amenity implications of this option would need to be discussed with Melbourne Water.

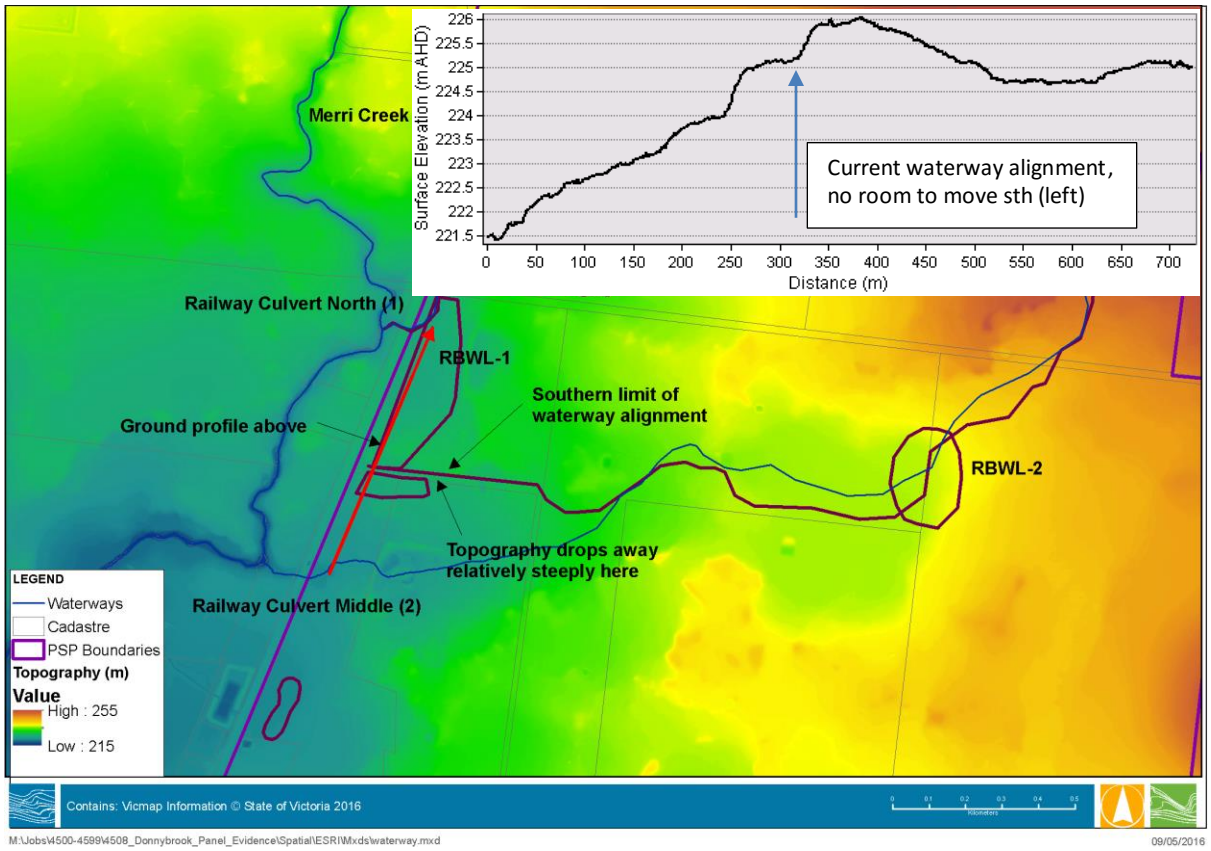

Figure 8-3 Location of east-west waterway and topographic constraints

9. SUBMISSION 27 – DRAINAGE ISSUES

I have been requested to specifically review Submission 27 in relation to drainage.

The issues of concern raised in relation to Section 3.6 – Integrated Water Management (IWM) and Utilities of the PSP are listed below, along with a discussion on each. Note in the discussion below the "land holding" refers to the land associated with the party that put together submission 27.

1. ***The IWM plan grossly burdens the land holding in terms of land take:*** The presently proposed DSS is based on sound principles for the location of water management assets and has been altered to better suit the land holder since it was first developed. The requirement of land for the purposes of managing stormwater water is primarily dictated by the natural topography of the land and characteristics of the catchment and receiving waters. Whilst there is some flexibility in the final outcome, the general principles for developing the DSS are clearly described in the Melbourne Water publication, Principles for Provision of Waterway and Drainage Services for Urban Growth (2007).
2. ***The IWM plan grossly burdens the land holding financially in terms of funding construction costs:*** The costs of construction of drainage assets to cater for new development is covered by the DSS and will be reimbursed by Melbourne Water. This may pose some challenges in terms of timing of the construction of infrastructure and the subsequent reimbursement, however these issues are regularly managed by developers and is a matter of negotiation with Melbourne Water. I do not believe this is a strong argument to change the makeup of the DSS.
3. ***Retarding Basin Wetland-2 (RBWL-2) should not be located as shown on plan 14:*** It is suggested that this RBWL should be relocated to the east onto a neighbouring property. I do not believe this is a feasible option. As currently presented in the DSS, RBWL-2 already presents a design challenge as it has been moved east from a previous version of the plan and now straddles the property boundary. It also extends into a significant rise to the east as can be seen in Figure 9-1 below. This shows there is more than 2 m rise in elevation from west to east across the proposed RB location. This will require either significant excavation on the eastern side or construction of a substantial embankment on the west side. This may lead to significant design difficulties and an increase in costs for the DSS. This is not consistent with DSS Principle 4, "Schemes should propose infrastructure to service development that is optimal in terms of cost and performance". Moving the RB further east will only exacerbate these issues and is considered impractical.

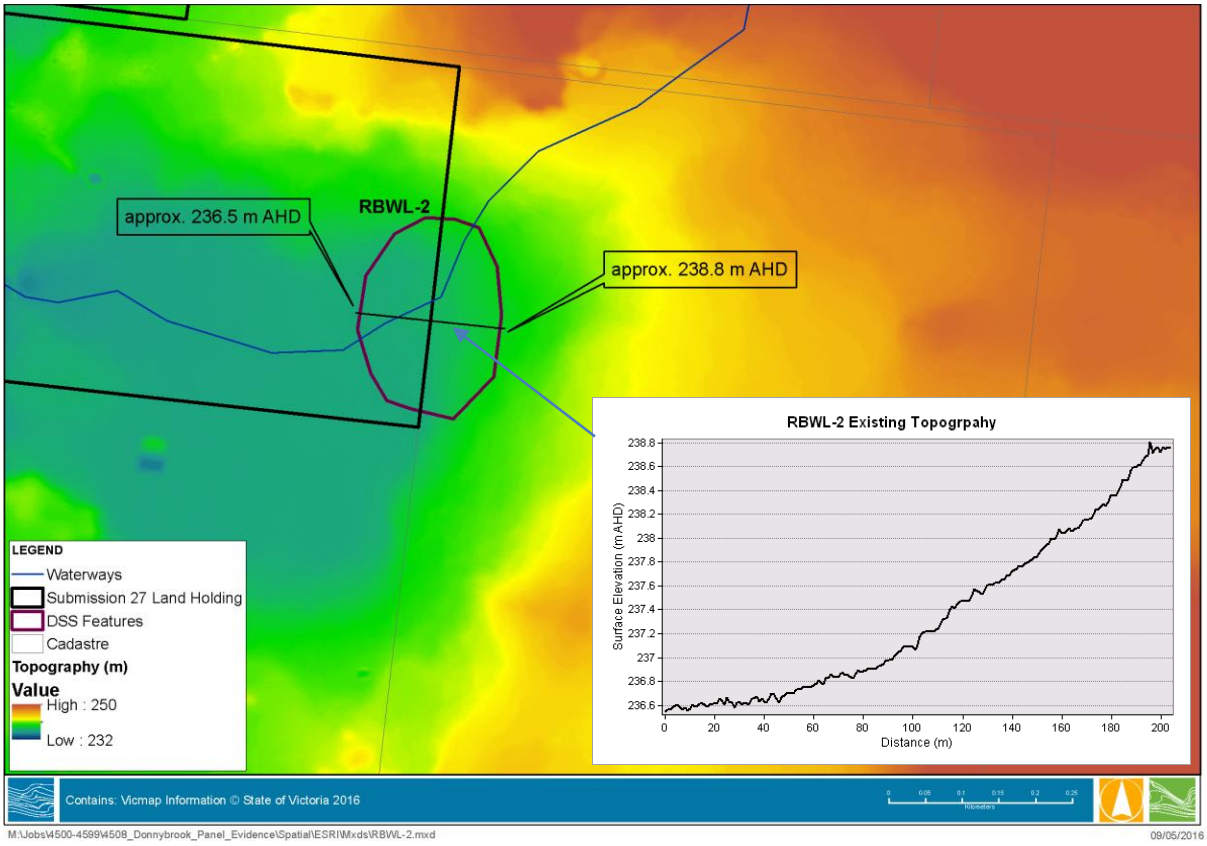

Figure 9-1 RBWL-2 existing topography

4. ***Details of RBWL-02 not provided by MW in the DSS:*** It is common that this level of detail is not provided with the DSS at this stage of planning. It is true, however, that functional design details and checks such as contouring and levels of inlets and outlets are helpful in testing the feasibility and refining the costing of works.

   It is suggested that the RB should be located on the land where the runoff is generated. The main driver for DSS's is that costs for water management infrastructure, that by necessity is often located in the downstream portion of a catchment, are shared equitably among landowners, including those upstream.

5. ***The main channel from east to west does not follow known contours and no natural watercourse exists:*** It is evident from the existing conditions topography as well as background documents (e.g., Condina and Associates, 2015) that there is no clearly defined existing waterway in the vicinity of the proposed east-west constructed waterway in the Donnybrook PSP area. Analysis of the topography indicates there is a preferential overland flow path that passes east to west through the Submission 27 land holding and then veers south towards the proposed GGF conservation area before discharging under the railway line via a 1050 mm culvert. During periods of high flow it is expected that some runoff would break away to the north-west and flow towards the northern culvert (2m brick arch).

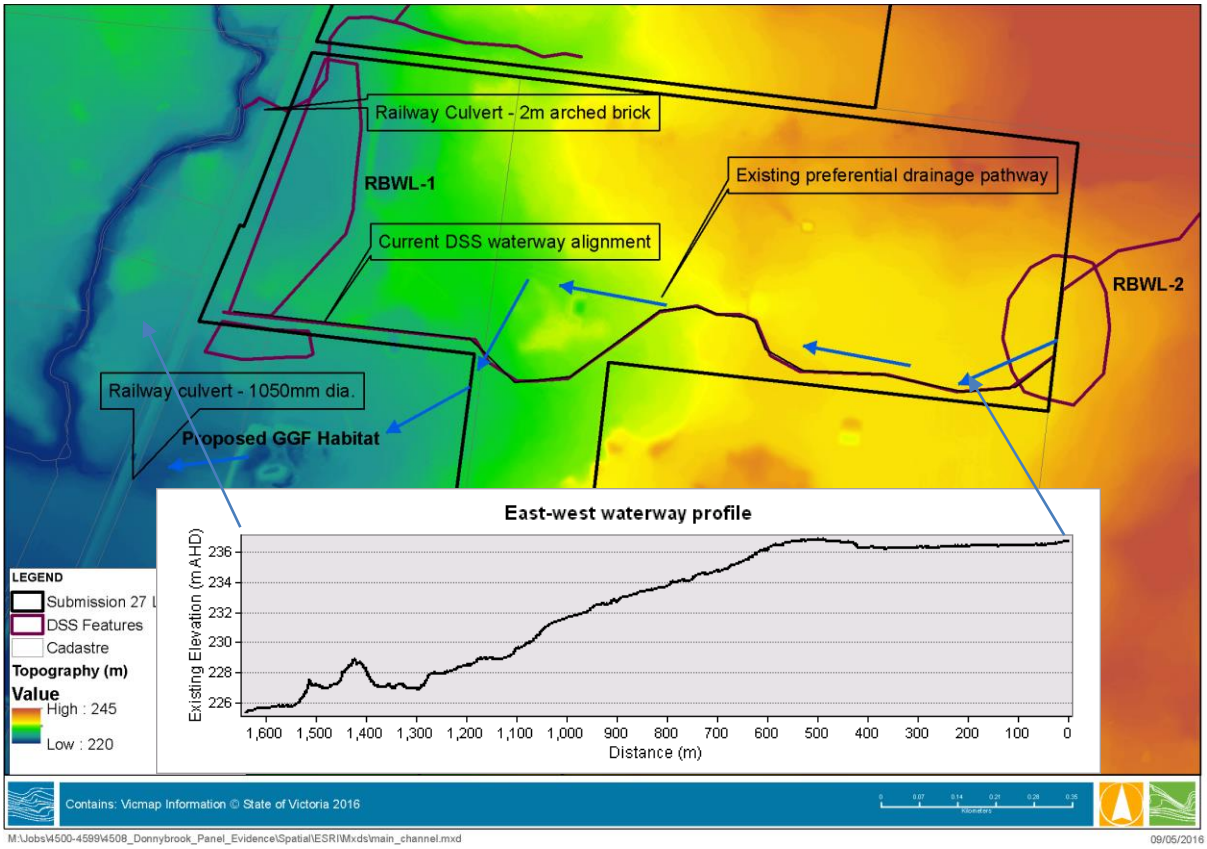

Figure 9-2 Existing topography profile along proposed waterway alignment

6. ***The main channel constructed waterway should be located off the land-holding:*** Following the natural valley and overland flow path is standard practice within a DSS, unless there is some other justification to do so.

7. ***Objection to location of RBWL-1:*** This wetland has been located so as to minimise surface area and maximise hydraulic performance. Due to the inverts of the railway culverts and slope of the land it is not feasible to extend the RB further to the south. The only likely way to reduce the RB size on the land would be to increase the culvert capacity under railway line.

8. ***Surface water does not outfall to all railway culverts:*** It is my understanding that all of the railway culverts will be utilised to their capacity. It may be possible to allow overflow for large flood events to inundate the frog conservation area, however this is unlikely to reduce the RBWL-1 size requirement but could provide an additional factor of safety if the railway culverts were blocked.

9. ***SB-1 is shown to align along a non-existent watercourse:*** Based on review of survey and photographs from Condina and Associates I agree that the merit of constructing the watercourse at SB-1 is questionable. It appears that no existing watercourse of any value exists.

10. CONCLUSIONS

With respect to drainage issues related to Amendment GC28 to the Whittlesea and Mitchell Planning Schemes, the following conclusions can be made:

- The PSP reflects the latest design from the Lockerbie East DSS and provides an appropriate drainage solution for the PSP area.
- The catchment drainage from the west side of the PSP towards Merri Creek is constrained by number of physical conditions including the railway embankment, the railway culverts, the frog conservation area and the variable topography elevations in the area.
- It is practical and most efficient from an overall scheme perspective to direct the majority of Merri Creek southern tributary catchment flows to the northern railway culvert crossing.
- The alignment of the open waterway between RBWL-2 and RBWL-2 should not be located any further south than is presently the case due to topographic constraints.
- RBWL-1 cannot be extended further south due to topographic constraints.
- It would be feasible to replace the waterway between RBWL-2 and RBWL-1 with a piped drain and overland flow path, however this would need to be discussed with MW in relation to practicality and overall DSS objectives for amenity and waterway values.

11. DECLARATION

I declare that 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.

Warwick A Bishop

B.E. (Hons), MEngSci

9 May 2016