ENGENY
WATER MANAGEMENT

Banyule City Council, Boroondara City Council, Manningham City Council, Whitehorse City Council

North East Link EES

Review of Matters Relating to Surface Water




July 2019

V1299_001

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REV	**DESCRIPTION**	**AUTHOR**	**REVIEWER**	**APPROVED BY**	**DATE**
0	Client Issue	Scott Dunn	Nick Andrewes	Scott Dunn	12 July 2019
Signatures					

CONTENTS

Appendices

List of Figures

1. INTRODUCTION

Report Details

This report has been commissioned by Maddocks Lawyers and Harwood Andrews on behalf of:

- Banyule City Council
- Boroondara City Council
- Whitehorse City Council
- Manningham City Council.

Report Author Details

The details of the report author are provided below.

Names and Address of the Author

Scott Matthew Dunn

Suite 5, Level 34
360 Elizabeth Street,
Melbourne VIC 3000

Qualifications

Scott Matthew Dunn has the following qualifications and professional memberships:

Education

Bachelor of Engineering (Civil and Environmental) Honours and Bachelor of Economics, Adelaide University, 2004

Registrations / Affiliations

Member, Institution of Engineers, Australia and Chartered Professional Engineer

Member, College of Civil Engineers, I.E. Aust.

Member, Stormwater Victoria and Past Committee Member

Experience and Expertise of the Author

Scott Dunn is a Principal Engineer, Sector Leader (Flooding and Drainage) and Director in the Melbourne office of Engeny. Scott is highly skilled and experienced in urban drainage and flood modelling, and Water Sensitive Urban Design (WSUD). Scott's skills and experience include 1 and 2 dimensional modelling of existing drainage systems for numerous Councils and other clients in Victoria and around Australia. This has included extensive hydrologic and hydraulic modelling and verification to actual flood behaviour. Scott is a leading user of RORB hydrologic models and TUFLOW hydraulic models to replicate the performance of urban drainage systems and overland flow patterns. Scott also has strong experience in WSUD having designed small bioretention systems through to complex wetlands and stormwater harvesting systems.

A CV with more details regarding Scott's experience is included in **Appendix A**.

2. INSTRUCTIONS

I have been instructed to review the North East Link Environment Effects Statement (EES) and provide expert evidence in the area of surface water. A copy of my instructions is provided in **Appendix B.** The focus of this report is to address the following instructions:

Review the exhibited documents relevant to your area of expertise and each of the Councils' municipal areas, in particular:

1. Review

   a) The EES:

      - Volume 1 (Chapters 1 to 8);

      - Volume 4 (Chapters 21 'Ground movement', 22 'Groundwater', 23 'Contamination and soil', 24 'Surface water', 25 'Ecology', 27 'Environmental management framework');

   b) Technical Report P Parts 1 & 2 and Appendices: Surface Water;

   c) EES Map Book;

   d) Attachment III: Risk Report;

   e) Attachment V: Draft Planning Scheme Amendment.

2. Review:

   a) The Ministerial Guidelines for assessment of environmental effects under the Environmental Effects Act 1978 (2006);

   b) Manningham City Council's public submission on the EES dated 5 June 2019;

   c) Banyule City Council, Boroondara City Council and Whitehorse City Council's joint public submission on the EES dated 7 June 2019;

   d) IAC tabled document no. 5 titled Preliminary Matters and Further Information Request, dated 20 June 2019;

   e) IAC tabled document no. 14 being the Maddocks further information request on behalf of Banyule, Boroondara and Whitehorse City Councils;

   f) Clayton Utz (acting on behalf of NELP) initial response to the Maddocks further information request (attached);

   g) Harwood Andrews further information request on behalf of Manningham City Council (attached);

   h) the draft Yarra River Bulleen Precinct Land Use Framework Plan 2019 and Manningham City Council's public submission on this dated 6 June 2019; and

i) any other submission or document we subsequently refer to you.

3. Prepare a single expert witness report on behalf of the Councils for circulation that contains your opinion on the following matters, as relevant to your area of expertise:

   a) Does the EES adequately document and assess the nature and extent of the environmental effects of the Project? In addressing this question please explain where you are satisfied with the content of the EES and why, and if not, what if any deficiencies exist in the documentation and/or assessment of the nature and extent of environmental impacts contained in the EES;

   b) Can the Project as described in the EES achieve a level of environmental performance which is consistent with relevant legislation, documented and endorsed policy or acknowledged best practice;

   c) If the Project, as described in the EES cannot achieve a level of environmental performance which is consistent with relevant legislation, documented and endorsed policy or acknowledged best practice, are there any recommendations that you would make as to specific measures which you consider necessary and/or appropriate to prevent, mitigate and/or offset adverse environmental effects? If so, please explain your reasoning in detail. To the extent that it is within your expertise to comment upon the feasibility of any of your recommendations, please state whether or not any recommendations are feasible, explaining your reasoning;

   d) How does the Project as described in the EES respond to the principles and objectives of "ecologically sustainable development" as defined in the IAC's Terms of Reference;

   e) Are there any recommendations that you would make as to specific measures which you consider necessary and/or appropriate to improve the response of the Project to the principles and objectives of "ecologically sustainable development"? If so, please explain your reasoning in detail. To the extent that it is within your expertise to comment upon the feasibility of any of your recommendations, please state whether or not any recommendations are feasible, explaining your reasoning; and

   f) To the extent that the content of the draft planning scheme amendment, works approval and environmental protection requirements lies within your expertise, do you have any recommendations for changes that should be made to the draft planning scheme amendment, works approval or planning approval and/or draft environmental performance requirements in order to improve the environmental outcome of the Project?

Prior to be briefed as an expert witness I was engaged by Banyule City Council to assist in the North East Link EES TRG process.

3. REVIEW APPROACH

3.1 EES Scoping Requirements

My review of the surface water and related documents prepared as part of the EES has considered the scoping requirements of the EES that are relevant to Surface Water. A copy of the relevant scoping requirements as presented in the EES Surface Water Technical Report is attached in **Appendix C**.

3.2 EES Main Aspects Relating to Surface Water

Throughout the Surface Water Technical Report four main aspects relating to surface water have been considered in the assessment undertaken as part of the preparation of the EES. As documented in Section 5.3 of the Surface Water Technical Report the main aspects are:

- ***Flooding*** *– A key project consideration is the potential for project works to affect waterways and hydrology with respect to flooding and future climate change scenarios. The project seeks to avoid or minimise adverse effects on surface water and groundwater environments*
- ***Water quality*** *– A key project consideration is the potential for contaminated runoff or other water to be transported into surface waters or groundwater environments. The project seeks to avoid or minimise adverse effects on surface water and groundwater and floodplain environments*
- ***Geomorphology*** *– Geomorphology is the study of landforms and their origin. This geomorphological assessment is focused on the banks and beds of waterways. A key project consideration is the potential for project works to contribute to land subsidence or erosion. The project seeks to avoid or minimise adverse effects of erosion and subsidence on land stability from project activities, including tunnel construction and river and creek crossings*
- ***Water supply*** *– A priority for characterising the existing environment is to identify and map the natural and constructed surface water drainage systems and storages relevant to the geographic coverage of project works. The coverage of project works has the potential to impact the water supply for the irrigation of sporting fields.*

3.3 Review Considerations in Response to Scoping Requirements

With consideration of the scoping requirements I have focussed my review to consider the following with respect to the four main surface water aspects as presented in the EES:

- Assessment of existing conditions
- Impact of project and assessment of mitigation measures

- Assessment of residual impacts (construction and operation)

I have also considered the following which I believe are of importance with respect to surface water:

- Integrated Water Management
- Drainage Asset Management

I have separately documented my review of the proposed approach to manage performance through the implementation of Environmental Performance Requirements (EPRs). My review of the proposed surface water EPRs is documented in Section 12 of this report.

3.4 Review of North East Link EES Documents

I have reviewed and given consideration to each of the EES documents outlined in my instructions with a focus on the surface water aspects of the Project. I have also reviewed the following EES related documents:

- Scoping requirements for North East Link Project Environment Effects Statement (June 2018)
- Terms of Reference: North East Link Project – Inquiry and Advisory Committee

3.5 Consideration of Other Similar EES / EIS Surface Water Documents

To inform my review of the Surface Water assessment undertaken as part of the North East Link EES I have reviewed and considered Surface Water reports prepared as part of the EES / EIS process for large infrastructure projects, primarily:

- Mordialloc Bypass (Melbourne)
- WestConnex M4-M5 Link (Sydney)
- Melbourne Metro (Melbourne)

3.6 Consideration of Other Information

I have also considered the following information made available to me from the Councils that have instructed me:

- Topographical information (LiDAR data and contour information)
- Flood modelling results, where available
- Drainage asset information in the form of GIS databases

- North East Link EES TRG comments and responses

In the absence of detailed flood modelling information available for the City of Whitehorse within and adjacent to the Project area I have developed a coarse flood model to assess flooding behaviour within that portion of the study area. Further details of my modelling approach and results are detailed in Section 4.1.1.

3.7 Site Visits

To inform my assessment I conducted site visits to several key locations within and adjacent to the Project area, including:

- AK Lines Reserve
- Yando Street Drain at Greensborough Highway
- Kalparrin Gardens
- Watsonia Railway Station carpark
- Banyule Creek at Borlase Reserve
- Banyule Creek at Lower Plenty Road
- Banyule Creek and Banyule Swamp
- Bolin Bolin Billabong
- Bolin Bolin Integrated Water Management project (wetland)
- Trinity Grammar Marles Playing Fields
- Koonung Creek at Boronia Grove Reserve and wetland
- Koonung Creek at Koonung Creek Reserve (Manningham) and wetland
- Koonung Creek at Tram Road retarding basin
- Koonung Creek at Elgar Park
- Koonung Creek wetlands

Appendix D contains a number of photographs taken during those site visits

4. FLOODING

4.1 Assessment of Existing Conditions

4.1.1 Modelling Methodology

With respect to flooding a key focus of my review has been to determine the appropriateness of the modelling methodology to represent existing conditions within and adjacent to the Project area. Accurate representation of existing conditions flooding is vitally important as it has been relied upon to assess the impacts of the Reference Design (the Project). The EES Surface Water Technical Report provides a range of modelling details with respect to the adopted methodology together with the associated limitations and assumptions.

The most obvious finding of my review is the fact that different modelling approaches have been adopted for different catchments within the Project area. I had noted this during the Technical Reference Group (TRG) review process for which NELP's response was, *"Modelling has used the best available information and is generally consistent in its approach and purpose. The regional flood models produced by Engeny are a useful basis for the modelling although the local focus of NEL project required some refinement to appropriately distribute flows and better assess potential local impacts."*[1]

I disagree with NELP's response and this is best highlighted by presentation of some examples. As shown in Figure 4-1 (an excerpt from the Surface Water Technical Report), a whole of catchment approach was adopted for the Banyule Creek catchment. This approach includes all Council and Melbourne Water underground drainage and waterway assets in the modelling.

[1] Refer to Appendix E for TRG comment and NELP response

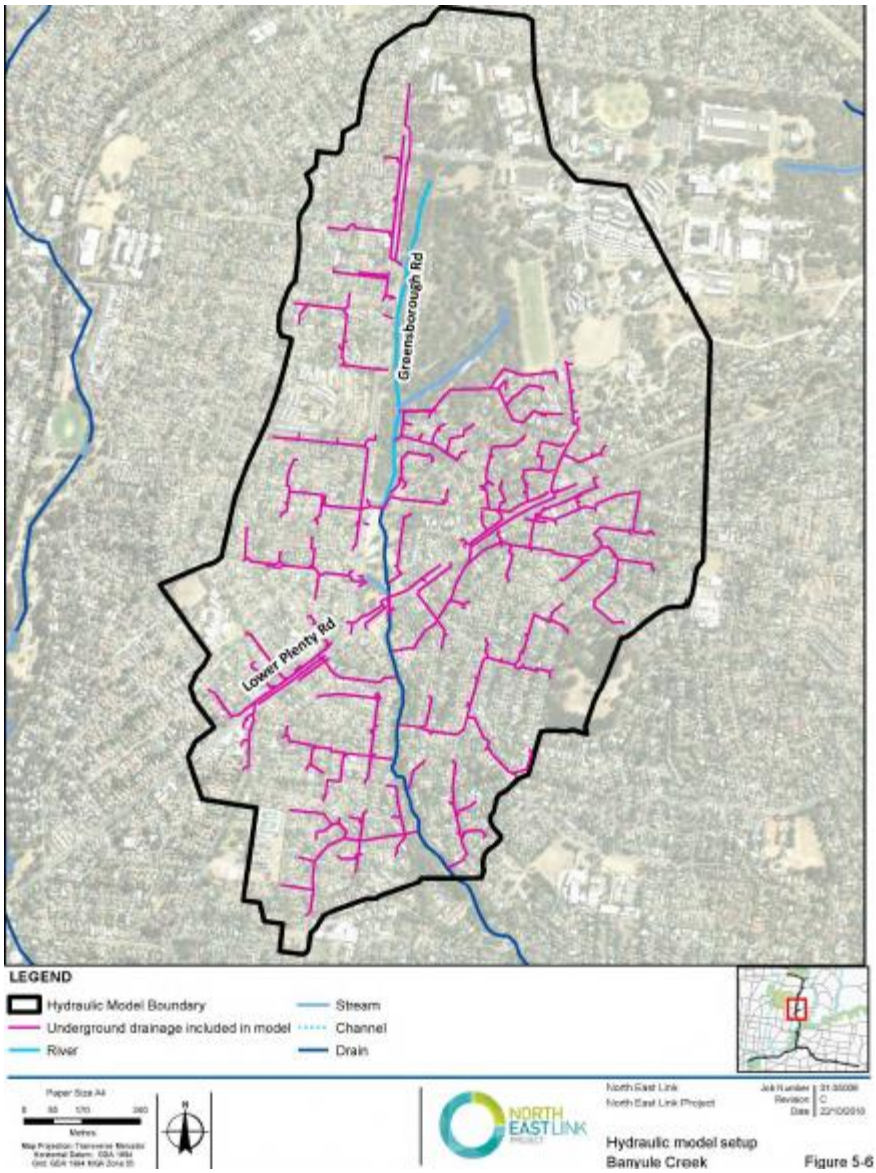

Figure 4-1 NELP Banyule Creek catchment model layout

The results produced from this modelling approach to estimate flooding in the Banyule Creek catchment are presented in Figure 4-2 (an excerpt from the Surface Water Technical Report) and highlights the extent of flooding across the catchment after filtering of flood depths less than 50mm.

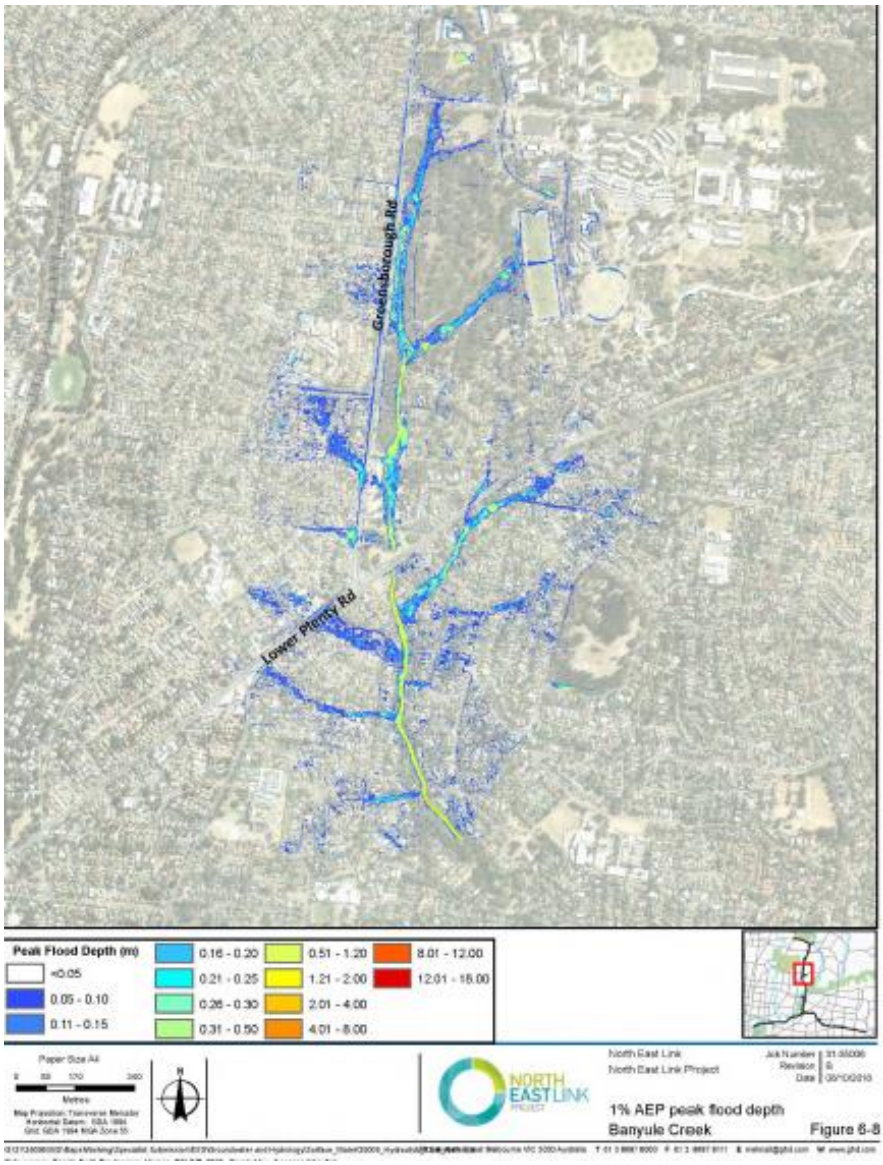

Figure 4-2 NELP Banyule Creek modelling results

For all other catchments within the study area a simplified modelling approach has been adopted in which the extent of modelling has been limited to major drainage and associated overland flow paths, together with waterways within the Project area. My major concern with this approach is that it fails to accurately represent flooding across the wider extent of the drainage catchments. As such all flood prone areas that are likely to be impacted by the Project have not been quantified in the existing conditions modelling.

I am aware that detailed flood modelling has been completed within the Cities of Manningham and Boroondara which has identified local overland flow paths that will be impacted by the Project. Several of these flow paths have not been assessed as part of the modelling undertaken as part of the EES.

There are also areas of flooding within the City of Banyule which have been represented within the Melbourne Water flood models that were provided to NELP and will be

impacted by the Project but have not been included as part of the EES modelling. Figure 4-3 (an excerpt from the Surface Water Technical Report) depicts the modelling extent of the Yando Street Main Drain catchment which only includes the Yando Street Main Drain (a Melbourne Water drainage asset) and the pedestrian underpass beneath Greensborough Highway as assets capable of conveying catchment flows. In the model provided to NELP by Engeny at the written request of Melbourne Water the full extent of the Yando Street Main Drain and Kempston Street Main Drain catchments were included within the same model as they connect into each other on the eastern side of Greensborough Highway before discharging to Kalparrin Gardens where Banyule City Council own and manage a large stormwater harvesting system.

The approach adopted by NELP has failed to acknowledge that there are locations in the Yando Street Main Drain catchment where overland flows in large storm events will flow into the Project area and be impacted by the Project. The consequence of this is that there are areas that will be impacted by the Project that are not identified by NELP's modelling.

The results produced from the NELP Yando Street Main Drain catchment model are presented in Figure 4-3 (an excerpt from the Surface Water Technical Report). The results show that the extent of flooding associated with overland flows is limited to the drainage assets that have been modelled. This is not a true reflection of flooding within the catchment that could be impacted by the Project.

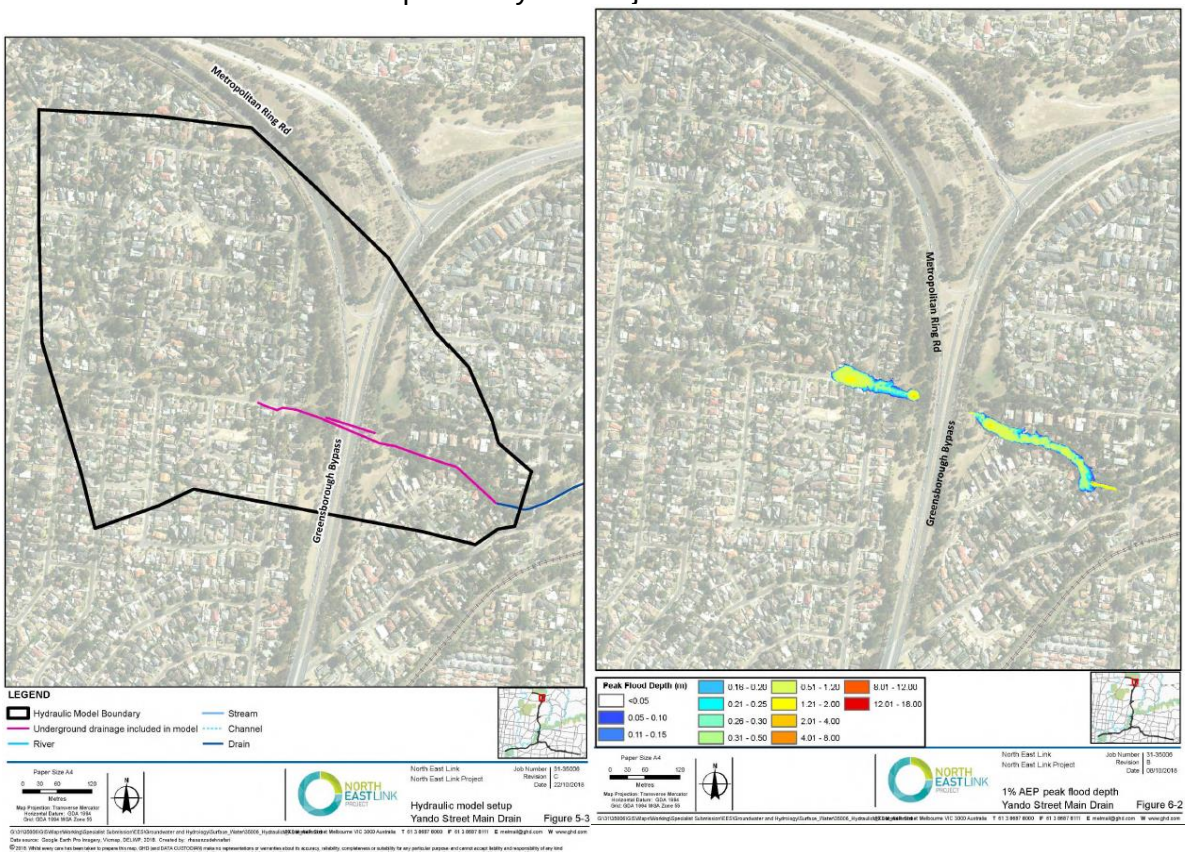

Figure 4-3 NELP Yando Street Main Drain flood model extent and results

Figure 4-4 presents the full extent of drainage assets and 1% AEP overland flows within the Melbourne Water flood model that was provided to NELP containing both the Yando Street Main Drain and Kempston Street Main Drain. This modelling is based on a whole of catchment approach and highlights several locations within the Project area where the Project will have an impact on existing flooding based upon a review of the nature and extent of works presented in the North East Link EES Map Books.

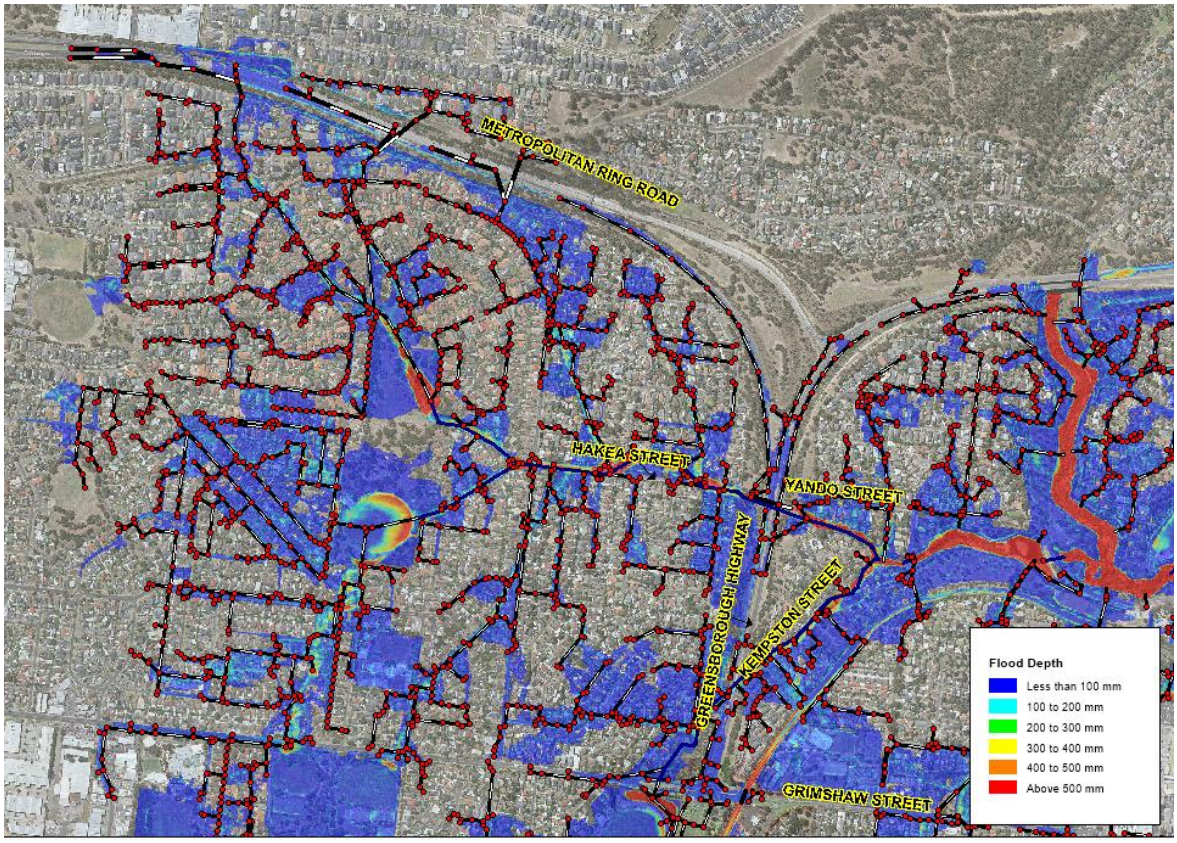

Figure 4-4 Extent of flooding from Melbourne Water flood model showing areas of flooding within the Project area not included in NELP modelling

I recommend that the Melbourne Water flood model that was provided to NELP be used to assess existing conditions flooding within the Yando Street Main Drain and Kempston Street Main Drain catchments. This will enable the combined effects of the project to be determined appropriately when assessing the impact of the Project.

Another example of the simplified modelling approach is the Koonung Creek catchment model. The Surface Water Technical Report acknowledges that local catchment flooding has not been allowed for *"The hydraulic model extent includes, the entire 12-kilometre length of Koonung Creek. While inflows have been carefully considered, flooding on the tributary streams (local catchment flooding) has not been explicitly modelled."*[2] Figure 4-5

[2] Page 48 of North East Link EES Surface Water Technical Report

(an excerpt from the Surface Water Technical Report) depicts the extent of NELP's modelling for the Koonung Creek catchment.

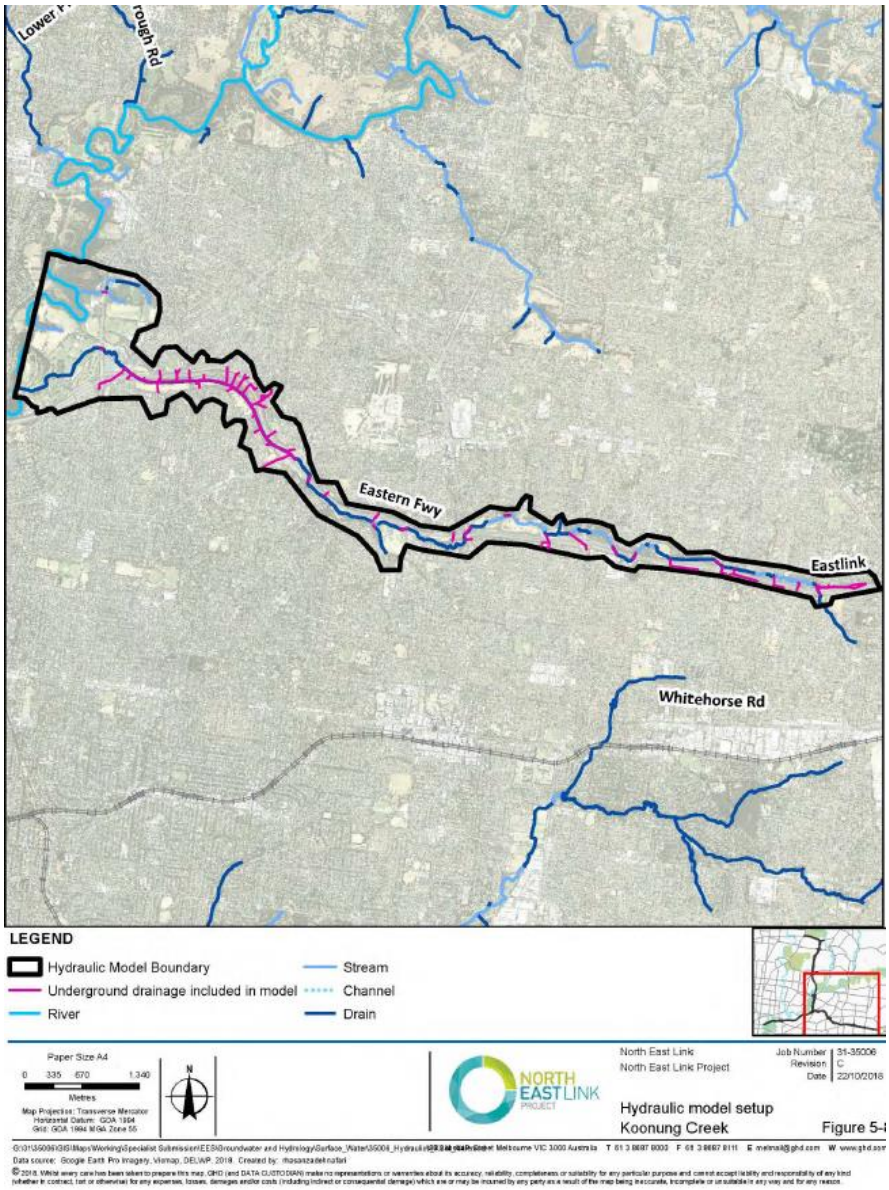

Figure 4-5 NELP Koonung Creek flood model extent

An example of the results produced by the NELP Koonung Creek catchment model is presented in Figure 4-6 (an excerpt from the Surface Water Technical Report).

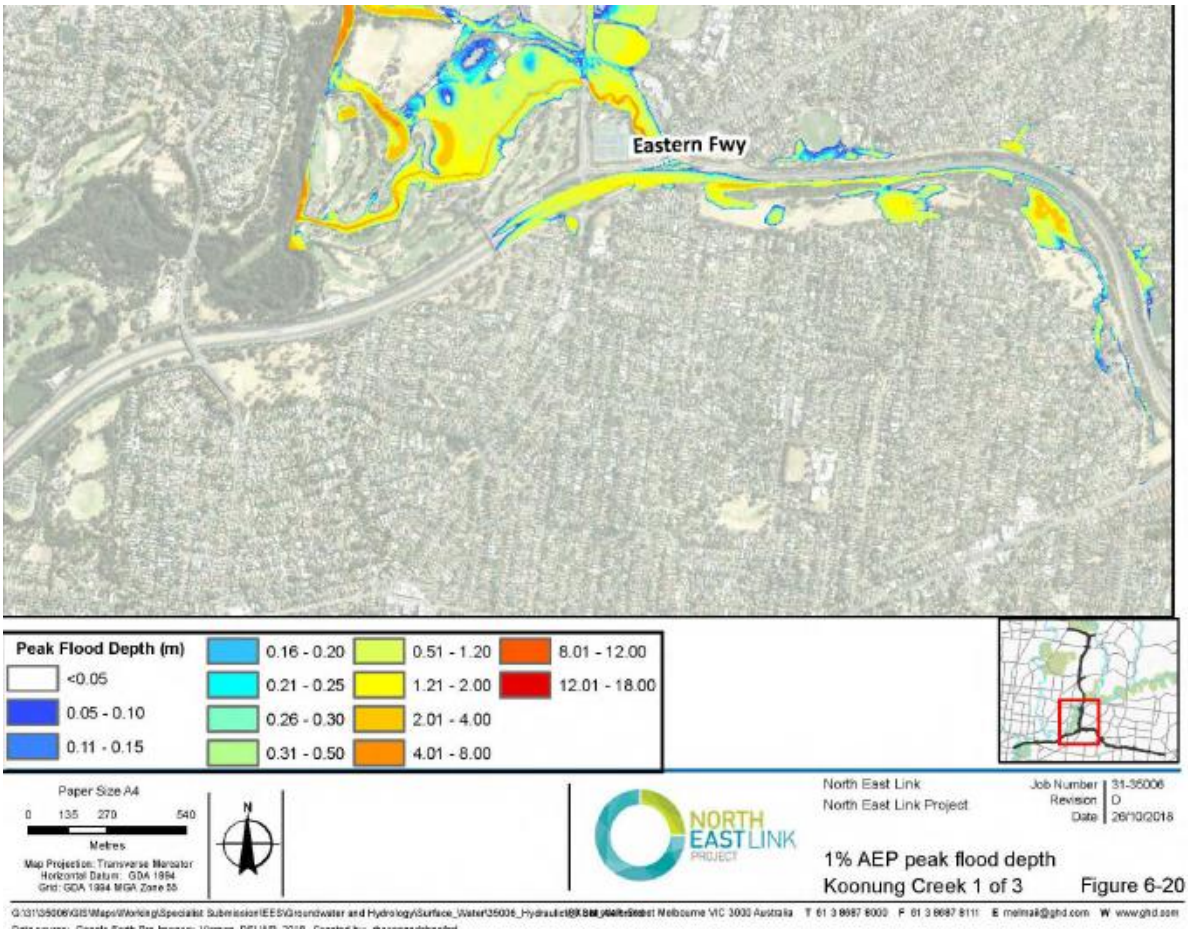

Figure 4-6 Example of Koonung Creek flood modelling results

Flood modelling undertaken for Boroondara City Council has included all Council drainage assets and overland flows that drain into Koonung Creek. Figure 4-7 presents an example of Council's flood modelling results (1% AEP) and identifies that the extent of flooding within Koonung Creek Reserve is more extensive than that predicted by the NELP modelling. As a result the flood impact assessment undertaken for the EES does not identify the full extent of impacts arising from the Project at this location.

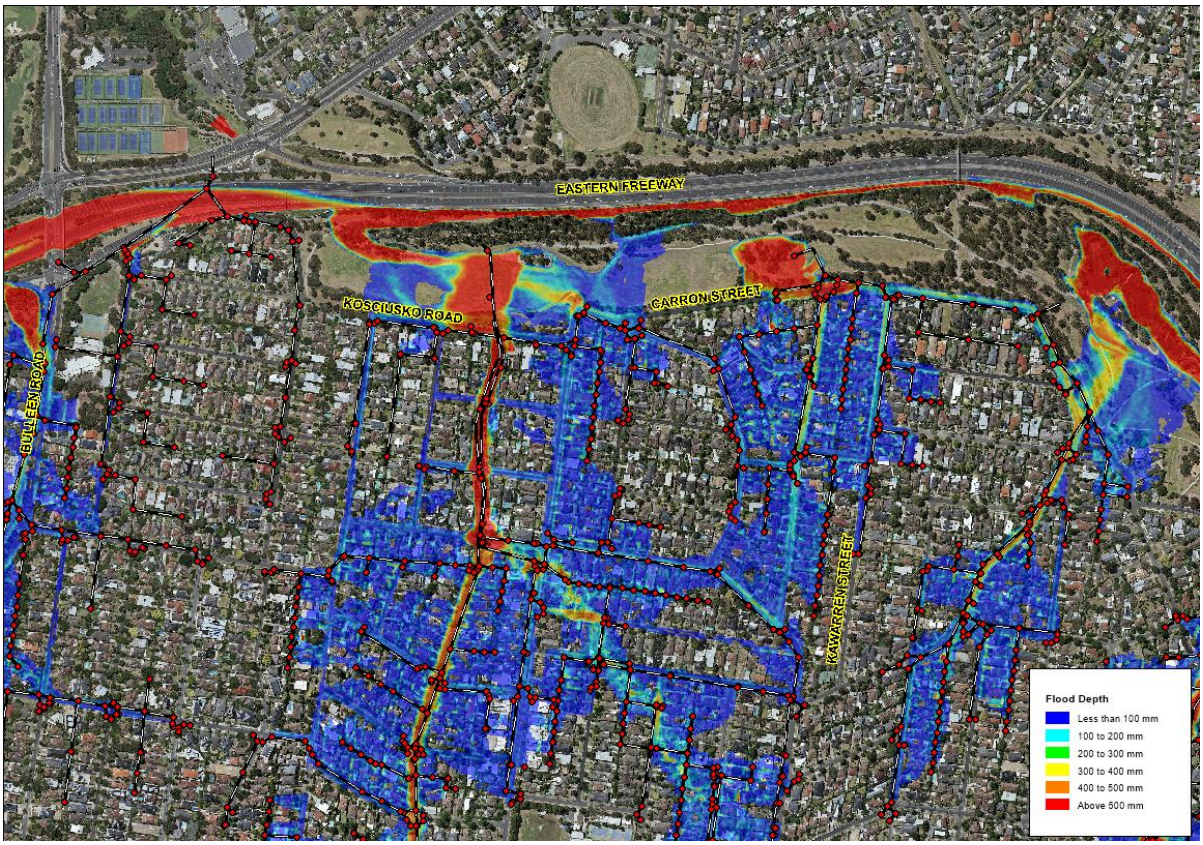

Figure 4-7 Example of extent of Boroondara City Council flood modelling within Koonung Creek catchment

The City of Whitehorse has not undertaken detailed flood modelling of the areas within the municipality that could be impacted by the Project. As part of my assessment I have developed a coarse flood model to identify and assess the local catchment flow paths within the City of Whitehorse that are likely to be impacted by the Project and have not been captured as part of the modelling assessment. An example is provided in Section 4.3.2 whereby local flooding within the City of Whitehorse has not been included as part of the NELP modelling and will be impacted by the Project.

The model is coarse in the sense that no drainage assets have been included, however the intent is to define the approximate extent and local catchment flow paths that could potentially be impacted by the Project. Figure 4-8 presents an example of the results of this modelling and identifies several key flow paths that flow toward the Eastern Freeway. Many of these flow paths are likely to be impacted by the Project given that the Eastern Freeway is proposed to be widened resulting in the road reserve being expanded to the south resulting in the loss of flood storage and potentially increasing flood levels within surrounding properties.

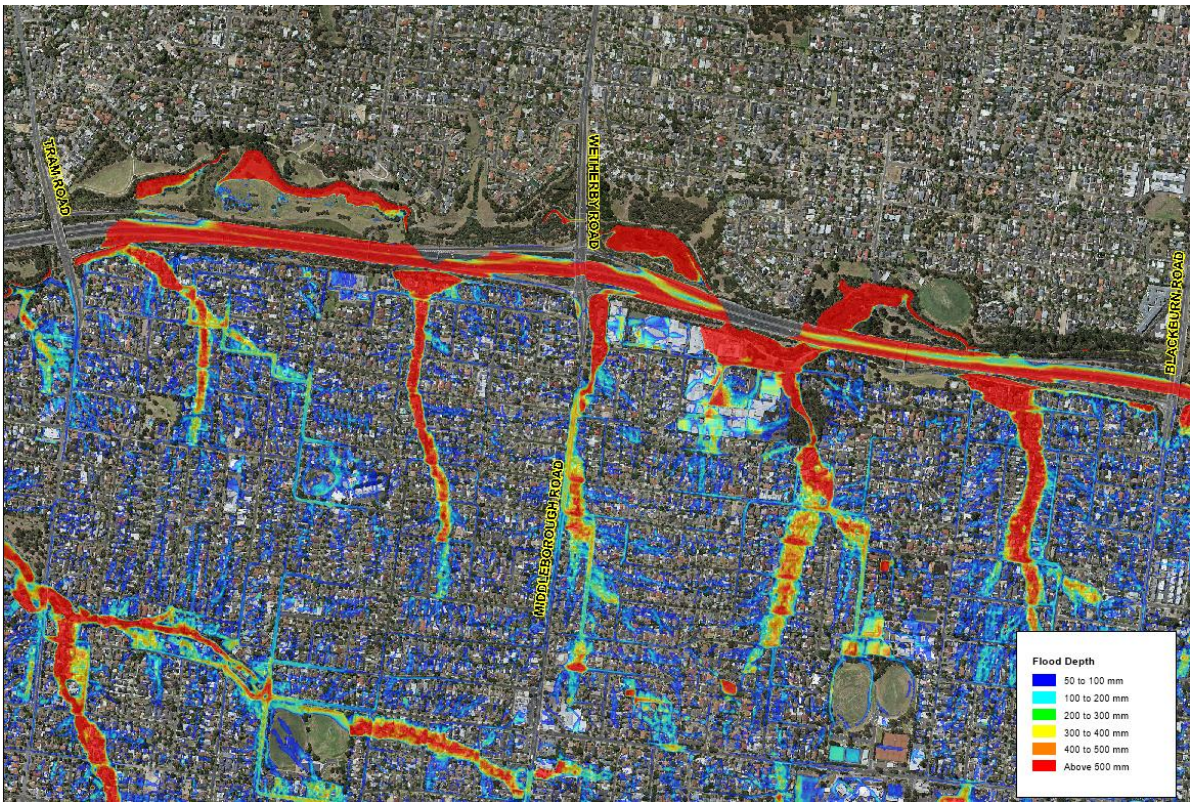

Figure 4-8 Coarse flood modelling results of local catchment flows within the City of Whitehorse

Manningham City Council have also raised concerns regarding the lack of overland flooding represented by the modelling undertaken by NELP, *"Comparison of flood extents given in report and Council's flood mapping does not align sufficiently".* NELP's response to this was concern was, *"There may be a number of reasons why the flood extent in the report and Council's C109 flood extents are different. A significant one is likely to be that the report focuses on the flooding along the larger waterways i.e. the Yarra River and Koonung Creek where as the C109 extents are focused on the local tributary catchments and do not map main stream flooding."*[3] Again, I do not believe that it is appropriate that the modelling undertaken by NELP has not considered flooding from local catchments within the Manningham municipality which flow toward and into the Project area. Figure 4-9 below highlights an area located at Wilsons Road, Doncaster where Council's 1% AEP flood extent is greater than that represented within NELP's modelling. The consequence of a smaller flood extent being represented in the NELP modelling is that the impact of the Project will not be accurately represented at this location. Given that Council's flood extent covers residential properties there could be impacts to these properties, such as an increase in flood level, as a result of the Project.

[3] Refer to Appendix E for TRG comment and NELP response

Figure 4-9 Comparison of Council and NELP flood modelling results at Wilsons Road, Doncaster

I recommend that the Koonung Creek existing conditions flood model developed by NELP be updated to include the full extent of local overland flow paths that will be impacted by the Project. I also recommend that as part of this process verification is undertaken to ensure that the extent of flooding represented in the respective Councils' flood modelling is accounted for and sound justification is provided for any differences.

4.1.2 Need for Sensitivity Analysis

The following assumption was made by the NELP modelling with respect to the downstream boundary condition adopted for the Koonung Creek catchment flood model, *"A downstream boundary water level of 11 mAHD was adopted based on the assumption the Yarra River would be at the top of bank level."*[4] In my opinion this assumption would benefit from a sensitivity analysis to assess the impact of the downstream Yarra River flood level. It is reasonable to expect that the Project should show no adverse impact under the various tailwater levels used as part of a sensitivity analysis in accordance with relevant guidelines (e.g. Melbourne Water's Guidelines for Development in Flood Prone Areas).

4.1.3 Assessment of Very Rare Events

I note that an assessment of very rare flood events has not been undertaken for the Koonung Creek or Yarra River catchments to assess the impacts of the Project. This is particularly important for both areas given the Eastern Freeway and associated noise walls act as a bank that causes ponding upstream to significant depth. This assessment would assist to determine the extent of any unexpected impacts that could require further mitigation measures.

[4] Page 48 of North East Link EES Surface Water Technical Report

4.2 Impact of Project and Assessment of Mitigation Measures

4.2.1 Impact of Project

There is no information within the Surface Water Technical Report to demonstrate what the extent and nature of the direct flooding impacts are as a result of the Project (without mitigation measures). In the absence of this information which would provide an appreciation of the direct flood risk it is difficult to understand the priority or importance of the mitigation measures that have been incorporated as part of the assessment.

As documented in Section 4.1.1 the modelling methodology adopted by NELP has meant that there are existing flood prone areas that have not been identified in the existing conditions modelling and hence have not been considered when assessing the impacts of the Project. The consequences of this are that the full extent of mitigation measures and associated environmental effects have not been identified.

Despite requests for NELP to provide flood hazard plots to assess the changes in flood hazard during the TRG process and again as part of an additional information request from Maddocks dated 19 June 2019, NELP's response to this request was, *"The EES contains mapping of both changes in depth and changes in velocity which are considered to provide a good indication of potential changes to flood hazard."* The flood depth differences are hard to interpret within the Surface Water Technical Report and it is possible to increase the category of flood hazard within only minor increases in flood depth. Flood hazard plots would assist to identify areas within the Project corridor sensitive to small changes in flooding as a result of the Project. Whilst, in certain circumstances, very small increases may be justified it will not be acceptable to increase the category of flood hazard above existing conditions.

4.2.2 Assessment of Mitigation Measures

Some mitigation measures have been assessed as part of the flood modelling assessment. This is particularly evident along Koonung Creek where decreases in flood levels are noted in the modelling results presented in the Surface Water Technical Report. The NELP modelling predicts flood levels at Melbourne Water's Tram Road retarding basin to be reduced by what appears to be 300-500mm. This reduction is only possible by expansion of the existing retarding basin.

Mitigation measures at other locations where the Project is predicted to increase flood levels have not been afforded the same level of mitigation assessment. Two such locations are located within the Koonung Creek catchment flood model:

- Carron Street, Balwyn North (maximum predicted increase approx. 545mm for 1% AEP with allowance for climate change as depicted in Figure 4-10)
- Eram Road Property, Box Hill North (maximum predicted increase approx. 547mm for 1% AEP with allowance for climate change as depicted in Figure 4-11)

As such the extent of works required to address the increases predicted at these locations, amongst other locations, is unknown.

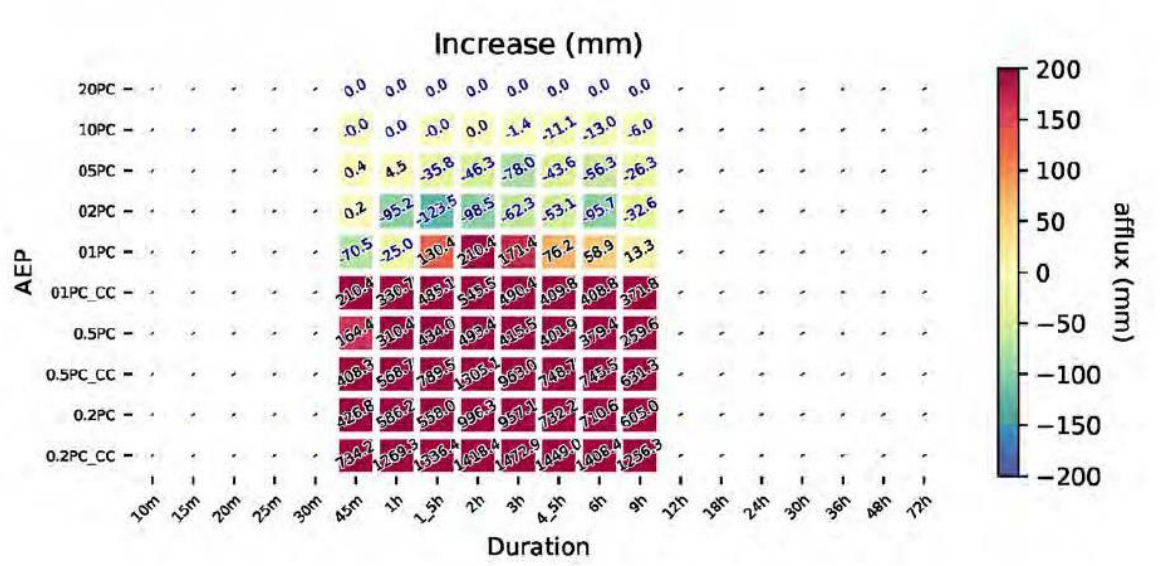

Figure 4-10 Carron Street Afflux (results from Surface Water Technical Report Appendices)

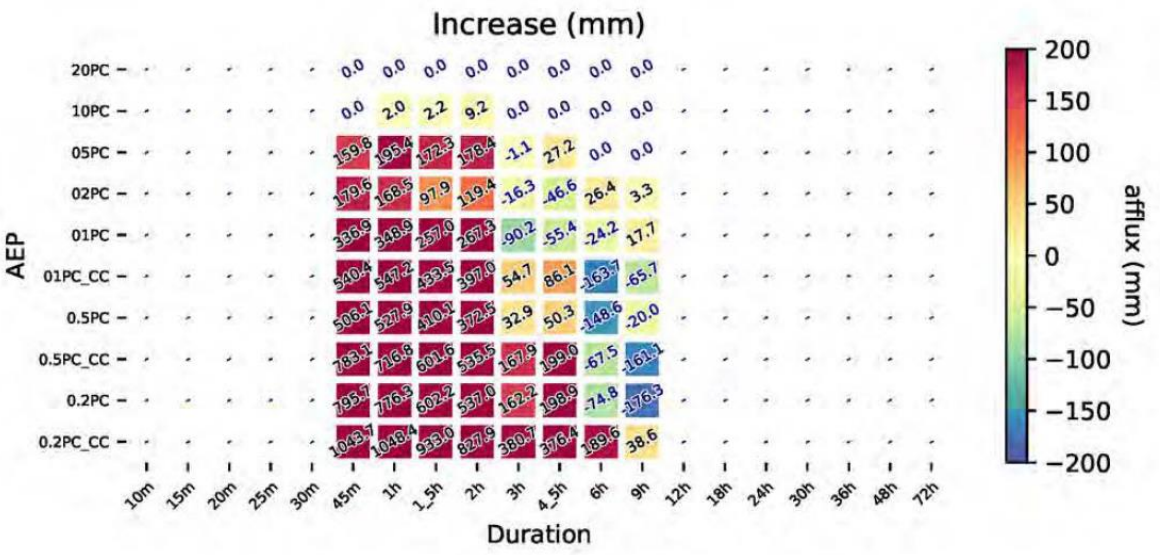

Figure 4-11 Eram Road Property Afflux (results from Surface Water Technical Report Appendices)

4.2.3 Representation of Mitigation Measures

Since the issue of the initial draft of the Surface Water Technical Report in July 2018 it has been understood that a new flood retarding basin is likely to be constructed immediately north of Lower Plenty Road to ensure that flooding downstream of Lower Plenty Road is not adversely impacted by the Project. Nothing is noted on the layout plan contained within the Surface Water Technical Report, as shown in Figure 4-12 below, with respect to a flood storage or water quality feature. The layout plans have depicted flood

storage locations elsewhere within the Project area (Compensatory Flood Storage Locations). Figure 4-13 identifies an area south of Lower Plenty Road where drainage features are proposed. It is not clear from the EES documents what function these drainage features are expected to perform.

Figure 4-12 Extract of Figure 9-13 from Surface Water Technical Report not indicating any drainage or WSUD features immediately north or south of Lower Plenty Rd

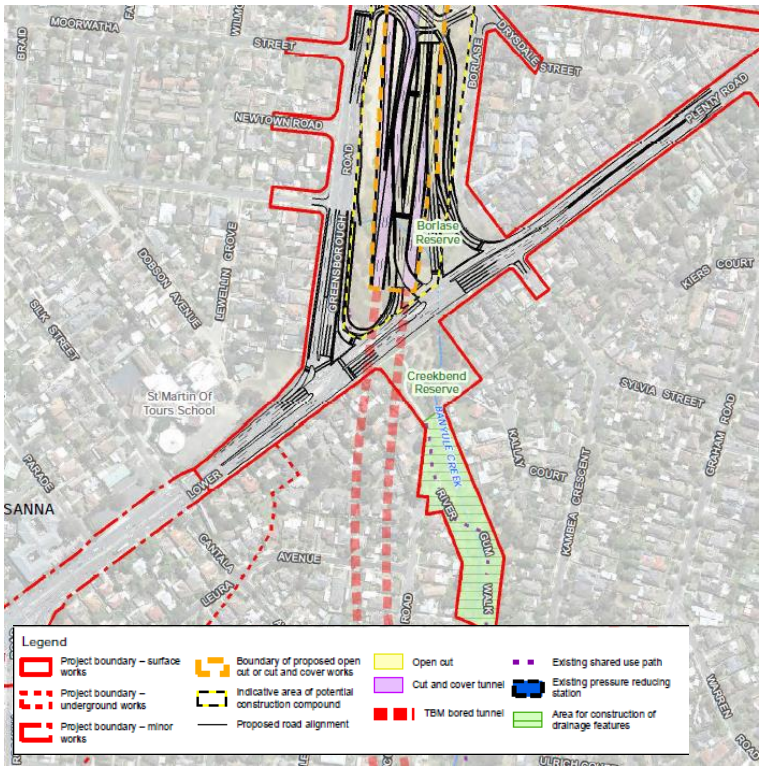

Figure 4-13 Extract from NELP EES Map Books indicating any drainage features immediately south of Lower Plenty Rd

4.2.4 Yarra River Modelling

With respect to the modelling of the Yarra River catchment I agree that there are some uncertainties with respect to use of 1934 flood levels for designating the 1% AEP flood levels. This is due to the nature of change within the catchment over time including the construction of dams and retarding basin within the catchment to manage flooding. Figure F-2 in Appendix F of the Surface Water Technical Report, reproduced as Figure 4-14 below, presents the water levels from a sensitivity analysis of Yarra River flood flow estimates produced from a range of methodologies. Figure F-2 highlights the uncertainty associated with the Yarra River flood flow estimates as the upper and lower flood flows correspond to a difference in water levels in some locations of greater than 1 metre.

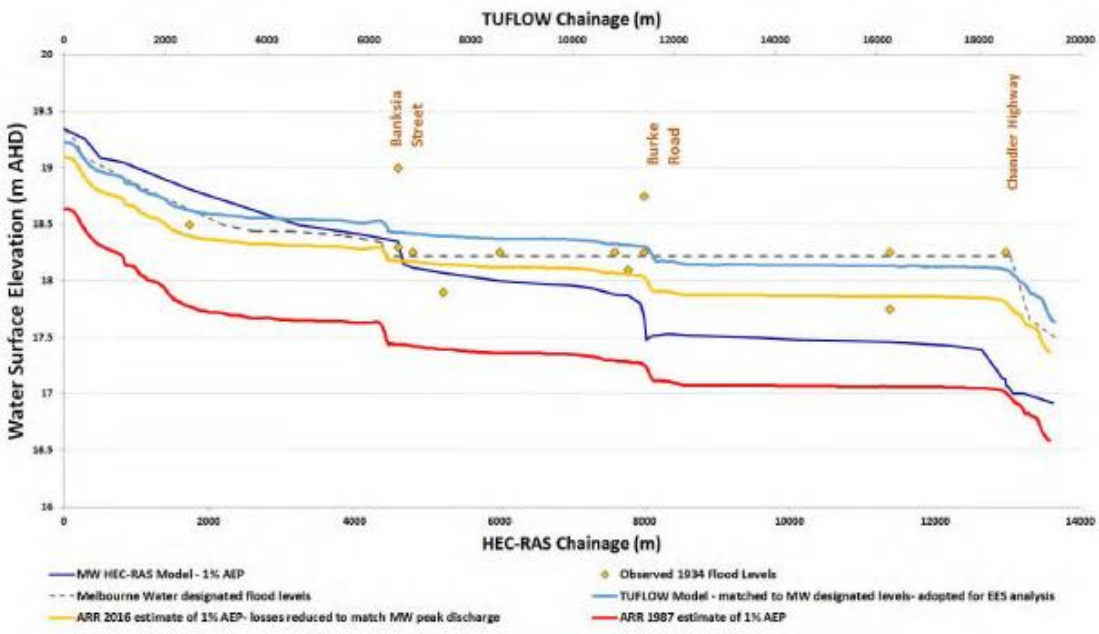

Figure F-2 Yarra River long sections and water surface elevation comparison

Figure 4-14 Figure F-2 from Appendix F of Surface Water Technical Report

A similar sensitivity analysis has not been presented to demonstrate the flooding impact of the Project under the various estimates of Yarra River flood flows for which there is uncertainty. The Project scoping requirements (documented in **Appendix B**) outline the need to undertake sensitivity analyses to identify the impact of uncertain variables. In my opinion this is one aspect of the flood assessment where it should have been undertaken. In the absence of the sensitivity analysis it is not possible to understand the impacts of the Project under the various Yarra River inflows. It is possible that the impacts of the Project are greater under different Yarra River flood flow estimates for the 1% AEP event. It is reasonable to expect that the Project should show no adverse impact under the various Yarra River inflows in accordance with relevant guidelines (e.g. Melbourne Water's Guidelines for Development in Flood Prone Areas).

Whilst I agree that the potential for significant future cumulative floodplain impacts due to the incremental loss of floodplain storage will be limited, as is documented on page 148 of

the Surface Water Technical Report, I believe that the impact from the Project justifies the need to consider design alternatives and / or mitigation measures. This is particularly the case considering that approximately 46 main buildings within the flood extent at Manningham Road are exposed to an increase in flood level.

The Surface Water Technical Report does not detail the range of events which could flood the southern portal. The modelling of the Yarra River catchment should also consider assessment of durations other than the 72 hour duration event. Whilst the 72 hour event may be critical with respect to producing peak flows and flood levels the timing allows for appropriate community preparedness and emergency management response. Shorter durations are challenging to provide implementation of a flood emergency management plan. As such shorter durations need to be considered. I also note that ARR 2019 (the most current ARR guideline) includes design rainfall data for events greater than 72 hour duration which was solely relied upon as part of the assessment. The modelling needs to consider these longer events to assess the extent of flooding associated with these storm durations.

There is no description within the Surface Water Technical Report as to what storm event the proposed flood walls at the Manningham Road interchange and southern portal will assist in managing the risk of flooding in the tunnels. I asked the following question as part of the TRG review, "*What level of flood immunity has been achieved by the reference design at the southern portal and Manningham Road?"* [6] NELP's response was, *"Unlike the northern portal, the immunity of the southern portal is less an issue of safety and more commercial issue given the greater warning time. As a result it is less an environmental performance requirement and more a project requirement."* As a result of the greater warning time I do not see a justification for having the flood wall at an excessive height adjacent to the Manningham Road interchange.

4.2.5 Constraints for Mitigation Measures

I note that three locations where flood retardation is proposed to mitigate flooding impacts are where historical landfills were located including:

- AK Lines Reserve
- Borlase Reserve
- Koonung Creek Linear Park

The presence of existing landfills amongst other site constraints will make construction of these assets challenging particularly with respect to minimising environmental impact.

[6] Refer to Appendix E for TRG comment and NELP response

4.2.6 Comparison to other EES Documents

The Mordialloc Bypass EES provided greater level of detail with respect to flood mitigation measures required to achieve project requirements by detailing the volume of stormwater detention required as shown in Figure 4-15 below.

OUTFALL NAME	OUTFALL LOCATION	DESCRIPTION	SUMMARY
M	Ch30875	Outfall M is an existing culvert of unknown size which eventually discharges to the Edithvale wetlands. Further investigation to be completed during detailed design to determine the condition of the outfall. The catchment area contains the road reserve and carriageway south of Springvale Road. Agreement between City of Kingston and VicRoad on the ownership and maintenance responsibility are recommended during detailed design.	Total ROW catchment area = 26.17 ha New impervious area = 2.97 ha Detention, bioretention, and spill containment systems to be incorporated into the drainage design. Detention basin volume approximately 500 m^3. Preliminary detention sizing omits Thames Promenade catchment.
N	Boundary Road	Outfall N is a 450 mm dia draining to the west across Boundary Road. This catchment contains 120m of the southbound carriage way of Boundary Road and 120 m of the eastbound carriageway of Centre Dandenong Road.	Outfall asset owned by the City of Kingston Total ROW catchment area = 0.30 ha New impervious area = 0.17 ha Detention system to be incorporated into the drainage design. Oversized pipe storage volume approximately 32 m^3.
O	Lower Dandenong Road	Outfall O is a 300 mm dia pipe (on the north side of Lower Dandenong Road) and 375 mm dia pipe (on the south side of centre Dandenong Road) draining to the west. Both pipes outlet into the Braeside West Drain 250 m away. This system drains a 320 m section of Lower Dandenong Road.	Outfall asset owned by City of Kingston Total ROW catchment area = 0.45 ha New impervious area = 0.18 ha Detention system to be incorporated into the drainage design. Oversized pipe storage volume approximately 25 m^3

Figure 4-15 Extract from Table H.1 of Mordialloc Bypass EES summarising expected detention volumes at drainage outfall locations

The flooding assessment would also benefit from a sensitivity analysis to assess the impact of blockage. As part of the WestConnex M4-M5 EIS a blockage assessment was undertaken as presented in Figure 4-16 below. EPR SW6 indicates that blockage is to be accounted for as part of any modelling undertaken during the detailed design and appropriate mitigation measures to be developed. However, in the absence of a blockage assessment at the EES stage I cannot be confident that the EPR will ensure that an acceptable environmental outcome will be achieved.

Table C-6 Summary of results for waterway blockage assessment (metres AHD)

Structure	No blockage		With blockage			
	100 year ARI	PMF	100 year ARI	Difference (m)	PMF	Difference (m)
The Crescent bridge at Whites Creek	2.75	5.07	2.82	+0.08	5.25	+0.18
Culvert at City West Link	2.09	3.33	2.26	+0.17	3.73	+0.40
Western channel upstream of tunnel portal bridge	2.33	3.61	2.41	+0.08	3.86	+0.25

Figure 4-16 Results of WestConnex M4-M5 EIS blockage assessment

4.2.7 Reference to Relevant Guidelines

Given that some of the mitigation measures involve alterations to existing retarding basins and flood walls I would expect the Surface Water Technical Report to reference the Australian National Committee on Large Dams (ANCOLD) guidelines as a relevant set of guidelines that the Project must consider and address as required.

4.3 Assessment of Residual Impacts

4.3.1 Inadequacies of Mitigation Measures Assessment

The Surface Water Technical Report has presented a range of afflux plots which clearly identify increased flooding within many private properties. The Reference Design has not addressed predicted increases in flooding across the Project area with only selected locations of predicted flood increase being afforded an investigation of possible mitigation measures. I believe that the extent and scope of mitigation works identified in the Reference Design will need to be increased to fully resolve the flooding impacts and as a result there will be a need to consume a greater portion of existing open space to achieve the intent of EPR SW6 which requires the Project to minimise risk from changes to flood levels, flows and velocities. The predicted impact on open space areas across the full extent of the Project area as presented in the EES is already significant with respect to having to accommodate several large flood mitigation and treatment assets. Further increases will result in increased environmental impacts including, but not limited to, potential vegetation removal to accommodate this requirement.

With respect to the full extent of open space that will be impacted by the Project the Surface Water Technical Report acknowledges that further impact to open space /

parkland areas is likely as is summarised by the following quote in the Report, *"The 1% AEP levels in Carron Street are expected to increase by approximately 400 millimetres. This may potentially be reduced by providing a high-level outlet from this area and or additional storage in the parkland."*[7]

Whilst the intent of EPR SW6 is to ensure that flooding is not impacted I believe the assessment to inform the EES should, as a minimum, confirm:

- that the flooding impacts can be addressed within the Project area
- the full extent of open space that will be impacted by the Project
- that all private properties will be protected from any increase in flood level.

4.3.2 Modelling Inadequacies

The Surface Water Technical Report documents the following with respect to flood impact along the southern edge of the Eastern Freeway from Wilburton Parade to Mountain View Road, *"The removal of existing surface flooding along the southern edge of the Eastern Freeway from Wilburton Parade to Mountain View Road also removes a location which would currently inundate the freeway in significant events near Mountain View Road (towards Bullen Road). As a result, flooding on the freeway is reduced although ponding in the reserve increases with afflux increasing with event size and in larger events extending across Carron Street into private property. The 1% AEP levels in Carron Street are expected to increase by approximately 400 millimetres. This may potentially be reduced by providing a high-level outlet from this area and or additional storage in the parkland."*[8] These impacts are shown in Figure 4-17 below which is an afflux plot from the Surface Water Technical Report. The afflux plot identifies an area within Koonung Creek Reserve where it is 'wet' under existing conditions and will be made 'dry' by the Project. It is adjacent to this location that a noise wall is proposed as per Figure 4-18. Based upon the information provided in the Surface Water Technical Report it is difficult to understand how the reported afflux pattern can occur, particularly with respect to the level of improvement predicted.

At my meeting with NELP's surface water experts on the 11th of July 2019 I was advised that further iterations of the Koonung Creek mitigation modelling had been undertaken since the delivery of the EES documents. Whilst I was informed the modelling indicated an improved level of flooding I did not view any modelling outputs to confirm this nor did I view the changes to the proposed mitigation measures.

[7] Page 161 of North East Link EES Surface Water Technical Report
[8] Page 161 of North East Link EES Surface Water Technical Report

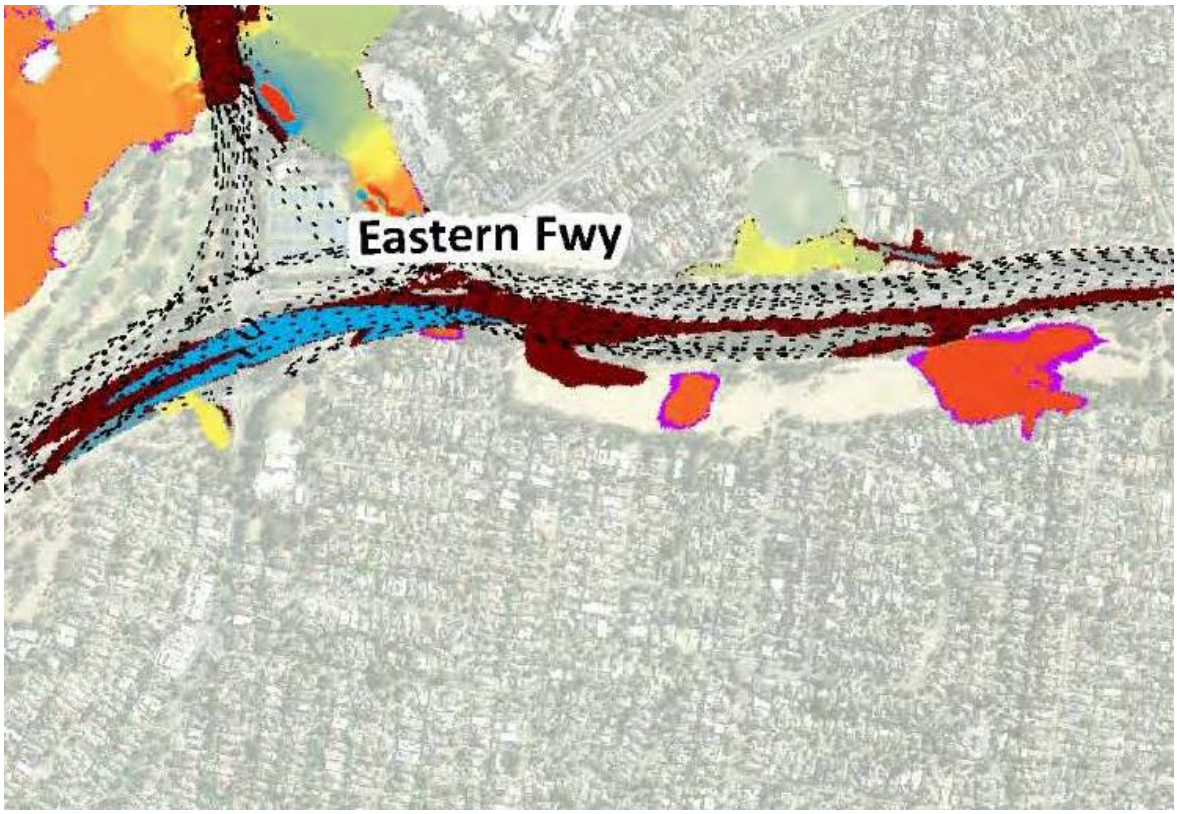

Figure 4-17 Flood impact assessment results at Bulleen Road interchange

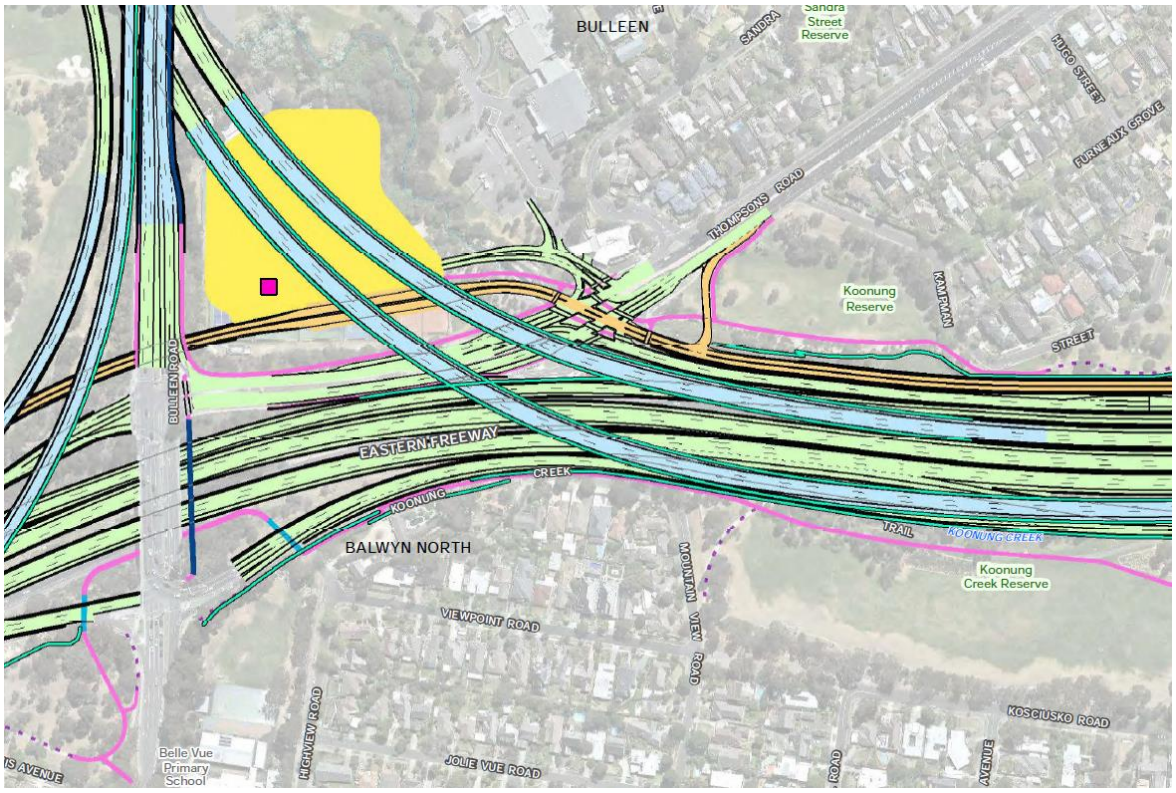

Figure 4-18 Proposed arrangement at Bulleen Road interchange from NELP EES Map Books

As stated in Section 4.1 the flooding assessment has also not assessed all likely flooding impacts associated with the Project since the existing conditions modelling has not considered all flood prone areas within the Project area. An example of a location that has not been identified as having any flooding impacts associated with the project is at Douglas Street, Blackburn North. As shown in Figure 4-19 below the Project will expand the Eastern Freeway southwards and as result the works, including a new noise wall, will be constructed within the extent of a predicted flood prone area. There are several other locations across the Project area like this whereby the impacts have not been assessed.

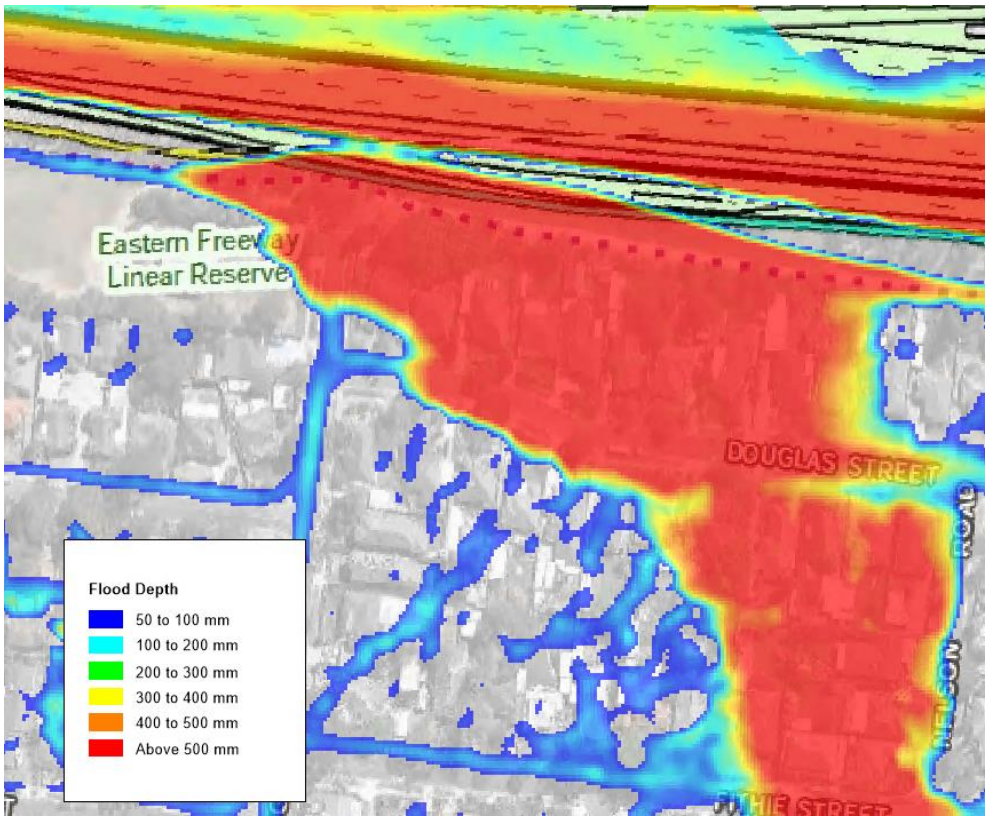

Figure 4-19 Existing conditions flooding at Douglas Street

4.3.3 Consideration of Performance Requirement to Manage Likely Impacts

The WestConnex M4-M5 EIS outlines the requirement for a flood review report to be prepared after the first defined flood event affecting the project works as summarised by the following extract:

A flood review report will be prepared after the first defined flood event affecting the project works for any of the following flood magnitudes – the five year ARI event, 20 year ARI event and 100 year ARI event - to assess the actual flood impact against those predicted in the design reports or as otherwise altered by the FMS. The Flood Review Report(s) must be prepared by an appropriately qualified person(s) and include:

- *Identification of the properties and infrastructure affected by flooding during the reportable event*

- *A comparison of the actual extent, level, velocity and duration of the flooding event against the impacts predicted in the design reports or as otherwise altered by the FMS*
- *Where the actual extent and level of flooding exceeds the predicted level with the consequent effect of adversely impacting of property(ies), structures and infrastructure, identification of the measures to be implemented to reduce future impacts of flooding related to the M4-M5 Link project including the timing and responsibilities for implementation.*

Flood mitigation measures will be developed in consultation with the affected property, structure and/or infrastructure owners, OEH and the relevant council(s).[9]

A statement like this provides confidence that if the Project was to result in flooding impacts above those predicted works would be implemented to address this impact. There is nothing currently presented within the North East Link EES to suggest that this would be considered after completion of the Project.

4.4 Summary

The following points outline the key deficiencies that I have identified with respect to the flooding assessment presented in the Surface Water Technical Report:

- There are inconsistencies in the modelling approach undertaken for the different catchment areas. There are flood prone areas within the Project area that have not been identified by the modelling undertaken. The result of this is that the likely impacts of the Project with respect to flooding are not considered equally and, in some instances, have not been assessed at all. As such the full extent of environmental effects has not been identified.
- Lack of sensitivity analysis with respect to adopted downstream boundary condition used in the Koonung Creek catchment modelling. It is possible that the downstream boundary condition used in the NELP assessment does not appropriately identify the impacts of the Project.
- Lack of sensitivity analysis with respect to Yarra River catchment flows for assessment of the impacts of the Project. An assessment of various Yarra River flood flow estimates was undertaken for existing conditions and highlighted there is inherent uncertainty with respect to the resultant 1% AEP flood levels. The assessment of the impact of the Project should also consider this uncertainty and assess the impacts for a range of Yarra River flood flow estimates. It is possible that the impacts of the Project are greater under different Yarra River flood flow estimates for the 1% AEP event.

[9] Page 174 of West Connect M4-M5 Link Technical working paper: Surface water and flooding

- Due to the modelling inconsistencies the extent of mitigation measures to address the impacts of the Project have not been quantified. There are also locations where predicted decreases in flood levels are hard to explain given the information provided.
- Mitigation measures have been considered and assessed for selected locations but not all. There are some locations with predicted significant impacts that have not been addressed as a part of the assessment of mitigation measures.
- An assessment of very rare flood events has not been undertaken for the Koonung Creek or Yarra River catchments to assess the impacts of the Project. This is particularly important for both areas given the Eastern Freeway and associated noise walls act as a bank that causes ponding upstream to significant depth. This assessment would assist to determine the extent of any unexpected impacts that could require further mitigation measures.

As a result of the modelling inadequacies and the absence of identification of appropriate mitigation measures the full extent of environmental effects has not been identified. It is concerning that there is currently no control proposed (e.g. EPR) to ensure that if the Project was to result in adverse impacts with respect to flooding there would be an appropriate response to identify the measures to be implemented to reduce future flooding impacts. This confidence has been afforded to other projects such as the WestConnexM4-M5 project and is documented in that project's EIS. There is nothing presented within the North East Link EES to suggest that this would be considered after completion of the Project.

In light of the inadequacies of the flood modelling updates should be undertaken prior to commencement of any further design. Once the Project is complete as-constructed information should be collected covering the full extent of works and used to assess the final impacts of the Project with the final flood models. This modelling must satisfactorily demonstrate that there are no adverse impacts as a result of the Project. I suggest that a new EPR, or alteration to an existing EPR, is created to ensure that this happens.

5. WATER QUALITY

5.1 Assessment of Existing Conditions

The assessment of existing conditions water quality within waterways impacted by NEL relies upon consideration of testing results captured at various locations within the Project area. At several locations these testing results are outdated, for example it is noted that the latest results presented for Banyule Creek were collated approximately 7 years ago. No existing water quality results are presented for the following catchments:

- Yando Street Main Drain catchment
- Kempston Street Main Drain catchment

Both the Yando Street Main Drain and Kempston Street Main Drain discharge to Plenty Creek via the Kalparrin Gardens stormwater harvesting system managed by Banyule City Council. I believe the existing conditions assessment should have considered undertaking some water quality testing at Kalparrin Gardens.

Whilst the intent of EPR SW4 is that a monitoring program be required to be established prior to commencement of and during construction I believe that this period is insufficient to provide a meaningful test record and as much testing should be undertaken as possible given that available testing is considered out of date. As part of the Mordialloc Bypass EES a water quality testing was undertaken during the preparation of the EES as documented in Appendix J (Surface Water) of the EES, "*To understand the water quality of ponds in Waterways Wetlands, water quality data were collected by WSP from 2017 in Waterways Wetlands adjacent to the proposed road corridor.*"[10]

A copy of any recorded water quality data that has been collated either during the preparation of the EES or since finalisation of the EES was requested from NELP as part of an additional information request from Maddocks dated 19 June 2019. NELP's response to this request was, *"No additional water quality information has been collated with during the preparation of the EES or since finalisation of EES."*

As a result of the lack of recent and current water quality testing data I cannot make an informed assessment of the existing water quality conditions. Due to the lack of recent and current data I do not believe that the assessment of existing water quality conditions assessment as presented in the Surface Water Technical Report can be considered an accurate reflection of existing conditions. I believe that any water quality testing data collected within a short period prior to construction will fail to capture the variable nature of water quality. It may be possible for the testing prior to construction to detect a short period of poor water quality yet fail to acknowledge a longer-term trend of higher water quality. I recommend that as much testing as possible is taken prior to construction, similar to that afforded to the Mordialloc Bypass EES, and that testing should begin immediately.

[10] Page 37 of Appendix J Surface Water (Mordialloc Bypass EES)

I would also expect that the assessment of existing conditions would include an assessment of the condition and performance of existing water quality treatment assets that could be impacted by the Project (directly / indirectly). This would include, but not be limited to, an assessment of the following existing assets:

- Koonung Creek wetlands
- Kalparrin Gardens stormwater harvesting system
- Bolin Bolin stormwater harvesting system

The WestConnex M4-M5 EIS documented the existing water quality treatment assets within the study area as shown in Figure 5-1 below.

Table 4-2 Known existing water quality improvement devices

Catchment	Device type	Location
Johnstons Creek	Gross Pollutant Trap (GPT)	Federal Park
	Wetland	Federal Park
	GPT Rocla basket trap	Creek Street and Wigram Road
	GPT	Gadigal Avenue, Victoria Park
	GPT	Larkin Street Road
	GPT Rocla Continuous Deflection Separation (CDS) Unit	Larkin Street Park
	GPT	Corner of Australia Square, Enmore and King Street, Newtown
	Biofiltration	Corner of Federal and Church Street
Hawthorne Canal	Litter Boom	Canal Mouth
	GPT	Francis Street
	GPT	Dept. of Defence, Hawthorne Parade
Whites Creek	CDS GPT	Thorby Avenue
	GPT Rocola basket trap	North Avenue and White Creek Lane
	Wetland	Wisdom Street
	Infiltration Basin	Gillies Street

Figure 5-1 Existing water quality treatment devices documented as part of the WestConnex M4-M5 EIS

In site visits undertaken for this engagement I inspected a number of the existing stormwater retardation / treatment assets located within the catchments impacted by NELP. One of those assets was the existing stormwater retarding basin located within the Watsonia Station carpark. Although this asset may not have been designed as a water quality treatment asset, I believe it is currently providing some water quality treatment benefit. This is due to the fact that the outlet pit is raised above the base of the basin and will allow sediment deposition and infiltration of stormwater. This should be acknowledged in the assessment of existing conditions water quality. In the absence of a detailed assessment of other existing assets it is possible that there are other assets within the Project area that could be performing similar functions that have not been captured and accounted for. This is particularly important when assessing mitigation

measures given that if the existing treatment is accounted for appropriately the proposed mitigation measures will have to increase in size to offset the treatment benefit of the existing assets.

5.2 Impact of Project and Assessment of Mitigation Measures

5.2.1 Impact of Project

There is insufficient information presented in the Surface Water Technical Report to understand the direct impact of the Project on water quality. Similar EES documents, e.g. Mordialloc Bypass EES, presented tabulations of MUSIC modelling results that provide an appreciation for how much target pollutants are increased as a result of the Project. At a meeting with NELP's surface water experts on the 11th of July 2019, despite my requests, I was not afforded an opportunity to view any additional details than what is presented in the Surface Water Technical Report.

I believe that appropriate consideration needs to be given to the pollutant generation rates being noted from other similar large infrastructure projects to predict the impact of the Project rather than using MUSIC software to estimate this.

5.3 Assessment of Mitigation Measures

From the limited information presented in the Surface Water Technical Report the assessment of mitigation measures has relied upon the achievement of stormwater pollutant removal targets documented in the Best Practice Environmental Management Guidelines (BPEMG, 1999) to suggest that the Project will address water quality impacts. I do not believe that the targets in BPEMG are directly applicable to North East Link. The reasons why I am of this opinion is due to the following:

- BPEMG states that the performance objectives for stormwater management have been derived from consideration of several studies with respect to the typical quality of urban stormwater and performance capabilities of certain treatment measures because of the limited availability of water quality data and limitations of modelling. The pollutant removal targets documented in the BPEMG are based on the expected improvement to meet SEPP objectives that can be achieved by current best practice techniques.

- BPEMG states that the performance objectives are indicative only and that, *"In many situations, where there are no extreme or unusual factors, stormwater management which achieves these objectives will generally satisfy the environmental objectives of the SEPP".* I believe that North East Link meets the definition of an extreme or unusual factor given the high value of the receiving waterways.

- A document titled, "Issues Paper: for the Improving Stormwater Management Advisory Committee, DELWP (June 2018)" states that *"BPEM standards were largely designed to protect Port Phillip Bay and, based on what we now know are, on their own, unlikely to maintain the ecological condition of relatively natural waterways on*

the edges of the city, or protect Westernport Bay and Gippsland Lakes into the future."

- If appropriate water quality testing had been undertaken to appropriately characterise then a direct determination of stormwater performance requirements could be quantified in lieu of the generic performance requirements documented in BPEMG as per Figure 5-2 below.

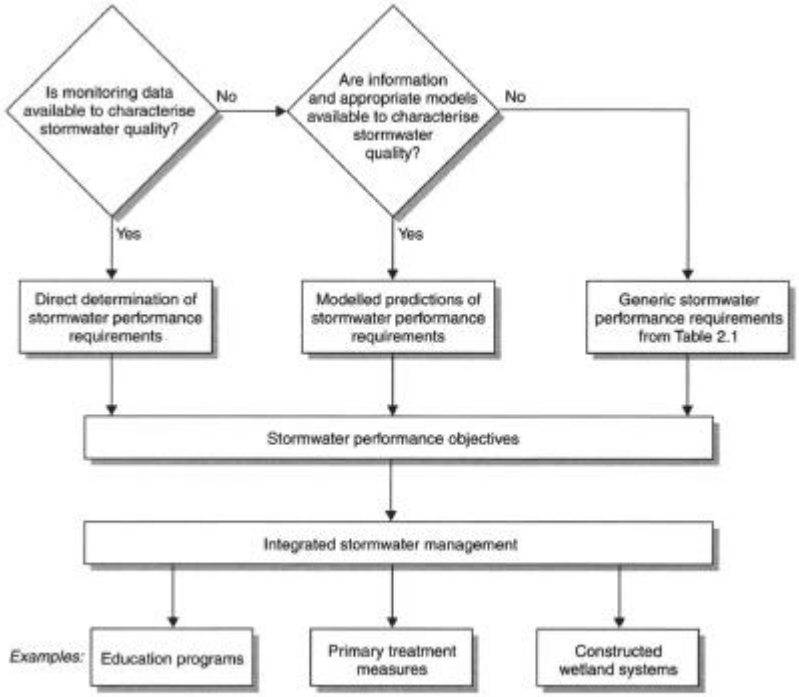

Figure 2.4 Alternative approaches for determining stormwater performance objectives and their context in integrated stormwater management.

Figure 5-2 Figure 2.4 from BPEMG outlining alternative approaches for determining stormwater performance objectives

- In my research I have identified that other large infrastructure projects have given consideration for the pollutant loads that have been generated and measured from other similar projects to identify the expected levels of pollutants from the proposed project. I have provided an example of this in Section 5.3.1, the Port of Brisbane Motorway, which also set specific target values for water quality objectives and not just percentage pollutant removal targets. This has resulted in water quality treatment assets being implemented which consider realistic pollutant generation rates and provide treatment above best practice targets.

Adoption of the pollutant removal targets within BPEMG allows the Project to increase pollutants above existing levels. This contradicts the following relevant guidelines to North East Link (as per Table 4-1 of the Surface Water Technical Report):

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)

  The Australian Guidelines for Urban Stormwater Management (part of the National Water Quality Management Strategy, ANZECC) presents a preferred hierarchy of stormwater management practices as shown in Figure 5-3 below which outlines that the highest priority is to retain and restore valuable ecosystems.

  1. **Retain and restore (or rehabilitate) valuable ecosystems**: retaining or restoring (if degraded) existing valuable elements of the stormwater system, such as natural channels, wetlands and riparian vegetation;
  2. **Source control: non-structural measures**: non-structural techniques for limiting changes to the quantity and quality of stormwater at the source;
  3. **Source control: structural measures**: constructed management techniques installed at or near the source to manage stormwater quantity and quality; and
  4. **In-system management measures**: constructed management techniques installed within stormwater systems to manage stormwater quantity and quality prior to discharge into receiving waters.

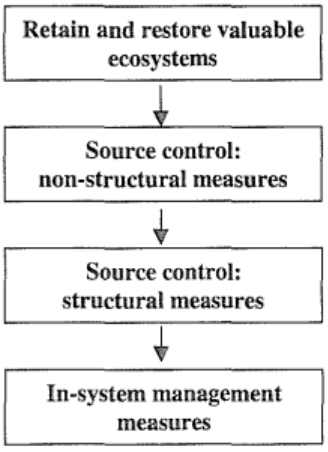

Figure 2 – Stormwater Management Hierarchy

Figure 5-3 Preferred stormwater management hierarchy, from Australian Guidelines for Urban Stormwater Management (ANZECC)

This approach focuses on pollution prevention in accordance with the principles of Ecologically Sustainable Development (ESD). Use of BPEMG targets will not retain and restore valuable ecosystems.

- The Healthy Waterways Strategy (2018)

  A key goal of this strategy directly relevant to North East Link is, *"The environmental values and significant ecological processes of all of the Yarra catchment waterways are protected and improved."*

  The Strategy acknowledges that, *"If current policy and levels of investment are maintained, without improvement, then it is likely that the Yarra catchment will*

experience declines in environmental and social values over the next 30 years. There is a real need to take action to avoid an otherwise inevitable decline in waterway health."

In summary I do not believe the stormwater pollutant removal targets documented in the current BPEMG (1999) are relevant to North East Link and that targets need to be set with consideration of improving upon existing conditions.

I also understand that the Environment Protection Authority (EPA) are currently reviewing the BPEMG and that recommendations will be made for an expanded range of stormwater management standards. Public consultation is anticipated to begin in mid-2019 and I expect that the changes proposed and adopted must be considered as part of the future design stages for North East Link.

5.3.1 Documented Detail of Assessment

As documented in the Surface Water Technical Report MUSIC software has been used to assess the effectiveness of mitigation measures. Whilst MUSIC software is recognised as industry leading software to undertake this assessment I do not believe that the parameters within the model are likely to reflect the pollutant loads that can reasonably be expected to be generated from the Project which are as documented in the April 2019 Fact Sheet, *"North East Link will be a new connection for up to 135,000 vehicles a day, reducing travel times through the north-east drawing trucks away from the arterial road network and reducing 'rat-runs'."*

Research suggests that having regard to stormwater pollutants from highways and freeways Event Mean Concentration (EMC) of pollutants can be up to four times as high on highways with traffic volume greater than 30,000 vehicles per day compared to those highways with lesser traffic volumes. This is documented within *Water Sensitive Road Design – Design Options for Improving Stormwater Quality of Road Runoff*, August 2000, Tony Wong / Peter Breen / Sara Lloyd, "*Work undertaken by Driscoll et al. (1990) found differences between the concentration of pollutants generated from road surfaces of different traffic volumes. Table 4.2 shows that the Event Mean Concentration (EMC) of pollutants can be up to four times as high on highways with traffic volume greater than 30,000 vehicles per day compared to those highways with lesser traffic volumes."*

This is supported by a technical paper documenting the water sensitive highway design undertaken for the Port of Brisbane Motorway (Dean Toomey, Bill Johnson & Darren Drapper (2003) *Water sensitive highway design Port of Brisbane Motorway*, Australian Journal of Multi-disciplinary Engineering, 1:1, 31-36).

Experience has shown that stormwater run-off from highways can contain high concentrations of pollutants that are harmful to receiving watercourses. A review of measured water quality from several of Brisbane's comparable major arterial roads indicated that the following pollutants are of most concern:

- *suspended solids;*

- *hydrocarbons;*
- *chemical spills;*
- *nutrients; and*
- *gross pollutants.*

The collated data shows a wide variation in median concentrations, which is a result of varying climatic conditions, traffic volumes, vehicle types, rainfall characteristics, road surface types and antecedent dry periods. Intersections, interchanges and ramps promote brake use, lower engine efficiency and increase tyre wear, and generally have higher pollutant loads than straight sections of road. All of these factors were considered before setting the expected levels of pollutants from the PBM (see Table 1).

Table 1: Comparison of Expected Run-off Quality from Port of Brisbane Motorway with Brisbane City Council Water Quality Objectives (BCC WQOs)

Indicator	Expected PBM Run-off (Drapper 2001)	BCC WQO (BCC 2000)	Reduction to Meet BCC WQO
PH	6–7	6.5–8.5	within required range
Total phosphorus	270–1900 µg/L	60 µg/L	reduce by 75–95 %
Total nitrogen	2000–9900 µg/L	450 µg/L	reduce by 75–95 %
Suspended solids	80–560 mg/L	30 mg/L 90%ile <100 mg/L	Reduce by 60–95%
Total copper	40–260 mg/L	1 µg/L	reduce by 98–99 %
Total nickel		15 µg/L	
Total lead	100–430 mg/L	5 µg/L	reduce by 95–99 %
Total zinc	185–1400 mg/L	5 µg/L	reduce by 95–99 %
Oils and grease	Films evident	No visible films or odour	

Figure 5-4 Table 1 from (Dean Toomey, Bill Johnson & Darren Drapper (2003) Water sensitive highway design Port of Brisbane Motorway, Australian Journal of Multi-disciplinary Engineering, 1:1, 31-36)

Given the significant traffic loads for North East Link and the findings of my research it is not unreasonable to expect that stormwater pollutants loads will be significantly higher from North East Link than highways with lesser traffic volumes. There are no details contained within the Surface Water Technical Report to suggest that this has been considered. In my opinion the assessment should account for this by adjusting the default pollutant concentration data within the MUSIC model. By doing so a more accurate representation of the mitigation measures required to address stormwater pollutant generation from North East Link will be achieved.

The Surface Water Technical Report presents limited detail regarding the assessment of water quality mitigation measures. The level of detail presented is far less than what is presented in the Mordialloc Bypass EES and West Connex M4-M5 EIS. In the WestConnex M4-M5 EIS the assessment of mitigation measures is presented in tabular form to summarise the results for the main locations where stormwater will be discharged

to and for the total project. An extract of the information contained in the EIS is presented in Figure 5-5 below.

Table 6-9 MUSIC modelling results – water quality

Parameter	M4-M5 Link operation source load	M4-M5 Link operation residual load (following treatment)	% Reduction	Existing residual load	Impact compared to existing conditions
TOTAL PROJECT					
Total suspended solids (kg/year)	48600	8450	83%	33900	-25450
Total Phosphorus (kg/year)	81	39	52%	58	-19
Total Nitrogen (kg/year)	353	209	41%	271	-62
Gross pollutants (kg/year)	3520	242	93%	2530	-2288
ROZELLE BAY					
Total suspended solids (kg/year)	36500	5300	86%	24500	-19200
Total Phosphorus (kg/year)	61	28	55%	42	-15
Total Nitrogen (kg/year)	271	156	43%	202	-46
Gross pollutants (kg/year)	2710	108	96%	1860	-1752
IRON COVE					
Total suspended solids (kg/year)	7470	2170	71%	6680	-4510
Total Phosphorus (kg/year)	13	6	56%	11	-6
Total Nitrogen (kg/year)	51	31	39%	49	-18
Gross pollutants (kg/year)	501	103	80%	488	-385
WHITE BAY					
Total suspended solids (kg/year)	1130	240	79%	1080	-840
Total Phosphorus (kg/year)	2	1	27%	2	-0.4
Total Nitrogen (kg/year)	8	5	30%	7	-2
Gross pollutants (kg/year)	76	8	90%	72	-65
WHITES CREEK					
Total suspended solids (kg/year)	1850	395	79%	1650	-1255

Target achieved
Target not achieved
Reduced load compared to existing conditions
Increased load compared to existing conditions

156

Figure 5-5 Presentation of MUSIC modelling of water quality mitigation measures from WestConnex M4-M5 EIS

In response to Maddocks Lawyers request for additional information from NELP, dated 19th of June 2019, the following response from NELP was received with regards to a request for further details of the MUSIC modelling inputs and results, *"MUSIC modelling has considered both existing and potential WSUD assets. Given the early conceptual nature of the WSUD features, it is appropriate that the EES includes a high level discussion of these modelling results. It is not normal for high level concepts to be detailed to any greater degree at an EES stage particularly when the performance objectives are so easily met."*

I disagree with this statement given other similar documents have presented such information.

5.3.2 Inadequacies of Assessment

Considering the information in the Surface Water Technical Report and details obtained from meeting with NELP's surface water expects on the 11th of July 2019, with respect to the assessment of water quality mitigation measures, it is understood that the assessment of water quality mitigation measures has failed to:

- meet water quality treatment targets at a municipal scale; and

- meet water quality treatment targets at a catchment scale.

I also have concerns that the proposed mitigation measures may have been used in the assessment to treat existing land uses and offset the impact of the Project. This concern was unable to be resolved in my meeting with NELP's surface water experts on the 11th of July 2019. This could only be considered if the assessment has appropriately considered the difference in pollutant loads generated by different land use types. The pollutant loads that will be generated from North East Link will be significantly higher than that of existing land uses due to the high traffic volumes.

5.3.3 Proposed Mitigation Assets

I have reviewed the mitigation measures documented in the Surface Water Technical Report and documented the number and type of each water quality treatment asset within the municipal areas impacted by the Project. The results of my review are presented in Table 5-1 below.

Table 5-1 Summary of water quality treatment assets proposed in Surface Water Technical Report

Location (Municipality)	Subsurface Storage	Bioretention	Wetland	Total
Whitehorse	2	-	1	**3**
Manningham	2	3	2	**7**
Boroondara	2	5	4	**11**
Banyule	3	3	1	**7**
Nillumbik	-	-	1	**1**
Yarra	1	-	-	**1**
Total	**10**	**11**	**9**	**30**

With consideration of the findings of my review I am concerned that one third of the assets proposed are subsurface storage assets. In my opinion these assets will provide limited water quality treatment benefit with Total Suspended Solids (TSS) removal being the only stormwater quality target that could reasonably be expected to be achieved by this type of asset. The removal of other stormwater pollutants such as Phosphorus and Nitrogen is only possible if the assets allow for exfiltration or reuse of capture stormwater. There is nothing to suggest in the Surface Water Technical Report that this has been allowed for. I expect that the storages will only be capturing relatively small catchment areas of road runoff which will not provide a reliable source of stormwater for reuse. There are also no details provided to suggest that the exiting geotechnical conditions have been assessed to determine if exfiltration will provide basis for stormwater treatment.

The assessment does not document whether primary treatment has been included in the assessment. I would expect that the majority of assets proposed have some form of primary treatment such as Gross Pollutant Traps (GPTs), sediment ponds and / or grassed swales (where possible). These assets are water quality treatment assets in their own right and should be presented in the assessment to give a full appreciation for the proposed treatment system and number of assets that are required to achieve pollutant removal targets.

5.3.4 Locations of Proposed Mitigation Assets

With respect to mitigation measures I believe that the Project will result in unacceptable environmental impacts at several locations in particular where a lack of consideration for mitigation measures has been afforded. These locations include:

- Banyule Creek

  The layout plan in the Surface Water Technical Report does not depict any water quality treatment asset within the Banyule Creek catchment.

- Plenty River

  There will be additional pavement draining to the Plenty River when considering the vertical alignment at this location as is presented in the Map Book. There is also a need to account for greater traffic volumes at this location, as well as all other locations, where rates of stormwater pollutant generation will increase compared to existing conditions.

- Upper 2.5 km of Koonung Creek adjacent to the Project area

  Unless road drainage for this section of the Project will entirely drain to WSUD ID 1, which I believe is unlikely due to cost implications of doing so, there is no treatment proposed for the upper section of Koonung Creek. This is a key reason why the Surface Water Technical Report would benefit for a layout plan and tabular summary of the proposed discharge locations. This section of Koonung Creek is one of the remaining relatively unaltered sections of the waterway and it is concerning to identify that no mitigation measures are proposed along this section, particularly considering that the Project is proposing significant alterations, diversions and covering of the waterway, at other locations.

I have considered the appropriateness of the proposed water quality mitigation measures by undertaking an assessment of the following two proposed wetlands:

- WSUD ID 13 – Wetland
- WSUD ID 7 – Wetland

I have estimated the largest possible catchment from the Eastern Freeway (existing and proposed road surfaces) that could be drained to WSUD ID 13 to be in the order of 4 hectares. Australian Rainfall and Runoff 2019 (Book 9, Chapter 4) outlines that

constructed wetlands are most suitable for water quality improvement on catchments larger than approximately 10 hectares. This raises the question whether existing land uses, such as neighbouring residential areas, are proposed to drain to the wetland also to provide a sufficient catchment area. If so, this then raises a concern that the treatment benefit afforded by the wetland for the existing land use areas may be used to offset areas where treatment is not proposed to be implemented. This is a significant concern given the pollutant load generation from North East Link which will be far greater than neighbouring existing land uses.

I have assessed the existing landform at the area where WSUD ID 7 is proposed and identified a significant constraint to its implementation in the form of the existing ground surface profile. I have examined two cross sections through the existing ground surface profile at the locations identified by the purple and yellow arrows in Figure 5-6 below. Figures 5-7 and 5-8 show the existing ground surface for these locations and highlight the significant variance in existing ground surface levels in this area. Based on consideration of the existing terrain and the proposed design it is difficult to envisage how a wetland would be constructed at this location without a significant retaining structure. Furthermore, it is unclear if the location of this proposed asset is a factor in the reference design proposing to divert sections of Koonung Creek. If it is, I believe this is unacceptable and the asset is recommended to be relocated to a more appropriate location to reduce the environmental impact.

I believe that the functionality and siting of proposed water quality treatment assets needs to be considered as part of the EES assessment. In the absence of a proof of concept it is possible that alternative locations for implementation of mitigation measures within open space / parklands areas will be required and could result in other / greater environmental impacts not identified in the EES.

Figure 5-6 Cross section locations through WSUD ID 7

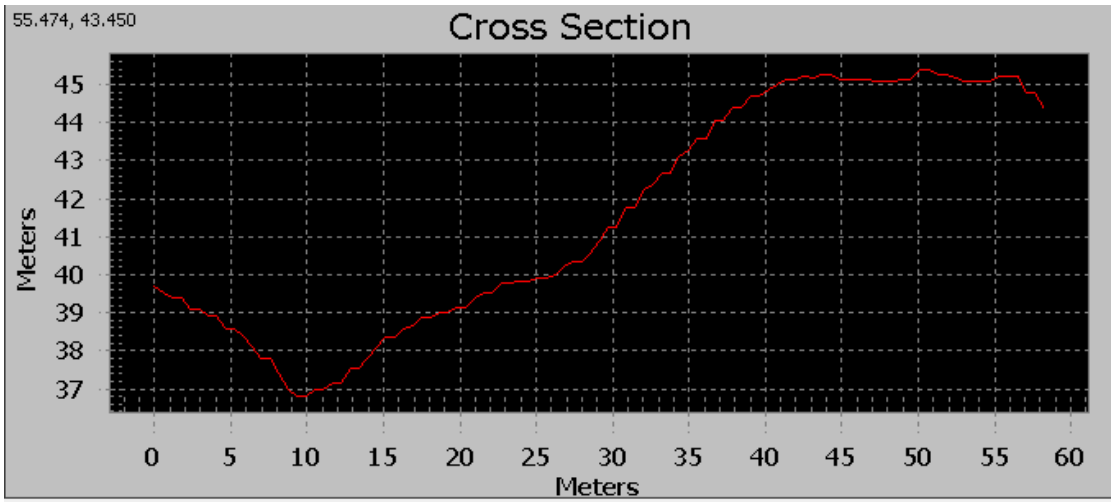

Figure 5-7 Existing ground surface profile (yellow line)

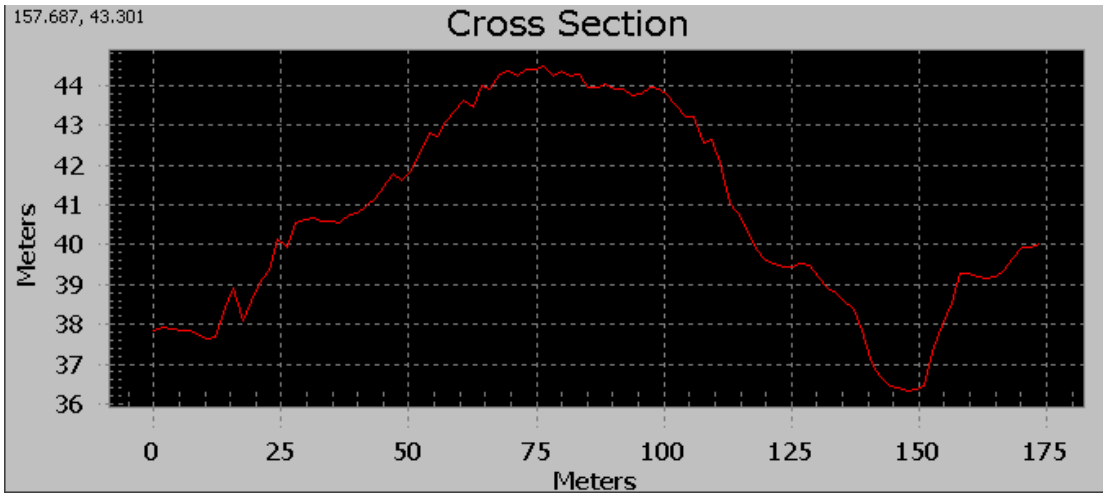

Figure 5-8 Existing ground surface profile (purple line)

I also note that several proposed water quality treatment assets are located within the Yarra River floodplain and below the 1 in 10 year flood levels for the Yarra River. Design guidance suggests that these assets should be located above such levels to minimise potential maintenance issues that may result from more frequent inundation.

There is also reliance upon bioretention systems to provide water quality treatment to mitigate the impacts of the Project. When compared to other water quality treatment assets, bioretention systems require a higher degree of ongoing maintenance and have a shorter lifespan.

I have been involved in a technical review role on large infrastructure projects in the past and have seen design changes made late in the process which have meant that water quality treatment assets have been deleted due to site constraints and these assets were not compensated for. In this role I also reviewed as-constructed information and found that in many instances the proposed drainage / water quality treatment assets were not constructed in accordance with the design intent. In one instance the result of these as-

constructed discrepancies was the failure of those assets during the next storm event. In my opinion this resulted in an acceptable environmental outcome.

5.3.5 Consideration of Climate Change

From the information presented in the Surface Water Technical Report it is not evident that the water quality mitigation assessment has considered the impacts of climate change. It was confirmed to me in a meeting with NELP's surface water experts on the 11th of July 2019 that no consideration of climate change has been afforded in the water quality assessment.

From my experience I understand that the stormwater pollutant removal performance of different treatment asset types is sensitive to climate change with some assets being more sensitive than others. Depending upon climatic conditions, catchment areas and land use types, some assets will provide less pollutant removal benefit in a climate change scenario. Given the expected completion date of construction for North East Link I strongly recommend that the sizing of water quality treatment assets is undertaken for climate change predictions to ensure that these assets can perform to their design intent into the future.

5.3.6 Spill Risk Assessment

I note that the Surface Water Technical Report does not document the findings of a spill risk assessment. For the Mordialloc Bypass EES this level of detail was provided to confirm locations where spill containment is required. An assessment matrix was developed to assess the spill risk and is shown in Figure 5-9 below. *"If the matrix returns a high risk, spill containment is recommended. For a medium spill risk, separate spill containment is not recommended and a channel/swale may be available to restrict/contain any spill. The results of the spills risk assessment are Table L.2."*[11]

[11] Page L-1 of Appendix J Surface Water (Mordialloc Bypass EES)

Table L.1 Spills risk assessment matrix

LIKELIHOOD OF SPILL	IMPACT (DISCHARGE PROXIMITY TO A SENSITIVE RECEPTOR)		
	Minor (500 m to 2 km)	Moderate (100 m to 500 m)	Major (0 to 100 m)
Merge/diverge zones Intersections	L	M	H (provide spill containment)
Through alignment	L	L	M

Table L.2 Spills containment risk assessment

OUTLET CHAINAGE	SENSITIVE RECEPTOR	DISTANCE TO SENSITIVE RECEPTOR	OUTLET TYPE	LIKELIHOOD OF SPILL	IMPACT
26000 SB	Woodlands Industrial Estate Wetland	1930	Headwall	Intersection	Low
26315 NB	Woodlands Industrial Estate Wetland	1585	Headwall	Merge/diverge zones	Low
26350 SB	Woodlands Industrial Estate Wetland	1615	Headwall	Merge/diverge zones	Low
26500 NB	Woodlands Industrial Estate Wetland	1400	Headwall	Merge/diverge zones	Low
26500 SB	Woodlands Industrial Estate Wetland	1430	Headwall	Merge/diverge zones	Low
27075 NB	Woodlands Industrial Estate Wetland	825	Headwall/Swale	Through Alignment	Low
27075 SB	Woodlands Industrial Estate Wetland	855	Headwall/Swale	Through Alignment	Low
27375 SB	Woodlands Industrial Estate Wetland	675	Headwall	Through Alignment	Low
27900 NB	Woodlands Industrial Estate Wetland	30	Bioretention Swale	Through Alignment	Moderate

Figure 5-9 Spill risk assessment as presented in Mordialloc Bypass EES

The Urban Design Strategy presents the possibility of adopting stormwater harvesting at several locations including at AK Lines Reserve. There are also areas where the Urban Design Strategy presents the possibility of incorporating the consideration of WSUD assets when it has not been considered in the information presented in the Surface Water Technical Report (i.e. Borlase Reserve). Whilst assets in addition to those presented in the Surface Water Technical Report would be beneficial appropriate consideration needs to be given to the ownership and ongoing maintenance of those additonal assets.

5.4 Assessment of Residual Impacts

The residual impacts are not well understood given the lack of detail presented in the Surface Water Technical Report. However, it is understood that:

- The mitigation measures proposed and assessed as part of the EES do not meet water quality treatment targets at a municipal scale

The assessment needs to demonstrate that stormwater targets can be met at a municipal scale to ensure that the Project does not hinder the ability of Local Councils to achieve their own stormwater quality treatment targets. This is essential given that the assets proposed as part of the Project will consume areas where Council could potentially locate future WSUD assets limiting the availability of locations for future assets. It is possible that the ownership of some of the constructed assets will be transferred to the respective Councils' increasing the maintenance burden on Council staff. This could have a detrimental impact on existing assets due to the need to provide additional maintenance above the capacity of Councils' existing resources.

- The mitigation measures proposed and assessed as part of the EES do not meet water quality treatment targets at a catchment scale.

  The assessment needs to demonstrate that stormwater targets can be met at a catchment scale to ensure that the Project does not adversely impact downstream waterway environments.

- The proposed mitigation measures are possibly being used to treat existing land uses to offset the impact of the Project and that expected higher than normal pollutant loads, driven by higher than normal traffic loads, have not been accounted for.

  This could only be considered if the assessment has appropriately considered the difference in pollutant loads generated by different land use types. The pollutant loads that will be generated from North East Link will be significantly higher than that of existing land uses due to the high traffic volumes.

The success of the mitigation measures will ultimately rest upon appropriate maintenance activities that will be required to ensure that the assets operate in accordance with their design intent. In my experience having visited and reviewed several water quality treatment assets constructed as part of major road projects the constructed assets have not been maintained in accordance with industry guidelines. Examples of such assets are presented in **Appendix E**.

The Project needs to acknowledge this and provide assurance the maintenance activities will be carried out with accordance with industry guidelines to ensure adequate performance of the constructed assets. Whilst the intent of EPR SW11 may attempt to indicate that the implementation of WSUD will be in accordance with relevant Specifications and Guidelines there is nothing to suggest that an agreement / memorandum of understanding will be developed to ensure that the assets are maintained appropriately.

Given that a large portion of the proposed assets will be expected to be owned and maintained by an authority other than Council (e.g. VicRoads) this raises concerns regarding what powers Council will have to ensure that adequate maintenance is afforded. This will be of high importance for existing water quality treatment assets owned and maintained by the respective Councils'. An example is the Kalparrin Garden stormwater harvesting system. Proposed Project works upstream of this location (e.g. road widening and new roads) within the Yando Street Main Drain catchment will generate runoff

containing additional stormwater pollutants that will drain to Kalparrin Gardens compared to existing conditions. It is understood that WSUD ID 30, a wetland at the M80 interchange, has been proposed to reduce stormwater pollutant loads draining to Kalparrin Gardens. I expect that this asset would be owned and maintained by VicRoads and as such Council is dependent on the maintenance activities of VicRoads to ensure that there are no impacts of the Project at Kalparrin Gardens. I understand that there is a precedence for developing an agreement / memorandum of understanding between multiple stakeholders when implementing water quality treatment assets. An example of this is the Bolin Bolin Integrated Water Management project. As such I believe that any adopted EPR with respect to water quality needs to ensure that similar agreements be reached to ensure that maintenance activities are undertaken and enforced where required.

There is nothing within the Surface Water Technical Report, in particular the proposed EPRs, to outline the duration and scope of water quality testing that is to be undertaken post construction to ensure that the project does not adversely impact the downstream receiving environments. EPR W5 within the Mordialloc Bypass outlines the need to undertake surface water monitoring for a period of five years following opening the project to the public as is shown in Figure 5-10 below. As such I am not confident that the likely impacts of North East Link will be adequately assessed, and where required, remedied.

EPR number	Environmental performance requirement	Project phase
W5	**Water Management and Monitoring Plan** A Water Management and Monitoring Plan (WMMP) must be prepared in consultation with EPA Victoria and relevant water authorities, and be implemented prior to construction, during construction and for five years following opening the project to the public. The WMMP must incorporate both surface and groundwater monitoring. Incorporating the baseline data collected to date, the WMMP must include: • detail of the monitoring parameters, including the frequency and location of surface water monitoring points and groundwater monitoring bores • specific trigger levels (water quality in surface water bodies and groundwater bores) and details of contingency plans in the case trigger levels are exceeded • detailed reporting requirements • roles and responsibilities, not limited to: – the owner of monitoring network assets – the manager of monitoring network assets and results – the party (or parties) undertaking monitoring (prior to construction, during construction and for five years following opening).	All

Figure 5-10 EPR W5 as documented in the Mordialloc Bypass EES

The need for water quality testing beyond a five-year period is unlikely to be required if maintenance agreements between stakeholders can be reached. If not, then arguably longer testing may be required to confirm the impact of the Project and ensure that the operation of the Project does not impact downstream receiving waterway environments.

5.5 Summary

My review of the water quality assessment undertaken as part of the EES has identified the following points of concern that have led me to believe that the water quality modelling is not sufficient to assess and mitigate the environmental impacts that could result from construction of North East Link. Particular deficiencies are summarised below:

- To provide a comprehensive and reliable assessment of baseline water quality conditions that I believe is required for a project of this size, NELP should have captured as much data as possible during the development of the EES. Testing was undertaken during the development of the Mordialloc Bypass EES.
- Alternatives to BPEMG stormwater pollutant removal targets need to be considered. This is because the BPEMG targets are indicative only and essentially allow the Project to pollute waterways to levels in excess of existing conditions. This contradicts several objectives of the Project including the protection and enhancement of the natural environment.
- Other large infrastructure projects have given consideration for the pollutant loads that have been generated and measured from other similar projects to identify the expected levels of pollutants from the proposed project. This should be considered for North East Link given that the nature of the Project is not defined within industry guidelines (e.g. Melbourne Water MUSIC modelling guidelines).
- There is no mention of the scope and duration of the water quality testing that will be undertaken after the Project has been opened to the public. EPR W5 from the Mordialloc Bypass specified a length of 5 years, I recommend that a similar length be adopted for North East Link.
- The assessment has not considered the fact that the pollutant generation rates from a project of this scale will be in excess of those rates from highways with lesser traffic volumes.
- Maintenance is a key concern particularly where the impact of the Project upon existing water quality assets will be dependent upon the maintenance regime of proposed assets to be owned and maintained by other drainage authorities. The current EPRs cannot be relied upon to ensure appropriate maintenance activities will be undertaken. This is supported by my experience with water quality treatment assets constructed as part of other large infrastructure projects where a lack of maintenance has led those assets to perform a water quality treatment function less than the design intent.
- The likely impacts of the Project on water quality in the receiving waterways are not well understood given the lack of detail presented in the Surface Water Technical Report. However, it is understood that:
    - The mitigation measures proposed and assessed as part of the EES do not meet water quality treatment targets at a municipal scale

    - The assessment needs to demonstrate that stormwater targets can be met at a municipal scale to ensure that the Project does not hinder the ability of Local Councils to achieve their own stormwater quality treatment targets.
  - The mitigation measures proposed and assessed as part of the EES do not meet water quality treatment targets at a catchment scale.
    - The assessment needs to demonstrate that stormwater targets can be met at a catchment scale to ensure that the Project does not adversely impact downstream waterway environments.
  - The proposed mitigation measures are possibly being used to treat existing land uses to offset the impact of the Project and that expected higher than normal pollutant loads, driven by higher than normal traffic loads, have not been accounted for.
    - This could only be considered if the assessment has appropriately considered the difference in pollutant loads generated by different land use types. The pollutant loads that will be generated from North East Link will be significantly higher than that of existing land uses due to the high traffic volumes.

- The locations of some assets appear to have inherent constraints which could require alternative land take that has not been accounted for. I would expect further rigour as part of the assessment to confirm that the assets can be constructed appropriately to meet design intent and allow for necessary maintenance activities.

- The water quality mitigation assessment has not considered the impacts of climate change. Depending upon climatic conditions, catchment areas and land use types some water quality treatment assets will provide less pollutant removal benefit in a climate change scenario. Given the expected completion date of construction for North East Link I strongly recommend that the sizing of water quality treatment assets is undertaken for climate change predictions to ensure that these assets can perform to their design intent into the future.

- I believe that the Project will result in unacceptable environmental impacts at several locations in particular where a lack of consideration for mitigation measures has been afforded. These locations include:

  - Banyule Creek
  - Plenty River
  - Upper 2.5 km of Koonung Creek adjacent to the Project area

- One third of the assets proposed are subsurface storage assets. In my opinion these assets will provide limited water quality treatment benefit with Total Suspended Solids (TSS) removal being the only stormwater quality target that could reasonably be expected to be achieved by this type of asset. Further detail on the intended design / function of these assets and how the water quality treatment benefits that have been considered in the assessment needs to be provided.

- Spill risk assessment not undertaken during the development of the EES, as part of the Mordialloc Bypass EES a risk assessment was undertaken.

6. WATER SUPPLY

6.1 Assessment of Existing Conditions

The assessment of existing conditions has failed to identify that existing water supply storages, other than the existing private dam on the Trinity Grammar School Sporting Complex, could be impacted by the Project, this is described further in Section 6.2.1 below.

6.2 Impact of Project and Assessment of Mitigation Measures

6.2.1 Impact of Project

The assessment of the impact of the Project on water supply is limited predominantly to the impact of a private dam on the Trinity Grammar School Sporting Complex which supplies irrigation water for Trinity Grammar and Marcelin College grounds. This asset is directly impacted by the Project. Consideration has also been given to indirect impacts to the Bolin Bolin Integrated Water Management project.

There is, however, another asset, the Kalparrin Garden stormwater harvesting system, located adjacent to the Project area which has not been considered and could receive indirect impacts which have not been considered. Water from the Kalparrin Garden stormwater harvesting system is used to irrigate adjacent open space areas. There is potential that this asset could be impacted during the construction and operation of the Project.

6.2.2 Assessment of Mitigation Measures

The mitigation measures documented in the Surface Water Technical Report is limited to the adoption of EPR SW12.

As described in Section 5.3 the impact of the Project at Kalparrin Gardens is dependent upon the successful implementation and maintenance of upstream water quality mitigation measures (WSUD ID's 15, 20, 22 and 30) some of which will be owned and maintained by others.

An important consideration of water supply is during the construction of the Project. As documented in the VicRoads Integrated Water Management Guidelines (June 2013), major road construction projects can consume up to one megalitre of water a day. The environmental impact of having to supply this amount of water could be significant, particularly if the Project was to be constructed in a drought period. As part of the WestConnex M4-M5 EIS water required during construction activities was estimated and tabulated. Figure 6-1 below is an extract from the EIS from that project. The assessment also estimated the daily and annual stormwater and treated groundwater reuse. I believe the North East Link EES should provide a similar assessment to enable an assessment of the environmental impact of water supply for construction of the project.

2.4.1 Construction

Water use

The total volume of water required during construction of the project is estimated to be around 900 megalitres. The use of non-potable water would be preferred over potable water where possible.

Non-potable water demands include:

- Surface activities such as dust suppression, wheel washing and plant washing
- Underground activities such as road header dust suppression, rock bolting and plant washdown.

Stormwater and other non-potable sources such as treated tunnel groundwater and treated 'dirty' construction water would be reused for non-potable water demands during construction. It is not proposed that surface water would be extracted from the local urban waterways.

The extent to which non-potable water sources can be used would be variable and governed by workplace health and safety considerations, economic feasibility, the functional specifications of the design and the availability and quality of non-potable water.

An estimate of daily stormwater and treated tunnel groundwater usage is provided in **Table 2-3**.

Table 2-3 Indicative stormwater and groundwater daily construction use

Site	Rainwater / stormwater reuse		Treated Groundwater Use	
	Daily (kL/day)	Annual (kL/year)	Daily (kL/day)	Annual (kL/year)
C1a – Wattle Street civil and tunnel site	2	730	250	91250
C2a – Haberfield civil and tunnel site	1	365	0	0
C3a – Northcote Street civil site	0	0	0	0
C1b – Parramatta Road West civil and tunnel site	2	730	250	91250
C2b – Haberfield civil site	1	365	0	0
C3b – Parramatta Road East civil site	1	365	0	0
C4 – Darley Road civil and tunnel site	1	365	50	18250
C5 – Rozelle civil and tunnel site	3	1095	370	135050
C6 – The Crescent civil site	1	365	0	0
C7 – Victoria Road civil site	1	365	0	0
C8 – Iron Cove civil site	1	365	50	18250
C9 – Pyrmont Bridge Road tunnel site	1	730	25	9125
C10 – Campbell Road civil and tunnel site	1	365	100	36500

Figure 6-1 Summary of non-potable water sources for construction activities (WestConnex M4-M5 EIS)

The intent of EPR SW11 is for Water Sensitive Urban and Road Design to be adopted as part of the Project. However, the wording does not suggest that this EPR includes a requirement to use non-potable water for construction activities. The VicRoads Integrated Water Management Guidelines (June 2013) suggest, *"VicRoads will continue to identify non-potable water sources for use in road construction and maintenance activities, and will minimise the use of potable water in the future. To this end, VicRoads objectives are that, by the end of 2015, 80% (by volume) of all water used during road construction, and 40% of all water used for regional projects and maintenance, is non-potable."* However, the current wording of EPR SW11 relates to stormwater treatment design only.

6.3 Assessment of Residual Impacts

I believe that EPR SW12 is appropriate to manage the impacts of the Project with respect to construction and operation. I would suggest changing the wording from "… irrigation of sporting fields" to "… irrigation of open space areas including sporting fields."

I also propose that the EPR should consider including wording that outlines only water of appropriate water quality be used to maintain existing storage and available water supply.

However, to ensure that reliance on potable water is kept to a minimum I suggest inclusion of a new EPR "Use of non-potable water" with wording as follows, "Where available and practicable, of suitable quality, and meets health and safety requirements, stormwater, recycled water, groundwater inflow to tunnels or other water sources must be used in preference to potable water for construction activities, including concrete mixing and dust control."

7. GEOMORPHOLOGY

7.1 Assessment of Existing Conditions

Existing geomorphic conditions for waterway stability has been appraised through observations made during site visits, which I believe is appropriate. Many of the site observations documented in the Surface Water Technical Report are consistent with mine from my site visits. However, to better understand the existing conditions at locations where there will be impacts from the project there would be benefit in presenting a layout plan in the Surface Water Technical Report to depict all proposed discharge locations.

The existing conditions assessment should have also appraised and considered the existing geomorphic conditions at the channelised section of the Yando Street Main Drain immediately downstream of the confluence of the Yando Street Main Drain and Kempston Street Main Drain, immediately west of Pinehills Drive. This is due to the fact that there is potential for the Project to result in impacts at this location, either during construction or operation.

7.2 Impact of Project and Assessment of Mitigation Measures

7.2.1 Impact of Project

The Project has the potential to impact the key geomorphic features which include the bed and banks of existing waterways. The Surface Water Technical Report presents velocity afflux plots to demonstrate the impacts of the Project when compared to existing conditions. There would also be benefit in having the change in pipe outfall velocity documented at each proposed outfall location.

7.2.2 Assessment of Mitigation Measures

There is no mention within the Surface Water Technical Report of possible options that will be required to mitigate predicted increases in velocities. There is reliance upon the EPRs to mitigate any adverse geomorphic impacts. I consider this to be appropriate only if both the flooding and water quality mitigation measures, and inherent EPRs, are appropriately implemented.

Mitigation measures should be chosen based on the sensitivity of the downstream waterway environment. Highly sensitive waterways need a more comprehensive approach to managing impacts from the Project. I also believe there would be a benefit in documenting a hierarchy of mitigation measures that needs to be considered when addressing impacts. The hierarchy could include, for example:

- Highest Priority – Address impacts as part of the drainage design (e.g. via use of drop pits to reduce velocities and the resultant need for rock armouring at the pipe outlet).

- Lowest Priority – Works within waterways. Any works within waterways should also consider complementary works to improve waterway habitat and where practicable remediate areas of existing bank erosion.

7.3 Assessment of Residual Impacts

To assess and confirm the impacts of the Project I would have expected that as part of the Surface Water assessment that the impact on the existing hydrological flow regime would have been assessed. Figure 7-1 below is an extract from the Mordialloc Bypass EES and documents the expected impact on the flow regime.

7.1.1.2 FLOW REGIME IMPACT

The increase in impervious pavement areas in the proposed project will increase the stormwater runoff in the downstream waterway system. This increase has the potential to impact on the downstream drainage system during major flooding events and also during regular wet weather events, i.e. the full flow regime of the downstream waterway system. Flow duration curves were generated using daily flow simulated by the MUSIC model to provide an understanding of the impact of the proposed road on the overall flow regime.

Figure 7.1 to Figure 7.4 show that there are insignificant changes in the flow duration curves for Mordialloc Creek (at Dunlops Road Drain) and Woodlands Industrial Estate Wetlands for both the 1952–1961 and 1975–2017 periods, indicating that the project will have no impact on the downstream flow regime. The figures demonstrate that climate change could cause a notable decline in water availability for 80% of the time; however, this is solely due to the change in climate and not related to changes to the catchments caused by the project.

The inflow from the sub-catchments affected by the project into the Waterways Wetlands increases from 16.3 ML/yr to 27.8 ML/year (only increase to 24.3 ML/year under the climate change scenario). While this flow increase seems significant, 16.3 ML/year represents less than 0.4% of the total flow entering the Waterways Wetlands. This means that the increase in flow from the affected sub-catchments only represents an increase in flow of less than 0.3% of the total inflow to the wetlands.

The project is therefore anticipated to have minimal impact on the waterways and wetlands system and hence the industry and agriculture water users, and aquatic plants and animals. No mitigation measures are considered necessary for the minimal flow increases caused by the project.

It should be noted that analysis in this section aims to assess impact on change in flow regime, which could results in change in riparian ecology and geomorphology of the waterways. However, the impact on small flow events such as 1.5 year ARI events are addressed as part of the drainage design that the post development peak flow from the outlets are not to be higher than existing conditions and, if necessary, flow retardation is to be provided.

Figure 7-1 Extract from Mordialloc Bypass EES regarding flow regime impact

There are comments within the Surface Water Technical Report such as, *"With appropriate mitigation, changes in the downstream flow regime would be insignificant with no significant impacts on the downstream waterway."*[12] I believe this statement is insufficient without documented evidence of the outcomes of a robust assessment.

[12] Page 177 of North East Link EES Surface Water Technical Report

8. INTEGRATED WATER MANAGEMENT

Integrated Water Management is documented as a key urban design outcome within the Urban Design Strategy (Attachment II). The principle of Objective 4.3 is to, "*Optimise environmental performance and embed sustainability initiatives into the design response. This includes integrated water management, biodiversity and habitat enhancement and connections, green infrastructure provision and sustainable use of energy and materials."*

There is little information presented within the Surface Water Technical Report with regards to consideration of implementation of Integrated Water Management Principles. Instead there is reliance upon referring to VicRoads Integrated Water Management Guidelines (June, 2013) which translates into one EPR (EPR SW11). However, EPR SW11 appears to only suggest that integrated water management principles are to be adopted in the design of stormwater treatment assets. As per Melbourne Water's website:

Integrated water management brings together all facets of the water cycle to maximise social, environmental and economic outcomes. By considering the whole water cycle when planning and delivering services, we can take advantage of links between different elements and develop solutions that have broader benefits over a long period of time. This wouldn't be possible if we managed each system in isolation.

These benefits often extend beyond the solution to the initial problem. They can include:

- *environment – leaving more water for healthy river flows and reducing stormwater pollution*
- *liveability – creating green open spaces, reducing the heat island effect and minimising flooding*
- *economic – supporting industry and agriculture*
- *affordability – reducing costs over the long run*
- *long-term resilience – diversifying our sources of water so we can withstand future shocks like droughts and floods*

Within the Urban Design Strategy some opportunities for incorporation of integrated water management appear to have been considered including stormwater harvesting treatment and reuse that support community facilities (such as providing a source of treated water for irrigation of sporting fields). As described in Section 5.3.6 there are inconsistencies in the WSUD assets opportunities proposed within the Urban Design Strategy and those documented in the Surface Water Technical Report. The Surface Water Technical Report should contain more detailed requirements on the reuse of stormwater.

In my opinion the Project should be treated as an Integrated Water Management precinct to assist in water sensitive city thinking and realise strategic precinct wide goals. This approach is supported by the Yarra Integrated Water Management Forum. The EES should include, at a minimum, a conceptual level strategy and identify the key parameters for such a strategy, including the land required for storage and treatment and the water quality parameters that will be met.

A key principle of an Integrated Water Management approach will be to avoid undergrounding and diverting existing waterways. The Reference Design presented in the EES outlines the proposal to underground sections of both Banyule Creek and Koonung Creek. Such works will result in the loss of important habitat and ecological impacts within the immediate area and adjacent areas. The undergrounding of waterways is contrary to Melbourne Water's current best practice and may irreparably damage the ecology of the creeks and their riparian environment. Given there are uncertainties in the flood modelling outcomes from the assessment of Koonung Creek I believe that the current flood modelling mean may not be representing the full extent of hydrological / hydraulic impacts of undergrounding sections Koonung Creek.

I also note that Option 2 proposed as part of the Bulleen Park Assessment (contained in the Soil Technical Report Appendices) includes covering a section of Koonung Creek to accommodate the relocation of the Boroondara Tennis Centre. In my opinion this should be avoided in preference to allowing for open flow of the creek. The Surface Water Technical Report does not include details of any assessment pertaining to the Bulleen Park options. As such I do not believe that the hydrological and corresponding ecological impacts have been assessed. The Social Technical Report Appendices also note that the tennis courts and buildings would be subject to flooding and would need to be built to be flood tolerant minimise maintenance and any impact on the floodplain. I would support alternative options which appear to maintain this open section of the creek and are able to achieve more appropriate siting of the tennis courts and buildings with respect to flooding.

The NEL Urban Design Strategy notes the following with respect to Key Direction 5 (Create a context sensitive design), "*The project must demonstrate a design that protects, maintains and enhances the local context through which the project passes"*. With respect to the Koonung Creek Valley the Urban Design Strategy outlines the following key design requirement for the area which is to, *"Celebrate, maximise and reinstate natural vegetation, wetlands and open waterways including Koonung Creek."* I do not believe the proposal in the EES to underground sections of Koonung Creek achieves this requirement. Alternatives to the undergrounding of Koonung Creek should be explored to maintain and where possible restore the creek consistent with Melbourne Water's approach to managing waterways.

I note that when the Minister for Planning approved the final EPR's for Melbourne Metro it included the following EPR (EPR SW2) with respect to Integrated Water Management (IWM), *"Prior to commencement of construction, submit to the relevant local council a stormwater drainage system incorporating integrated management design principles."* I recommend that this EPR should be incorporated into the EPR's for North East Link.

Another important Integrated Water Management consideration is the use of water for construction activities. As outlined in Section 6.3 to ensure that reliance on potable water is kept to a minimum I suggest inclusion of a new EPR titled "Use of non-potable water" with wording as follows, "Where available and practicable, of suitable quality, and meets health and safety requirements, stormwater, recycled water, groundwater inflow to tunnels or other water sources must be used in preference to potable water for construction activities, including concrete mixing and dust control."

9. DRAINAGE ASSET MANAGEMENT

I believe drainage asset management is a key aspect of surface water that needs to be given appropriate consideration as part of the EES. The impacts of the Project are likely to be increased in the absence of proactive drainage asset management and vice versa.

As described throughout the preceding Sections of this report I believe that there is benefit in providing a layout of the expected drainage outfall / discharge locations within the Surface Water Technical Report. This information was provided as part of the Mordialloc Bypass EES as shown in Figure 9-1 below. Figure 9-2 is a tabular summary of the outfalls and additional details from the Mordialloc Bypass EES.

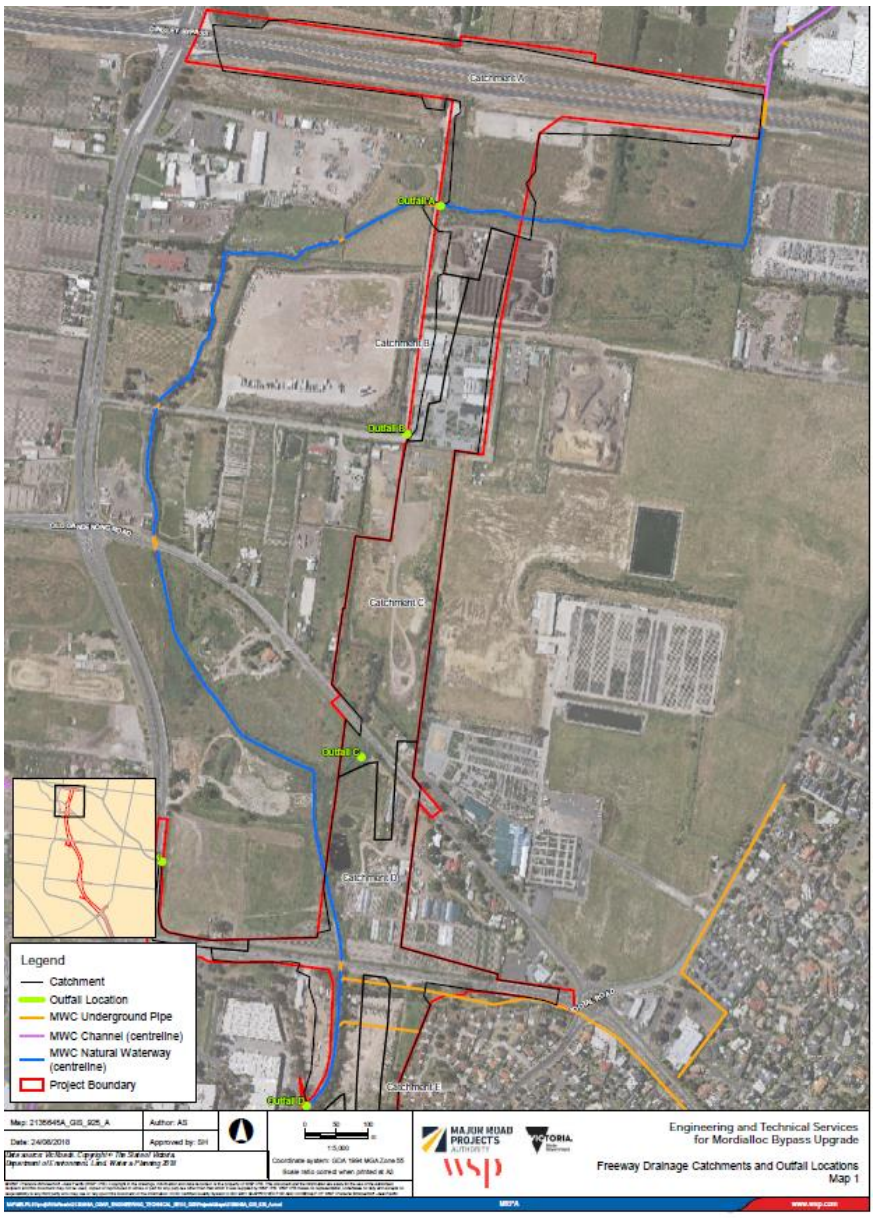

Figure 9-1 Layout plan of drainage catchment and outfall locations from Mordialloc Bypass EES

Table H.1 List of outfalls and their details

OUTFALL NAME	OUTFALL LOCATION	DESCRIPTION	SUMMARY
A	Ch23030	Outfall A is Old Dandenong Road Drain which drains to the west. The existing channel crosses the freeway via a new culvert. The road surface catchment begins with the Dingley bypass within the project boundary to the north and ends at the high point at CH23130 to the south.	Outfall asset owned by Melbourne Water Total ROW catchment area = 11.42 ha New impervious area = 1.69 ha Discharge to a major drainage system, impact due to increased runoff assessed using the flood models.
B	Ch23400	Outfall B is a 675 mm dia council pipe flowing to the west along Junction Road. The Outfall B catchment covers the northbound carriageway and road reserve of the freeway from Ch 23130 to Ch 23350. The road catchment discharges to roadside swales which connect to a grated pit connected to the existing 675 mm pipe. A detention basin has been incorporated into the design to maintain existing flow rates at the outfall.	Outfall asset owned by the City of Kingston Total ROW catchment area = 0.74 ha New impervious area = 0.11 ha Detention system to be incorporated into the drainage design. Basin volume approximately 21 m^3.
C	Ch23900 – Old Dandenong Road	Outfall C is an existing grassed channel which connects to the Old Dandenong Road Drain just west of the project boundary. The catchment area includes the southbound carriage way and road reserve from Ch23030 to Ch23900 and the northbound carriageway and road reserve from Ch23400 to Ch23900. It also includes the full carriageway from Ch23900 to the highpoint at Ch24020.	Outfall asset owned by City of Kingston (Melbourne Water asset immediately downstream) Total ROW catchment area = 8.63 ha New impervious area = 0.83 ha Discharge to a major drainage system, impact due to increased runoff assessed using the flood models.
D	Ch24400-Centre Dandenong Road	Outfall D is the Old Dandenong Road Drain at Ch24400. The drain, which flows to the south, now crosses under Centre Dandenong Road via a culvert. The catchment includes the road reserves on the east and west sides of the freeway from Ch23900 to Centre Dandenong Road and the carriageway from the highpoint at Ch24020 to the southern side of Centre Dandenong Road. It also includes all of Centre Dandenong Road to the east of the freeway, 150m of the road to the west, and both freeway ramps.	Outfall asset owned by Melbourne Water Total ROW catchment area = 7.53 ha New impervious area = 1.78 ha Discharge to a major drainage system, impact due to increased runoff assessed using the flood models.

Figure 9-2 List of outfalls and their details from Mordialloc Bypass

Despite repeated requests by Councils to obtain information relating to the expected drainage discharge locations and any subsequent impacts to Councils' existing drainage network the response from NELP to date has been, *"While a conceptual design solution has been considered as part of developing the reference project it is possible that changes in grade line for instance will change the location and or size of drainage outlets and their compensating storages. If Council choose to base future decisions on the current concept, they should be aware that details may and almost certainly will change."*[13]

[13] Refer to Appendix E for TRG comment and NELP response

With access to information relating to the reference design proposal Councils can begin to understand the extent of impacts on existing drainage assets and plan accordingly. For instance, Councils will be well placed to consider any complementary works that address existing drainage asset management concerns (e.g. age / condition of infrastructure) and existing flooding concerns.

The failure to identify asset maintenance or ownership means that it is currently impossible for the Councils to assess what their responsibilities in relation to these assets will be.

To improve drainage asset management, I suggest several changes to the Project EPR's to include:

- A need to inspect and confirm existing conditions for all existing drainage and water treatment assets prior to the commencement of any construction works (a summary report is to be provided to the relevant drainage authority prior to the commencement of works)
- Development of an Asset Management Plan to cover all proposed ongoing maintenance and renewal activities. The capital replacement cost and ongoing maintenance costs all new assets must be considered.
- A formal agreement between the relevant authorities be made prior to construction including, but not limited to, asset ownership and maintenance responsibilities.
- All drainage and water quality assets are to be inspected with the relevant drainage authority at completion of construction and prior to handover. Inspection reports / testing to be completed to demonstrate that these assets are in a fully functional state and not subject to any defects.

10. ASSESSMENT OF OTHER NORTH EAST LINK EES DOCUMENTS / REPORTS

10.1 Ecology

Surface water impacts have the potential to result in ecological impacts. Hence, I reviewed the Ecology Technical Report to assess the risk assessment and outcomes with respect to surface water. One of those impacts that is not assessed within the Surface Water Report is an increase in flow volume which will increase due to an increase in impervious areas proposed by the Project. As per SEPP, *"Urban stormwater runoff volume, flow and frequency can also have significant impacts on receiving waters by degrading the ecological integrity of streams."* The Ecology Technical Report suggests that, "*Surface water EPRs would serve to manage water volumes and quality."*[14] Whilst EPR SW1 suggests that increases in stormwater volume will be managed as in accordance with SEPP requirements, in my experience it is extremely rare to have measures enforced upon major projects or upon developments to ensure that volumes of runoff are not increased upon existing levels. Even if best practice measures (flooding and water quality) are used to treat runoff and reduce peak flows there will be an increase in total volume of runoff and resultant changes in the flow regime.

The Ecology Technical Reports notes that, *"Given the portion of Banyule Creek supporting native vegetation within the project boundary (north of Lower Plenty Road and for a short distance immediately south of Lower Plenty Road) is proposed to be fully removed during construction, it is not considered further in this section, as any effects of groundwater drawdown do not require assessment given these trees are deemed to be removed as part of the project (Figure 18)."*[15] I am unclear why there is a need to fully remove native vegetation south of Lower Plenty Road. I did not identify any proposed works at this location as part of my review.

10.2 Groundwater

The EES scoping requirements includes the following evaluation objective relevant to the groundwater assessment:

- *Catchment values – To avoid or minimise adverse effects on the interconnected surface water, groundwater and floodplain environments.*

Page 96 of the Groundwater Technical Report notes that, *"In general, there is a limited understanding of connectivity between surface and groundwater throughout the study area."* I believe that this is unacceptable given that this lack of knowledge does not enable an informed decision with respect to what the impacts of the Project will be with respect to surface water.

[14] Page 217 of North East Link EES Ecology Technical Report
[15] Page 201 of North East Link EES Ecology Technical Report

The quality of surface water has the potential to impact groundwater quality. There is an inherent reliance upon EPR SW11 to ensure that the adoption of WSUD mitigates the impacts of surface water quality upon groundwater quality. Currently the proposed water quality treatment measures allow stormwater pollutants to be increased above existing levels. Given the potential for groundwater impacts I believe that this further justifies the use of alternatives to BPEMG stormwater pollutant treatment targets.

There are known areas where surface water levels are maintained by groundwater interaction, for example Bolin Bolin Billabong. As such predicted drawdown impacts as a result of the Project have the potential to impact the hydrological regime of these surface water features.

Page 5 of the Groundwater Technical Report notes that, *"Changes in groundwater level affect flow regimes and without adequate controls, impacts may result. Drawdown of water levels has the potential to influence the stability of potential acid sulfate soils, effective stress changes and subsidence, water availability to ecosystems, and also the movement of contaminated groundwater plumes."* I do not believe that the information presented with the Groundwater Technical Report is sufficient to understand the resultant impacts of those changes upon surface water features. There is reliance upon EPR GW2 to monitor changes in groundwater levels and quality and to, *"… identify and implement any additional measures required to mitigate impacts from changes in groundwater levels, flow and quality."* Given the extent of impacts is unknown there is subsequent uncertainty in what measures will be required to mitigate those impacts and whether they will be successful in achieving the desired result. The extent of environmental effects is subsequently unknown and I do not believe this is acceptable when considering the appropriateness of the EES.

10.3 Ground Movement

Ground movement as a result of the Project has the potential to damage existing drainage assets and create adverse impacts with respect to surface water. From my review of the Ground Movement Technical Report I do not believe the full extent of existing stormwater drainage assets were considered in the assessment of impacts. The report suggests that, *"Sensitive receptors that may be adversely affected by ground movement are limited to existing road infrastructure or locations where the alignment intersects features such as utilities or waterways."*[16] Existing drainage assets that intersect the Project alignment includes the Yando Street Main Drain, Kempston Street Main Drain and numerous smaller Council owned assets, particularly within the Koonung Creek catchment.

With respect to the Maroondah Aquaduct which traverses the Project alignment at the M80 Ring Road the Technical Report documents the following, *"Preliminary calculations indicate the maximum ground displacement from the road widening would be approximately 16 millimetres, with an associated ground slope of 1:824. According to Rankin (1988) this places the aqueduct into the 'Slight' risk category thus a second stage*

[16] Page 35 of North East Link EES Ground Movement Technical Report

assessment was conducted as discussed in Section 8.3.1."[17] In light of this finding and given the close proximity of drainage assets including the Yando Street Main Drain I would expect to see some details of the potential impact placed upon this asset by the Project.

In my opinion the Ground Movement Technical Report would benefit from inclusion of discussion of the impact of the Project upon existing drainage assets regardless of whether the impact is insignificant. This would provide greater certainty that surface water impacts that could arise from the Project have been appropriately considered.

10.4 Contamination

I understand that some concerns have been raised regarding the level of testing relating to the former closed landfills within the Project area. With respect to surface water the reference design presented in the EES is proposed to impact former closed landfills at the following locations:

- AK Lines Reserve
- Borlase Reserve
- Koonung Creek Linear Reserve

Without appropriate consideration for the current status of the former closed landfills with respect to contamination I am concerned that there could be adverse impacts to surface water as a result of the Project.

[17] Page 51 of North East Link EES Ground Movement Technical Report

11. ENVIRONMENTAL PERFORMANCE REQUIREMENTS (EPRS)

11.1 Review of Proposed EPRs

I have reviewed the proposed EPRs documented in the Surface Water Technical Report. I note that the Project risk assessment, including surface water risks, assumes that the Project EPRs will be complied with. I also note that the EPRs are a mix of quantitative (e.g. EPR SW7 where standards must be met) and qualitative (e.g. EPR SW8 'to the extent practicable'). Where qualitative EPRs are proposed further details are required to demonstrate how they will be effectively implemented in particular with regards to how they will measured / enforced and what mitigation is proposed when a qualitative 'standard' cannot be met. I have provided comments and suggestions for amendment, where warranted, against each of the proposed EPRs in Table 11-1 below.

Table 11-1 Review summary of EPRs

EPR Code	Environmental performance requirements	Comment
EPR SW1	**Discharges and runoff to meet State Environment Protection Policy (Waters)** Meet the State Environment Protection Policy (Waters)) requirements for discharge and run-off from the project, including by complying with the Victorian Stormwater Committee's Best Practice Environmental Management Guidelines for Urban Stormwater (as published by CSIRO in 1999 with assistance from EPA Victoria and others).	This EPR should apply to both operation and construction
EPR SW2	**Design to include spill containment** Design and construct the spill containment capacity of the stormwater drainage system for all freeway pavements (including ramps) to manage the risk of hazardous spills from traffic accidents at or prior to every stormwater outlet, to meet AustRoads requirements. The design and location of spill containment must consider the risk and potential impact of a spill, as well as the effectiveness in reducing the risks associated with a spill on the environment. Develop procedures for freeway roads and ramps to be implemented in response to a hazardous spill.	OK
EPR SW3	**Wastewater discharges to be minimised and approved** The Surface Water Management Plan (refer EPR SW5) and OEMP must include requirements and methods for minimising, handling, classifying, treating, disposing and otherwise managing waste water. Any proposed discharge of waste water from the site must be approved by the relevant authority prior to discharges occurring and meet the State Environment Protection Policy (Waters) requirements.	OK

EPR Code	Environmental performance requirements	Comment
EPR SW4	**Monitor water quality** Develop and implement a surface water monitoring program prior to commencement of and during construction to assess surface water quality a suitable distance upstream and downstream of works to establish baseline conditions and enable assessment of construction impacts on receiving waters. This monitoring program must be developed in consultation with EPA Victoria and the asset owner/manager and as appropriate with reference to EPA Victoria Publication 596 Point source discharges to streams: protocol for in-stream monitoring and assessment and Industrial Waste Resource Guideline 701 Sampling and analysis of waters, wastewaters, soils and wastes. The surface water monitoring program is to be used to inform the development and refinement of the Surface Water Management Plan (EPR SW5).	There is a need to outline the length of monitoring to be undertaken once operation of the Project begins. EPR W5 from Mordialloc Bypass suggests 5 years of monitoring. I suggest that this length of monitoring be adopted for North East Link. Given the lack of available baseline conditions there is a need to agree upon baseline conditions with the relevant drainage authority with consideration of how baseline modelling compares to the outdated results presented in the EES. This is important given that only short window of testing will be undertaken prior to construction and there is potential for those results to be misleading due to seasonal variations.
EPR SW5	**Implement a Surface Water Management plan during construction** Develop and implement a Surface Water Management Plan for construction that sets out requirements and methods for: • Best practice sediment and erosion control and monitoring, in general accordance with EPA Victoria publications 275 Construction techniques for sediment pollution control, 347.1 Bunding Guidelines, 480 Best Practice Environmental Management Environmental Guidelines for Major Construction Sites, 960 Temporary Environmental Protection Measures for Subdivision Construction Sites, and Industrial Waste Resource Guideline 701 Sampling and analysis of waters, wastewaters, soils and wastes • Maintaining the key hydrologic and hydraulic functionality and reliability of existing flow paths, drainage lines and floodplain storage • Retain existing flow characteristics to maintain waterway stability downstream of construction • Location and bunding of any contaminated material (including tunnel spoil and stockpiled soil) to the 1% AEP flood level and to the requirements of EPA Victoria and the relevant drainage authority • Works scheduling to reduce flood related risks. • Bunding of significant excavations including tunnel portals and interchanges to an appropriate level during the construction phase. • Protecting against the risk of contaminated discharge to waterways when working in close proximity to potential pollutant sources (eg landfill or sewer infrastructure) • Documenting the existing condition of all drainage assets potentially affected by the works (including their immediate surrounds) to enable baseline conditions to be established and potential construction impacts on these assets to be assessed and managed.	The plan must be prepared in consultation with relevant drainage authority/s before the commencement of works. The extent of survey required must be agreed upon in consultation with relevant drainage authority

EPR Code	Environmental performance requirements	Comment
EPR SW6	**Minimise risk from changes to flood levels, flows and velocities** Permanent works and associated temporary construction works must not increase overall flood risk or modify the flow regime of waterways without the acceptance of the relevant drainage authority or asset owner (typically Melbourne Water) and in consultation with other relevant authorities (eg Council, VicRoads, Parks Victoria, SES, emergency services). To assess overall flood risk, undertake modelling of the design of permanent and temporary works to demonstrate the resultant flood levels and risk profile. This modelling analysis is to include sufficient events (at least up to and including the 1% AEP event) and scenarios (eg with and without blockage) to support the estimation of tangible (eg average annual damages) and intangible flood damages. If significant increases in flood risk are predicted for any events analysed, an assessment of overall flood risk considering tangible and intangible flood damages must be prepared and presented with appropriate mitigation measures for the acceptance of the relevant drainage authority or asset owner.	The wording of this EPR needs to include flood levels, flows, velocities and hazard and not just 'overall flood risk.' The wording must also include the upper portion of catchment not draining directly to waterway (entire catchment and not just waterways). EPR GW2 (Groundwater) requires the effectiveness of applied measures as identified in the Groundwater Management Plan to be confirmed and if required, identify and implement contingency measures to restore groundwater to an acceptable level. I believe the same level of assessment should be afforded to surface water impacts that may arise from the Project. There is no mention of minimising impacts on current or future performance of Council drainage systems. This must be considered. Add the words "where possible and practicable improve existing conditions flooding" Given that some of the mitigation measures will involve alterations to existing retarding basins and construction of new flood walls this EPR should reference the Australian National Committee on Large Dams (ANCOLD) guidelines as a relevant set of guidelines that the Project must consider and address as required.
EPR SW7	**Develop flood emergency management plans** Develop and implement flood emergency management plans for each of construction and operation. Flood emergency management plans are to include but not be limited to measures to manage flood risk to construction sites (including consideration of scheduling works), the tunnels and tunnel portals including interchanges and substations, and operation, maintenance and emergency management procedures for flood protection works.	OK

EPR Code	Environmental performance requirements	Comment
EPR SW8	**Minimise impacts from waterway modifications** Where waterway or flow regime modification is necessary, modifications will be designed and undertaken in a way that mitigates to the extent practicable the effects of changes to flow and minimises, to the extent practicable, the potential for erosion, sediment plumes, impacts on bed or bank stability and exposure or mobilisation of contaminated material during construction and operation to the requirements of Melbourne Water or the relevant drainage authority. Waterway modifications are to be designed and undertaken in a way that maximises the visual and aesthetic amenity and environmental conditions (including habitat, connectivity, refuge and hydraulic conditions) to support aquatic ecosystems of the waterways having regard to relevant strategies, policies and plans for that waterway and in consultation with Melbourne Water or the relevant drainage authority.	This is a qualitative EPR, it needs to document how performance will be measured / enforced.
EPR SW9	**Maintain bank stability** Develop and implement appropriate measures to minimise erosion and protect bank stability of waterways affected by construction or operation activities both directly or indirectly (for example as a result of site access), to the requirements of Melbourne Water or the relevant drainage authority.	As I have documented in Section 7.2.2 highly sensitive waterways need a more comprehensive approach to managing impacts from the Project. I believe there would be a benefit in documenting a hierarchy of mitigation measures that needs to be considered when addressing any impacts. The hierarchy could include, for example: Highest Priority – Address impacts as part of the drainage design (e.g. via use of drop pits to reduce velocities and the resultant need for rock armouring at the pipe outlet). Lowest Priority – Works within waterways. Any works within waterways should also consider complementary works to improve waterway habitat and where practicable remediate areas of existing bank erosion.
EPR SW10	**Provide access to Melbourne Water and other drainage assets** Provide adequate clearances and access for ongoing maintenance of Melbourne Water and other drainage authority assets to the requirements of the relevant drainage authority.	OK

EPR Code	Environmental performance requirements	Comment
EPR SW11	**Adopt Water Sensitive Urban and Road Design** Adopt and implement water sensitive urban design and integrated water management principles in the stormwater treatment design, in general accordance with the Urban Design Strategy, the specifications of the relevant local council as applicable, and VicRoads Integrated Water Management Guidelines (June 2013), the Victorian Stormwater Committee's Victoria Best Practice Environmental Management Guidelines for Urban Stormwater (as published by CSIRO in 1999 with assistance from EPA Victoria and others) and the DELWP Integrated Water Management Framework for Victoria (September 2017).	IWM principles must be applied to other aspects of the project other than just stormwater treatment design which the current wording suggests it is limited to. This EPR should document the need to work with relevant drainage authority/s as part of the design process to ensure best possible outcome. Targets other than BPEMG must be considered to ensure that the Project protects and enhances the natural environment. Ownership and maintenance agreements to be agreed upon prior to construction. An Asset Management Plan must be developed to cover all proposed ongoing maintenance and renewal activities. The capital replacement cost and ongoing maintenance costs all new assets must be considered.
EPR SW12	**Minimise impacts on irrigation of sporting fields** Maintain existing storage and available water supply for the irrigation of sporting fields impacted by the project as necessary in consultation with the impacted stakeholders.	Irrigation of open space needs to be considered not just sporting fields.
EPR SW13	**Consider climate change effects** The flood risk assessment (as required by EPR SW6) must consider current climate conditions as well as the potential effects of climate change on pre and post work scenarios for future climate conditions (ie increased rainfall intensity and sea-level rise) as predicted at the end of the asset's design life using RCP8.5 projections from CSIRO to the requirements of Melbourne Water or the relevant drainage authority.	OK. There is further advice and guidance regarding climate change documented in ARR2019
EPR SW14	**Meet existing water quality treatment performance** Retain or replace existing water quality treatment assets to meet or exceed existing water quality treatment performance. Consider climate change effects where practicable.	The performance of existing assets needs to be agreed upon with relevant drainage authority. As part of this process it is expected that an inspection is undertaken and a summary report provided to the relevant drainage authority and Council prior to the commencement of works.

EPR Code	Environmental performance requirements	Comment
EPR B3[1]	**Minimise and remedy damage or impacts on third party property and infrastructure** Through detailed design and construction, and in consultation with relevant land owners and parties as necessary, design and construct the works to minimise, to the extent practicable, impacts to, and interference with, third party property and infrastructure and to ensure that infrastructure and property is protected during construction and operation. Any damage caused to property or infrastructure as a result of North East Link must be appropriately remedied in consultation with the property or asset owner.	OK
EPR CL5	**Manage chemicals, fuels and hazardous materials** The CEMP and OEMP must include requirements for management of chemicals, fuels and hazardous materials including: • Minimise chemical and fuel storage on site and store hazardous materials and dangerous goods in accordance with the relevant guidelines and requirements. • Comply with the Victorian WorkCover Authority and Australian Standard AS1940 Storage Handling of Flammable and Combustible Liquids and EPA Victoria publications 480 Environmental Guidelines for Major Construction Sites and 347 Bunding Guidelines • Develop and implement management measures for hazardous materials and dangerous substances, including: – Creating and maintaining a dangerous goods register – Disposing of any hazardous materials, including asbestos, in accordance with Industrial Waste Management Policies, regulations and relevant guidelines – Implementing requirements for the installation of bunds and precautions to reduce the risk of spills. • Contingency and emergency response procedures to handle fuel and chemical spills, including availability of on-site hydrocarbon spill kits.	OK

11.2 Additional EPR Considerations

In addition to my review of the proposed EPRs I also suggest that consideration be given to the inclusion of additional EPRs that address the following:

- Include an EPR similar to EPR AE3 approved for Melbourne Metro which documented the following:

  During construction, discharge tunnel, station box and portal construction water to sewer. Where groundwater interception during construction is predicted to occur, dewatering is to be managed so that groundwater is not released to stormwater or sensitive surface water bodies."

  This will ultimately be dependent upon the quality of intercepted groundwater.

- As part of the agreement of the EPRs for Melbourne Metro I note that the IAC recommended the following be included in the wording of EPR SW2 Melbourne Metro which was approved by the Minster for Planning, *"Prior to commencement of*

construction, submit to the relevant local council a stormwater drainage system incorporating integrated management design principles." I suggest that this EPR be included as part of the North East Link EPRs.

- A new EPR to encourage the use of non-potable water for construction activities. The wording is to include, "Where available and practicable, of suitable quality, and meets health and safety requirements, stormwater, recycled water, groundwater inflow to tunnels or other water sources must be used in preference to potable water for construction activities, including concrete mixing and dust control."

12. CONCLUSIONS / SUMMARY OF OPINION

12.1 Adequacy of EES Documents

a) Does the EES adequately document and assess the nature and extent of the environmental effects of the Project? In addressing this question please explain where you are satisfied with the content of the EES and why, and if not, what if any deficiencies exist in the documentation and/or assessment of the nature and extent of environmental impacts contained in the EES.

In my opinion there are some particular aspects of the assessment undertaken to inform the EES that I am satisfied with and I have stated those views in this report. I am, however, firmly of the opinion that the inadequacies I have identified do not allow the nature and extent of the environmental effects associated with the Project to be fully identified and assessed. The inadequacies are best summarised with consideration of the findings of my review of the flooding and water quality assessment undertaken as part of the EES.

Flooding Assessment

- There are inconsistencies in the modelling approach undertaken for the different catchment areas. There are flood prone areas within the Project area that have not been identified by the modelling undertaken. The result of this is that the impacts of the Project with respect to flooding are not considered equally and, in some instances, have not been assessed at all. As such the full extent of environmental effects has not been identified.

- Lack of sensitivity analysis with respect to adopted downstream boundary condition used in the Koonung Creek catchment modelling. It is possible that the downstream boundary condition used in the NELP assessment does not appropriately identify the impacts of the Project.

- Lack of sensitivity analysis with respect to Yarra River catchment flows for assessment of the impacts of the Project. An assessment of various Yarra River flood flow estimates was undertaken for existing conditions and highlighted there is uncertainty with respect to the resultant 1% AEP flood levels. The assessment of the Project should consider this uncertainty and assess the impacts for a range of Yarra River flood flow estimates. It is possible that the impacts of the Project are greater under different Yarra River flood flow estimates for the 1% AEP event.

- Due to the modelling inconsistencies the extent of mitigation measures to address the impacts of the Project have not been quantified. There are also locations where there are predicted decreases in flood levels that are hard to explain given the information provided.

- Mitigation measures have been considered and assessed for selected locations but not all. There are some locations with predicted significant impacts that have not been addressed as a part of the assessment of mitigation measures.

- An assessment of very rare flood events has not been undertaken for the Koonung Creek or Yarra River catchments to assess the impacts of the Project. This is particularly important for both areas given the Eastern Freeway and associated noise walls act as a bank that causes ponding upstream to significant depth This assessment would assist to determine the extent of any unexpected impacts that could require further mitigation measures.

It is concerning, in light of the flood modelling deficiencies, that there is currently no control measure proposed (e.g. EPR) to ensure that if the Project was to result in adverse impacts with respect to flooding that there would be an appropriate response to identify the measures address those impacts. A control measure that addresses unexpected impacts to groundwater has been considered and proposed in the North East Link EES. With respect to flooding impacts, control measures have been afforded for other projects such as the WestConnexM4-M5 project and is documented in that project's EIS.

Water Quality Assessment

- The Surface Water Technical Report is limited with respect to details of the assessment undertaken to understand the impacts of the Project and to assess the mitigation measures proposed to address impacts to water quality.
- The assessment has not considered the fact that the pollutant generation rates from a project of this scale will be in excess of those rates from highways with lesser traffic volumes.
- The locations of some water quality treatment assets appear to have inherent constraints which could require alternative land take that has not been accounted for. I would expect further rigour as part of the assessment to confirm that the assets can be constructed appropriately to meet design intent and allow for necessary maintenance activities.
- The water quality mitigation assessment has not considered the impacts of climate change.

12.2 Environmental Performance of Project

b) Can the Project as described in the EES achieve a level of environmental performance which is consistent with relevant legislation, documented and endorsed policy or acknowledged best practice.

In my opinion the Project cannot achieve a level of environmental performance which is consistent with relevant legislation, documented and endorsed policy or acknowledged best practice. I have reached my opinion based upon the following outcomes of my review of surface water matters:

- Due to the inadequacies of the flood modelling assessment the full extent of flooding impacts has not been identified nor have mitigation measures been considered to address the impacts caused by the Project.

- Without a measure to enforce the maintenance of water quality treatment assets I do not believe the assets will be maintained in accordance with acknowledged best practice and in a short period of time post construction many of the assets will not deliver a benefit in accordance with their design intent. My opinion is based upon my experience having reviewed and inspected water quality treatment assets constructed as part of other large infrastructure projects.
- The water quality treatment mitigation measures proposed and assessed as part of the EES do not meet water quality treatment targets at a municipal scale or at a catchment scale.
- The Project will result in unacceptable environmental impacts at several locations in particular where a lack of consideration for mitigation measures has been afforded. These locations include:
  - Banyule Creek
  - Plenty River
  - Upper 2.5 km of Koonung Creek adjacent to the Project area
- The Reference Design proposes to underground and divert sections of both Banyule Creek and Koonung Creek. Such works will result in the loss of important habitat and ecological impacts within the immediate area and adjacent areas. The undergrounding of waterways is contrary to Melbourne Water's current best practice which is to daylight waterways that were undergrounded many years ago to address flooding.
- The EES lacks consideration of the development of an Integrated Water Management Strategy. Current best practice is to develop IWM strategies which adopt IWM principles and objectives that ensure that proposed works improve existing conditions. This is supported by the development of the Integrated Water Management Framework for Victoria. This Framework includes IWM Forums to identify, coordinate and prioritise IWM opportunities.

12.3 Recommended Measures for Mitigation of Adverse Environmental Effects

c) *If the Project, as described in the EES cannot achieve a level of environmental performance which is consistent with relevant legislation, documented and endorsed policy or acknowledged best practice, are there any recommendations that you would make as to specific measures which you consider necessary and/or appropriate to prevent, mitigate and/or offset adverse environmental effects? If so, please explain your reasoning in detail. To the extent that it is within your expertise to comment upon the feasibility of any of your recommendations, please state whether or not any recommendations are feasible, explaining your reasoning.*

I believe that further flood modelling and water quality modelling is required to address the inadequacies that I have identified. There is a need to identify the extent of mitigation measures to address the impacts of the Project and to enable the resultant environmental

effects to be fully understood. Currently the resultant environmental performance and effects are not well understood due to the inherent inadequacies of the assessments undertaken to inform the EES.

I have proposed several changes to the proposed EPRs which I consider necessary to prevent, mitigate and / or offset adverse environmental impacts. I expect that my recommendations are feasible especially considering that some suggestions are based upon accepted EPRs from other EES / EIS documents. This includes a requirement for a review of the effectiveness of mitigation measures to be undertaken post construction after a period of time in which the effectiveness of those measures is understood during operation of the Project.

I consider the development and implementation of an Integrated Water Management Strategy to be of upmost importance. The NEL Urban Design Strategy notes the following with respect to Key Direction 5 (Create a context sensitive design), "*The project must demonstrate a design that protects, maintains and enhances the local context through which the project passes"*. With respect to the Koonung Creek Valley the Urban Design Strategy outlines the following key design requirement for the area which is to, *"Celebrate, maximise and reinstate natural vegetation, wetlands and open waterways including Koonung Creek."* I do not believe the proposal in the EES to underground sections of Koonung Creek achieves this requirement. Alternatives to the undergrounding of Koonung Creek should be explored to maintain and where possible restore the creek consistent with Melbourne Water's approach to managing waterways. This also applies to the proposed undergrounding of Banyule Creek.

Given that there are adverse environmental impacts associated with the Reference Design there must also be consideration afforded to alternative Project works to reduce or eliminate those effects. This could include alterations to the alignment, extent and nature of the proposed works.

12.4 Ecologically Sustainable Development

d) How does the Project as described in the EES respond to the principles and objectives of "ecologically sustainable development" as defined in the IAC's Terms of Reference.

In my opinion a genuine commitment to ESD requires that mechanisms are available for achieving environmental outcomes. I do not believe the proposed mechanisms (e.g. proposed mitigation measures or EPRs) are appropriate to ensure that the principles and objectives of ESD are achieved.

The Reference Design, and its impacts, are contrary to the overall objectives for the Project. Development in environmentally sensitive areas must be avoided and this includes the avoidance of undergrounding and diversion existing waterways.

The mitigation measures proposed as part of the Reference Design are unable to appropriately mitigate the environmental effects in order to maintain existing conditions let alone improve and enhance current conditions and safeguard the environmental welfare for future generations.

12.5 Recommendations to Improve Response to Principles and Objectives of Ecologically Sustainable Development

e) *Are there any recommendations that you would make as to specific measures which you consider necessary and/or appropriate to improve the response of the Project to the principles and objectives of "ecologically sustainable development"? If so, please explain your reasoning in detail. To the extent that it is within your expertise to comment upon the feasibility of any of your recommendations, please state whether or not any recommendations are feasible, explaining your reasoning.*

I would recommend that an Integrated Water Management Strategy be developed for the Project. Current best practice is to develop IWM strategies which adopt IWM principles and objectives that ensure that proposed works improve existing conditions. This is supported by the development of the Integrated Water Management Framework for Victoria. This Framework includes IWM Forums to identify, coordinate and prioritise IWM opportunities.

I also recommend that the assessment of water quality treatment mitigation measures must consider the impacts of climate change. Allowance for climate change consideration is required to protect the environment from future impacts in the face of a changing climate.

There is no evidence that the Reference Design has considered the learnings from other similar large infrastructure projects. In my experience there are learnings that should be adopted for NEL including, but not limited to:

- Consideration of EPRs that have been adopted for other similar projects (e.g. Melbourne Metro, Mordialloc Bypass and WestConnex M4-M5). This would include an EPR to ensure that if the Project was to result in adverse impacts with respect to flooding that there would be an appropriate response to identify the measures to be implemented to address those impacts. A control measure that addresses unexpected impacts to groundwater has been considered and proposed in the North East Link EES (EPR GW2).

- Consideration of mechanisms to enforce maintenance of water quality treatment assets to ensure that the performance in the future is equal to the design intent.

- Making appropriate allowance for the greater pollutant generations from a project of this scale in the assessment and subsequent design of water quality mitigation measures. My research has identified that the Event Mean Concentration (EMC) of pollutants can be up to four times as high on highways, such as North East Link, with traffic volume greater than 30,000 vehicles per day compared to those highways with lesser traffic volumes.

- Alternatives to BPEMG stormwater pollutant removal targets need to be considered. This is because the BPEMG targets are indicative only and essentially allow the Project to pollute waterways to levels in excess of existing conditions. This contradicts several objectives of the Project including the protection and enhancement of the natural environment.

12.6 Recommendations for Draft Planning Scheme, Works Approval and/or Draft EPRs

f) To the extent that the content of the draft planning scheme amendment, works approval and environmental protection requirements lies within your expertise, do you have any recommendations for changes that should be made to the draft planning scheme amendment, works approval or planning approval and/or draft environmental performance requirements in order to improve the environmental outcome of the Project?

From my review of the planning scheme amendment documentation the proposed amendment does not appear to impact the existing extent nor provisions of flood overlays within the Project area. I believe this is an appropriate response given that it will be necessary for the relevant drainage authority/s to continue to influence development decisions within areas designated by flood overlays within the Project area.

With respect to the Works Approval documentation I believe that the documentation is suggesting that the Project does not trigger the LSIO as roadworks are exempt. I do not support this opinion as the works will include the construction of a ventilation structure which is not included within the definition of 'roadworks'. The structure will be located within the Yarra River LSIO and should not be exempt from further consideration and approvals.

I have proposed various changes to the draft EPRs (refer to Section 11). The EPRs proposed in the Surface Water Technical Report are a mix of quantitative and qualitative requirements. Where qualitative EPRs are proposed further details are required with respect to how they will be effectively implemented in particular with regards to how they will measured / enforced and what mitigation is proposed when a qualitative 'standard' cannot be met.

13. STATEMENT

I have made all the inquiries 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.

Scott Dunn

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APPENDIX A

Scott Dunn CV

Scott Dunn

Principal Water Resources Engineer
Director

BEng (Civil) (Hons)

SUMMARY

Scott is a Director and the sector leader for the Victorian office in Flooding and Drainage. He is a principal water resources and environmental engineer with over fourteen years' experience in the stormwater industry. Scott's experience and skills cover every aspect of projects including: initiation, planning, execution, delivery and implementation. In his role as sector leader, Scott is responsible for managing resourcing and budgeting within the office whilst providing a technical and peer review role across a variety of projects. Scott also has a large role in managing business development and client relationships for the office. Outside of the office he has had an active role with Stormwater Victoria, including a period of time as a Committee Member.

Scott holds a Bachelor in Engineering (Civil and Environmental) with Honours, and a Bachelor of Economics from the University of Adelaide. Scott has extensive experience in hydrologic and hydraulic modelling including TUFLOW, HEC-RAS, DRAINS, MUSIC, XP-RAFTS, RORB, and MIKE FLOOD software. Scott also has vast experience in the use of MapInfo (GIS) software and has developed many tools aimed at improving the speed and accuracy of manual tasks within MapInfo. Scott also strong skills in Water Sensitive Urban Design (WSUD) having project managed several stormwater harvesting design projects and presented findings from WSUD projects at Stormwater Victoria conferences.

KEY AREAS OF EXPERTISE

- Major Infrastructure Projects Technical Review (Surface Water)
- Floodplain modelling and management
- Mitigation works assessment
- Stormwater drainage design
- Water Sensitive Urban Design
- Expert advice
- Development assessment and planning.

EXPERIENCE

2010 - present Principal Water Resources Engineer, Engeny, Melbourne

North East Link Project Expert Drainage Review, Banyule City Council: Project Manager. Scott has worked closely with Banyule City Council to undertake technical reviews of all surface water related matters relating to this major infrastructure project with an estimated cost of $16 billion. Scott's involvement included attendance at Technical Reference Group (TRG) meetings, reviewing flood modelling outputs developed by the project alliance (NELA) as part of the Environment Effects Statement (EES), identifying opportunities for the project to resolve existing flooding concerns within the project corridor, and preparing comments on Council's behalf upon review of all EES draft documents pertaining to surface water matters.

North East Link EPBC Referral Hydrology Review, Boroondara City Council: Project Director. Engeny was commissioned by Boroondara City Council to prepare a report highlighting potential hydrologic issues associated with the proposed North East Link works within the City of Boroondara and surrounding areas. Scott assisted in preparing this report for Council.

Heidelberg to Rosanna Rail Duplication and Lower Plenty Road Level Crossing Removal Expert Drainage Review, Banyule City Council: Project Manager. Scott was entrusted by Banyule City Council to undertake technical reviews of all surface water related matters relating to this project. This included reviewing flood models and outputs developed by the project alliance (NEPA), reviewing all drainage and WSUD asset design drawings, and undertaking a number of site visits during construction to ensure compliance with the design intent. Through his reviews Scott identified numerous drainage improvement opportunities to reduce flooding and reposition drainage alignments to provide Council with an improved outcome with respect to land management and asset maintenance.

Ravenswood Interchange, VicRoads: Project Manager. Engeny was commissioned to carry out a hydraulic assessment for the proposed Ravenswood Interchange on the Calder Highway. Scott developed a RORB model to encompass both Bullock Creek and Ravenswood Creek catchments to Calder Highway and this included validation of flows to published methods such as the DNRE curves for catchment area vs flow. A TUFLOW (2D) hydraulic model was developed to model the existing catchment to produce the 100 year ARI flood extent and flood levels at the Calder Highway for both Bullock Creek and Ravenswood Creek. Scott also developed HEC-RAS (1D) hydraulic model which he used for calibration purposes and to provide additional outputs such as stream power which will assist with the design of erosion control works within the creeks adjacent to any drainage works. Preliminary concept layout plans were prepared for drainage and bridge structures.

M80 - Hume Freeway Interchange Hydraulic and Water Quality Assessment, VicRoads: Project Manager. Scott developed a detailed hydraulic model to determine the impact of construction of the proposed M80-Hume Freeway Interchange. Given the impact on upstream properties, concept level mitigation options were assessed to address the flood risk. Opportunities to construct WSUD features within the interchange were also assessed.

Banyule City Council Flood Modelling and Mapping, Banyule City Council: Project Manager. In response to recent large flooding events across the municipality Scott assisted Council with some small 'pilot' studies to present the outcomes and benefits of 2D flood modelling. Two small catchments were modelled and subsequently mitigation options were also assessed to address flood risk within the catchments. Given the success of these small catchment studies Council subsequently engaged Engeny to flood model the entire municipality. In collaboration with Council Scott identified the top 60 flooding 'hot

spots' for identification of mitigation works. Scott costed the proposed mitigation works developed a cost-benefit rating system to enable the works across the municipality to be prioritised. Engeny also developed a flooding overlay (Special Building Overlay) for Council's planning department to implement and use to control development within flood prone areas.

Boroondara Flood Modelling and Mapping, Boroondara City Council: Project Director. Scott has overseen and reviewed the development of several flood models to model and map flooding behaviour across the entire Boroondara municipality.

Feb 2008 - Apr 2010, Water Resources Engineer, AECOM Australia Pty Ltd (formerly Maunsell Aust Pty Ltd)

Northern Access Road Project, Qld: Project Engineer. This project involved the detailed design of all road drainage for the Northern Access Road (Brisbane Airport). Scott was involved in the hydraulic modelling of bridge and road drainage and in the hydraulic design and water quality modelling of swales and ponds (for stormwater transfer and detention) through the use of DRAINS and MUSIC software. Scott was also involved in the development of detailed construction drawings for all drainage structures.

Southern Link Upgrade, Vic: Project Environmental Management Representative (PEMR). This project involved an environmental site supervision role of construction activities along Southern Link as part of the Monash-CityLink-West Gate Freeway upgrade. Scott conducted routine weekly site inspections to ensure appropriate environmental management was being conducted. Water quality monitoring was also undertaken during these inspections to ensure that water quality within Gardiners Creek was not adversely impacted by construction activities. Scott was largely involved in the development of Construction Environmental Management Plans (relating to specific work activities) and Environmental Management Plans (project wide activities) to ensure contractors were aware of the project's environmental requirements. Scott was also involved in ensuring that the Net Gain Offset Agreement was adhered to, this involved liaison with the former Department of Sustainability and Environment.

Victoria Harbour, Vic: Project/Site Engineer. Scott was involved in the design of stormwater drainage within the Victoria Harbour project. He was also involved in site surveillance of construction activities whilst managing requests for information from the civil contractors in relation to the design of the overall project. Scott's site surveillance duties included overseeing testing (e.g. pressure testing and swabbing) of water and sewer mains.

Anthony's Cutting, Western Highway Realignment, Vic: Project Engineer. This project involved hydraulic modelling of creeks within the project area. Scott developed HEC-RAS models and determined appropriate sizes of culverts and bridges along the highway.

Truck Action Plan, Vic: Project Engineer. This project involved a surface water assessment of a number of routes for the Truck Action Plan. Scott was involved in determining the risks for each of the routes from a surface water perspective and ranking each of the routes according to the objective based evaluation model which he also helped develop.

Feb 2005 - Jan 2008
Water Resources Engineer, Tonkin Consulting, Adelaide

Roxby Downs Township Expansion, SA: Project/Site Engineer (Secondment to BHP Billiton). This project involved a site supervision role of township expansion projects in Roxby Downs. This included the supervision of the construction of residential subdivisions, an industrial subdivision, and effluent lagoon. Scott's role involved liaison with BHP Billiton (the client), Roxby Downs Council (asset owner) and York Civil (Civil contractor). He managed technical queries, site instructions and the various tasks necessary to keep the project on schedule. There was a major focus placed on the environmental impacts of the construction activities. Scott conducted weekly environmental inspections with BHP representatives to ensure the conditions of the environmental approvals were adhered to. It was necessary in some circumstances to adjust the Environmental Management Plan to cater for situations on site which weren't anticipated in the design phase (for example significant vegetation not surveyed as part of the original vegetation survey).

Port Road Floodplain Mapping/Rejuvenation Project, SA: Project Engineer. This project involved flood modelling and mapping the Port Road catchment to determine extent of flooding within the catchment. The flood mapping which Scott undertook highlighted areas of significant flooding and as a result Council commissioned further work to develop a stormwater master plan aimed at prioritising works to address the flooding. The project is significant given its multi-objective stormwater scheme with water reuse, water quality improvement, environmental enhancements all whilst reducing flood risk. The works form part of the Water Proofing the West Project which won the 2013 Smart Water Resource Management Award presented by the Water Industry Alliance.

Dec 2003 - Feb 2004
Vacation Work, SA Water

Happy Valley Dam Remedial Works, SA: Scott had a site supervision role which included the handling of technical queries, hold points, and site inspections

EDUCATION

2004 Bachelor of Engineering (Civil and Environmental) (Hons), University of Adelaide

2004 Bachelor of Economics, University of Adelaide

REGISTRATIONS / AFFILIATION

- Chartered Professional Engineer
- Member, Institution of Engineers, Australia
- Stormwater Victoria Committee Member

PUBLICATIONS

Dunn S.M., Bowden P.C., Bowden S.A. and Pollitt A.S. (2003), "Rainfall Runoff Modelling in Tasmania", final year Civil and Environmental Engineering Research Project, The University of Adelaide

APPENDIX B

Instructions

HARWOOD ANDREWS
Our ref: 3TED 21900952
Contact: Tessa D'Abbs
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Direct Email: tdabbs@ha.legal
Principal Lawyer: Kate Morris

MADDOCKS
Our ref: TGM:7849160
Contact: Sophie Jacobs
Direct Line: 03 9258 3546
Direct Email: sophie.jacobs@maddocks.com.au
Partner: Terry Montebello

28 June 2019

Scott Dunn
Engeny
Email: scott.dunn@engeny.com.au

Subject to legal professional privilege

Dear Scott

North East Link Environment Effects Statement process

Harwood Andrews act for Manningham City Council and Maddocks act for Banyule City Council, Boroondara City Council and Whitehorse City Council (collectively, the **Councils**) in relation to the North East Link Environment Effects Statement (**EES**) process, the draft planning scheme amendment and the works approval application prepared to facilitate the North East Link Project (**Project**).

We are instructed to engage you to provide expert evidence in the area of surface water.

An Inquiry and Advisory Committee (**IAC**) has been appointed by the Minister for Planning under section 9(1) of the *Environmental Effects Act* to hold an enquiry into the environmental effects of the Project. The role of the IAC in this regard is set out in paragraph 1 of the Terms of Reference (**TOR**).

The IAC has also been appointed as an advisory committee under section 151 of the *Planning and Environment Act 1987* to review the draft planning scheme amendment prepared to facilitate the Project. The role of the IAC in this regard is set out in paragraph 2 of the TOR.

The IAC is a multi-disciplinary committee. The biography of each committee member is available here.

The IAC will hold a public hearing from **25 July 2019** to approximately 6 September 2019.

A summary of key dates is set out below.

Instructions

We request that you provide a fee proposal to:

1. Review the exhibited documents relevant to your area of expertise and each of the Councils' municipal areas, in particular:
    a) The EES:
        - Volume 1 (Chapters 1 to 8);
        - Volume 4 (Chapters 21 'Ground movement', 22 'Groundwater', 23 'Contamination and soil', 24 'Surface water', 25 'Ecology', 27 'Environmental management framework');
    b) Technical Report P Parts 1 & 2 and Appendices: Surface Water;
    c) EES Map Book;
    d) Attachment III: Risk Report;
    e) Attachment V: Draft Planning Scheme Amendment.

2. Review:

a) The Ministerial Guidelines for assessment of environmental effects under the *Environmental Effects Act 1978* (2006);
b) Manningham City Council's public submission on the EES dated 5 June 2019;
c) Banyule City Council, Boroondara City Council and Whitehorse City Council's joint public submission on the EES dated 7 June 2019;
d) IAC tabled document no. 5 titled *Preliminary Matters and Further Information Request*, dated 20 June 2019;
e) IAC tabled document no. 14 being the Maddocks further information request on behalf of Banyule, Boroondara and Whitehorse City Councils;
f) Clayton Utz (acting on behalf of NELP) initial response to the Maddocks further information request (**attached**);
g) Harwood Andrews further information request on behalf of Manningham City Council (**attached**);
h) the *draft Yarra River Bulleen Precinct Land Use Framework Plan 2019* and Manningham City Council's public submission on this dated 6 June 2019*;* and
i) any other submission or document we subsequently refer to you.

3. Prepare a single expert witness report on behalf of the Councils for circulation that contains your opinion on the following matters, as relevant to your area of expertise:

    a) Does the EES adequately document and assess the nature and extent of the environmental effects of the Project? In addressing this question please explain where you are satisfied with the content of the EES and why, and if not, what if any deficiencies exist in the documentation and/or assessment of the nature and extent of environmental impacts contained in the EES;

    b) Can the Project as described in the EES achieve a level of environmental performance which is consistent with relevant legislation, documented and endorsed policy or acknowledged best practice;

    c) If the Project, as described in the EES cannot achieve a level of environmental performance which is consistent with relevant legislation, documented and endorsed policy or acknowledged best practice, are there any recommendations that you would make as to specific measures which you consider necessary and/or appropriate to prevent, mitigate and/or offset adverse environmental effects? If so, please explain your reasoning in detail. To the extent that it is within your expertise to comment upon the feasibility of any of your recommendations, please state whether or not any recommendations are feasible, explaining your reasoning;

    d) How does the Project as described in the EES respond to the principles and objectives of "ecologically sustainable development" as defined in the IAC's Terms of Reference;

    e) Are there any recommendations that you would make as to specific measures which you consider necessary and/or appropriate to improve the response of the Project to the principles and objectives of "ecologically sustainable development"? If so, please explain your reasoning in detail. To the extent that it is within your expertise to comment upon the feasibility of any of your recommendations, please state whether or not any recommendations are feasible, explaining your reasoning; and

    f) To the extent that the content of the draft planning scheme amendment, works approval and environmental protection requirements lies within your expertise, do you have any recommendations for changes that should be made to the draft planning scheme amendment, works approval or planning approval and/or draft environmental performance requirements in order to improve the environmental outcome of the Project?

4. In due course, review and comment on other parties' expert evidence (surface water);

5. Attend any conclave of surface water experts requested by the IAC;

6. Present your expert evidence at the hearing. You should anticipate preparing a short (no more than 30 minutes) presentation to facilitate this. The presentation is to be drawn from your expert witness report and may respond to other expert reports (as relevant).

Please ensure you carefully read and comply with both Planning Panels Guide to expert evidence (DOCX, 81.8 KB), April 2019 and the IAC directions set out in tabled document 15 here.

Key Dates

Please note the following key dates:

- NELP has offered for its experts to meet with other experts (outside the formal expert conclave process) prior to **5pm Friday 12 July 2019** to discuss issues, view models etc. The IAC has encouraged parties to take up offer in the IAC Directions (orders 4-7). If you would like to take up this offer and meet with a NELP expert before you finalise your expert evidence, please let us know as soon as possible and we will arrange for this to occur.
- Your expert witness statement will need to be circulated by **9.00 am on Monday 15 July**. We kindly ask that you provide us with a copy of the report by **5:00pm on Wednesday 5 July**.
- A conclave of surface water experts is likely occur (as per order 14 of the IAC Directions). A time and date for this meeting has not yet been scheduled but we expect it to occur during the week of 15 July. We will confirm this as soon as possible;
- Presentation of the proponent's case is scheduled to commence on Thursday 25 July; and
- Presentation of the Councils' case is likely to be scheduled to commence in mid-August. We are waiting on a timetable for hearings to be circulated so will confirm this as soon as possible.

Documents

The exhibited EES documents may be accessed at: https://northeastlink.vic.gov.au/environment/environment-effects-statement-ees/environment-effects-statement-documentation.

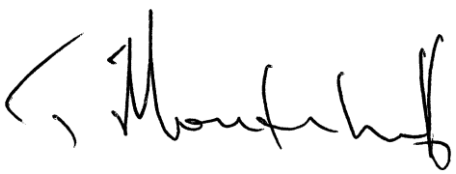
Confidentiality

Please keep our engagement of you and the preparation of your expert witness statement confidential until we have notified you that we have circulated your evidence externally or made it publicly available.

If you have any queries, please contact Tessa D'Abbs on 9611 0117 or at tdabbs@ha.legal (acting for Manningham) or Sophie Jacobs on 9258 3546 or at sophie.jacobs@maddocks.com.au (acting for Banyule, Boroondara and Whitehorse).

Yours sincerely,

HARWOOD ANDREWS **MADDOCKS**



APPENDIX C

Surface Water Scoping Requirements

Table 2-1 from Surface Water Technical Report – Surface Water Scoping Requirements

Aspect	Scoping requirement	Section addressed
Key issues	Potential for project works to cause or lead to land subsidence or erosion that could adversely affect properties, structures, infrastructure, drainage, river health or other values including under future climate change scenarios.	Impact assessment: Sections 8.3 and 9.3
	Potential for project works to affect waterways, groundwater and hydrology, including with respect to flooding and future climate change scenarios.	Impact assessment: Sections 8.1 and 9.1 Technical report N – Groundwater.
	Potential for contaminated runoff or other water, including groundwater, to be discharged into surface waters or groundwater environments.	Impact assessment: Sections 8.2 and 9.2 Technical report O – Contamination and soil Technical report N – Groundwater.
Priorities for characterising the existing environment	Identify and map ground conditions along the project corridor including geology, hydrogeology and drainage.	Existing conditions: Sections 6.1.1, 6.2.1, 6.3.1, 6.4.1.
	Identify hydrological or geomorphic conditions that may contribute to susceptibility to erosion (eg steep slopes, channels).	Existing conditions: Sections 6.4.3, 6.5.4, 6.6.3.
	Identify and map the natural and constructed surface water drainage system relevant to the geographic coverage of project works.	Existing conditions: Section 6.
	Document the key assumptions to be adopted in the surface and groundwater hydrological analysis with respect to future climate change scenarios.	Methodology: Section 5.3.1. Technical report N – Groundwater.
	Identify existing key surface water quality and stream condition parameters and trends.	Existing conditions: Sections 6.4.2, 6.5.3, 6.6.2.
Design and mitigation measures	Identify design and construction management measures to maintain ground stability and prevent erosion where risks of potential instability due to the project have been identified.	Impact assessment: Section 8.3.
	Describe measures to avoid or mitigate project effects on waterways and flood behaviour and management.	Impact assessment: Section 8.1.
	Describe measures to protect surface water quality, especially during the construction phase, with reference to SEPP objectives and other relevant standards and guidelines.	Impact assessment: Section 8.2.

Aspect	Scoping requirement	Section addressed
Assessment of likely effects	Predict subsidence and erosion due to project works and assess residual effects on assets and values.	Erosion assessed in impact assessment: Section 8.3. Subsidence is addressed by Technical report M – Ground movement.
	Assess residual effects on waterways and hydrology, including with respect to flood behaviour and management with respect to public safety and potential effects on private property and assets.	Impact assessment: Sections 8.1.
	Assess residual effects on quality and availability of groundwater and water quality in receiving waters, having regard to existing water quality conditions, proposed mitigation measures and relevant SEPP standards.	Impact assessment:
	Assess residual effects of short-term or longer-term changes to groundwater conditions, with particular regard to ground subsidence, tunnel drainage, groundwater availability and quality, relevant SEPP standards and beneficial uses.	Technical report N – Groundwater and Technical report M – Ground movement.
	Assess residual effects on surface and groundwater users or environmental values from contaminated soil, acid forming materials or contaminated groundwater.	Technical report O – Contamination and soil
	Undertake sensitivity analysis, if required.	Some limited sensitivity analysis has been undertaken to assess the impact of changes in the ARR guidelines refer Sections 6.1.2, 6.2.2 and 6.5.2. Other sensitivity analysis may be required as
Approach to manage performance	Describe the Environmental Performance Requirements to set subsidence and erosion outcomes that the project must achieve.	Erosion assessed in Impact assessment: Section 8.3. Subsidence is addressed in Technical report M – Ground movement.
	Describe the Environmental Performance Requirements to set surface water and groundwater quality outcomes as well as groundwater level or flood behaviour outcomes that the project must achieve.	Surface water and flood behaviour addressed in Section 8.2. Groundwater is addressed in Technical report N – Groundwater.

APPENDIX D

Site Visit Photos

Appendix C 1 AK Lines Reserve Retarding Basin

Appendix C 2 Eastern entrance to pedestrian underpass at location of Yando Street Main Drain

Appendix C 3 Looking eastwards from pedestrian underpass at location of Yando Street Main Drain

Appendix C 4 Kalparrin Gardens

Appendix C 5 Existing basin within Watsonia Railway Station carpark

Appendix C 6 Banyule Creek at Borlase Reserve

Appendix C 7 Banyule Creek south of Lower Plenty Road

Appendix C 8 Banyule Creek looking south towards Banyule Swamp

Appendix C 9 Bolin Bolin Billabong

Appendix C 10 Bolin Bolin Integrated Water Management project (wetland)

Appendix C 11 Private dam within Trinity College

Appendix C 12 Koonung Creek at Boronia Grove Reserve

Appendix C 13 Boronia Grove Reserve wetlands

Appendix C 14 Koonung Creek at Koonung Creek Reserve (Manningham)

Appendix C 15 Wetland at Koonung Creek Reserve (Manningham)

Appendix C 16 Koonung Creek at Tram Road retarding basin

Appendix C 17 Koonung Creek at Tram Road retarding basin

Appendix C 18 Koonung Creek at Elgar Park

Appendix C 19 Koonung Creek wetlands

Appendix C 20 Area between Koonung Creek and Eastern Freeway

APPENDIX E

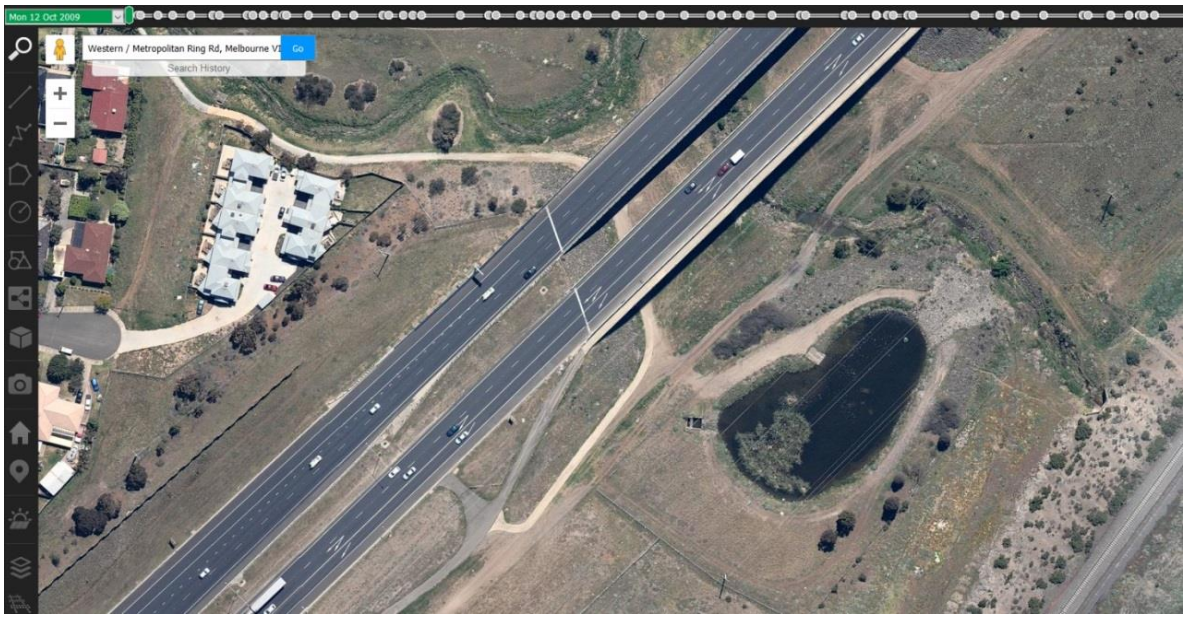
TRG Comments and Responses (Surface Water)

www.ghd.com
Tel. (03) 8687 8000 Fax. (03) 8687 8111
180 Lonsdale Street Melbourne Vic 3000

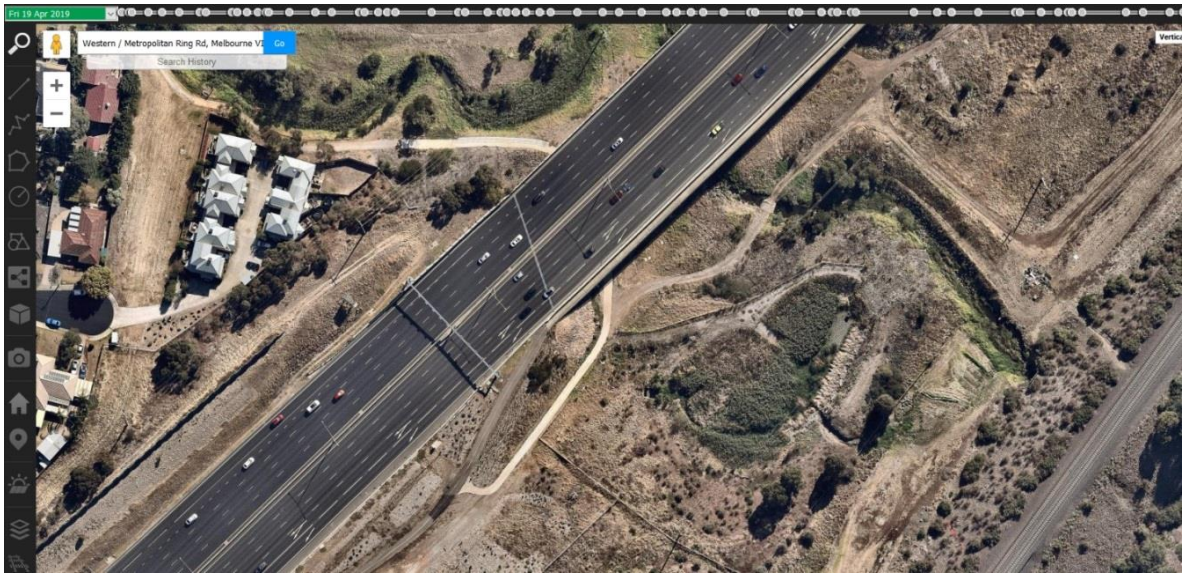
#	Secti	Sub-section	Commenter organisation	Commenter name	Comment Category	Comment Type	Comment	Changes sought	NELA Agreed / For further discussion / Closed	NELA response	Response Section / page
2	6		BCC	S Dunn	3 - Critical Issue	2 - Technical comment - specific	It is noted that the modelling of the catchments, as presented in the June 2018 report, has been undertaken using different approaches (e.g. Banyule Creek all Council assets are included whilst for Yando Street Main Drain just the MW drains have been included). Engeny is finalising an update of flood modelling for all drainage catchments within the City of Banyule for Melbourne Water and Council incorporating all Council and MW drainage assets. It is recommended that a workshop be setup with MW to discuss these models with a view to sharing the models as appropriate.	Consistent modelling approach sought using the latest flood models developed for the City of Banyule catchments. Hold workshop between NELA, Council and Melbourne Water to discuss status of existing flood models.	Closed - no action	Modelling has used the best available information and is generally consistent in its approach and purpose. The regional flood models produced by Engeny are a useful basis for the modelling although the local focus of NEL project required some refinement to appropriately distribute flows and better assess potential local impacts.	no change proposed
11	8		BCC	S Dunn	2 - Important Issue	2 - Technical comment - specific	There is a need for more information to be provided relating to where proposed road drainage will be discharged to. For example along the existing Greensborough Bypass there are low lying areas located at Kempston Street and south of Yando Street. Is it proposed to drain NEL via existing drainage assets at these locations? This information is required to understand Council's future asset management and maintenance requirements.	Proposed discharge locations for NEL road drainage are to be identified and presented on layout plans in future revisions of the report	Closed - no action	While a conceptual design solution has been considered as part of developing the reference project it is possible that changes in grade line for instance will change the location and or size of drainage outlets and their compensating storages. If Council choose to base future decisions on the current concept, they should be aware that details may and almost certainly will change.	no change proposed
		9.1.6	Manningham	Andrew Allan	2 - Important Issue	2 - Technical comment - specific	Comparison of flood extents given in report and Council's flood mapping does not align sufficiently to give confidence. Would like to understand the reaasons for difference before finalising a view, especially where innundation regime that is impacting on Manningham residents or Council assets is altered. For instance, flood extent and shape in Bulleen flats is very different in both cases. GHD should have Councils raw GIS data to undertake a preliminary review. Much of this information was agreed with Melbourne Water and shouldn't be discounted. Council has received legal advice that Councils's flood mapping results should be used to inform future risks.		Closed - no action	There may be a number of reasons why the flood extent in the report and Council's C109 flood extents are different. A significant one is likely to be that the report focuses on the flooding along the larger waterways ie the Yarra River and Koonung Creek where as the C109 extents are focused on the local tributrary catchments and do not map main stream flooding.	
5	9	9.1.5	BCC	S Dunn	2 - Important Issue	2 - Technical comment - specific	What level of flood immunity has been achieved by the reference design at the southern portal and Manningham Road? Suggest this is documented in an EPR for the design to achieve this given that lower immunity is likely to be undesirable.	Include details of flood immunity afforded by reference design and include in EPR	Closed - no action	Unlike the northern portal, the immunity of the southern portal is less an issue of safety and more commercial issue given the greater warning time. As a result it is less an environmental performance requirement and more a project requirement.	

APPENDIX F

Assessment of Existing WSRD Assets for Major Road Projects



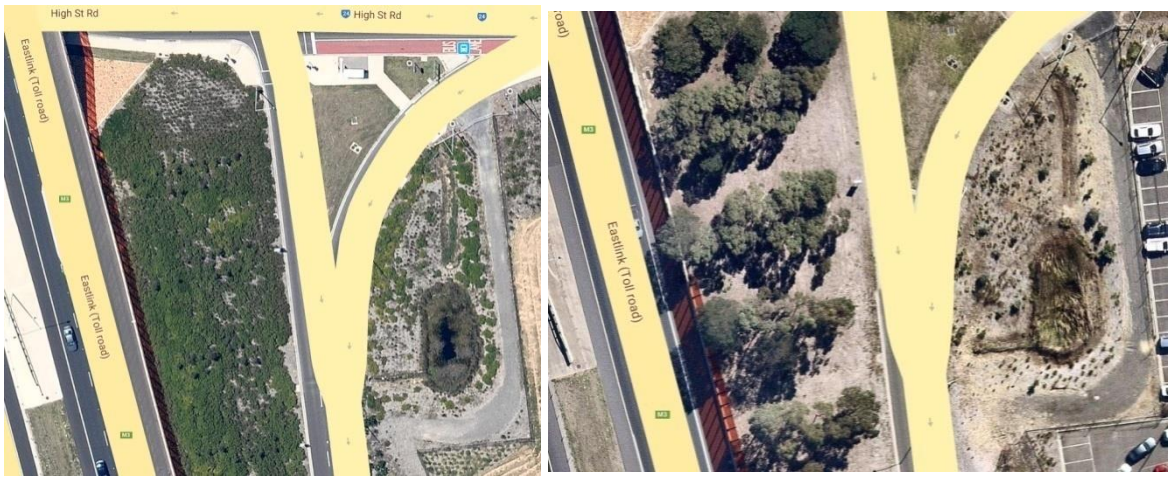
Appendix E 1 Sediment pond at Western Ring Road (Steele Creek) – October 2009



Appendix E 2 Sediment pond at Western Ring Road (Steele Creek) – April 2019

Appendix E 3 Sediment pond at Western Ring Road (Fitzgerald Road) October 2009 (left) and April 2019 (right)

Appendix E 4 East Link Sediment Ponds (High Street Road, north) October 2009 (left) and April 2019 (right)



Appendix E 5 East Link Sediment Ponds (High Street Road, south) October 2009 (left) and April 2019 (right)

Appendix E 6 East Link Sediment Ponds (Monash Freeway) November 2009 (left) and February 2019 (right)