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Our Ref: 110965.02 - Westlink Mod 5 - Response to Agency Comments on Stormwater.docx

PJM:pjm

29 May 2024

ESR Australia
Level 24, 88 Phillip Street
Sydney, NSW 2000

Attn: Grace Macdonald

Subject: Westlink Stage 1, MOD 5 –-Response to Agency Comments on Stormwater

Dear Grace,

This letter has been prepared in response to Agency comments raised recently relating to the Westlink Stage 1 MOD 5 – External Road Upgrades

Based on the email received from DPE on 27 May 2024 it is understood that EHG and Sydney Water have made the following specific comments regarding stormwater management for the proposed roadworks.

1. The construction-phase stormwater targets will need to be met. This could be conditioned.

   This statement is supported subject to ESR review on the proposed conditions.

2. The applicant is not proposing to meet the operational-phase stormwater targets. BCS believes these need to be met, but recognises the difficulties in situations like this where the external works are remote from the rest of the development site. Ultimately the stormwater targets will be met through Sydney Water trunk infrastructure but the interim situation (before Sydney Water infrastructure is built) is the problem. Options to achieve compliance include:

   a. The catchments can have a quantum of impervious (approx. 13% impervious) area before waterways will be impacted. These external works may possibly be considered as part of this impervious area. Further analysis is required by the applicant to confirm if this approach can be adopted for any subcatchments.

   We understand that the 13% impervious threshold at which flows are impacted was reported by AT&L in their letter dated 30 May 2023. A copy of this letter is provided in Attachment A. Based on the above comment the 13% threshold seems to be agreed by the agencies.

   Given that ESR has met the full flow curve/MARV requirements for Westlink Stage 1 (including all private roads and the new portions of public roads). The upgrade of external roads should be disconnected from the Westlink Stage 1 interim scheme, as it services the broader Precinct, not just ESR's Westlink Stage 1 estate. Therefore, an independent assessment has been undertaken on this basis.

   The additional impervious area created by the upgraded road corridors is estimated to be 25,770 m^2 (refer to Table 1 below). This represents around 0.75 % of the expected total impervious area created by the 400 ha portion of MRP that these road upgrades will service in the interim stage prior to the opening of the Southern Link Road and the future Bakers Lane upgrades. Given the road upgrades provide infrastructure for the benefit of the Precinct, we believe this slight increase to be appropriate as its enabling, essential infrastructure delivered on behalf of a road authority.

   The MUSIC modelling we have undertaken on a range of sites across the MRP has confirmed that achieving the required MARV/flow curve is quite challenging and highly sensitive to small changes in bypassing catchment areas. Based on this experience we expect that it will not be possible to increase the size of the currently proposed system under ESR's Westlink Stage 1 to compensate for the unmitigated flows discharging directly from these increased impervious areas and continue to meet the

performance requirements. Consequently, we do not believe this option is viable.

b. The stormwater targets could be met through an 'interim' Sydney Water framework where some of the regional stormwater infrastructure is delivered. Certification would be required by Sydney Water to confirm that these works are managed by the interim framework. Sydney Water note there are current land ownership issues with basin 16/17 and potential 14 that might take some time to resolve and might not be aligned with the timeframes for delivery of the road.

The Mod 5 application report prepared by Ethos Urban suggests the project works will be implemented in three stages between June 24 to Aug 2025. Any stormwater-related controls would be expected to be implemented during Stage 1 (before August 2024). The timing required to secure agreement from Sydney Water and then to implement the works required is likely to be some years away given the relevant land that could be used for this purpose is currently privately owned. This option is not considered to be viable.

c. The stormwater targets could be met through works included in the developers new land holding which is contiguous with the external road upgrade works. The developer would then need to define the works required in this new landholding to ensure the stormwater targets are achieved.

It is noted that none of the stormwater-related controls nor the technical guidelines clarify this interim expectation and consequently, it was not factored into AT&L's Water and Stormwater Management Plan developed in support of Stage 1. It is noted, however, that AT&L has included the new extension of Abbotts Road and the private roads in the catchment to the Stage 1 basin, so the current strategy is accounting for these elements.

As discussed above in our comment at Item 2 a) we expect that it will not be possible to apply an "offsetting" approach which increases the size of the currently proposed system to compensate for the unmitigated flows discharging directly from these increased impervious areas and continue to meet the performance requirements. Consequently, we also do not believe this option is viable.

Alternative Solutions

Compliant Solution

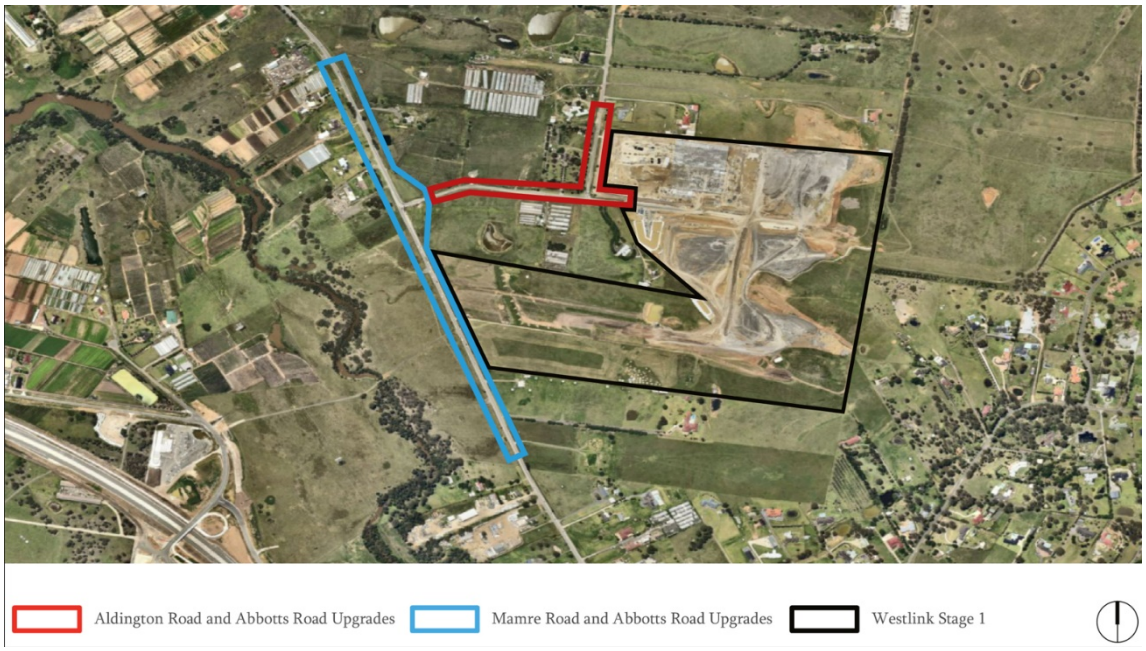
The only technically viable solution to achieve the performance requirements in the interim phase is to implement separate stormwater capture, storage and disposal systems for the road corridor. This has never been a requirement for a road and we expect the relevant road authority will not support this infrastructure. Further, there are fundamental engineering issues in implementing this infrastructure in the road corridor:

- There are at least four independent locations (low points) where this would need to be applied for the road upgrades covered by MOD 5.
- Penrith Council and TfNSW would have to accept ownership of the interim infrastructure in the public road and be prepared to maintain it. The risks around oil spills and other hazards that may be inadvertently caught by these systems are one of the barriers to this.
- As there is insufficient verge remaining in the corridor for irrigation disposal of the captured stormwater. separate land would have to be secured for this purpose via purchase or lease. Interim Rising mains would need to be laid in the road reserve amidst the other utility allocations.
- The contribution plan have not allowed for this type of system to be delivered in the interim, whether via a road authority or developer under works-in-kind.

The "Do Nothing" option

Given the significant difficulties in devising a workable interim solution and noting that Sydney Waters ultimate stormwater scheme will address the matter, we have also considered the likely impacts of adopting a "do nothing in the interim" approach.

In considering this approach it is important to consider the relative increases in impervious areas associated with the upgrade of the portions of Mamre Road, Abbotts Road and Aldington Road affected by MOD 5 (as highlighted in the extracted Figure 6 from the Mod application report below).



The relative proportions and scale of the additional impervious areas created have been derived form an assessment of the expected Road corridor formations as defined in the Mamre Road DCP and based on the current designs for the upgrade works completed by AT&L. The estimates are presented in Tables 1 and 2.

Table 1 Westlink Stage 1 MOD 5 Road Corridors – Increase in Impervious Areas

Road	Existing Road Length (m)	Existing Impervious Width (m)	Existing Impervious Area (m^2)	Proposed Road Corridor (m)	Proposed Road Length (m)	Proposed Impervious Width (m)	Proposed Impervious Area (m^2)	Increased in Impervious Area (m^2)	Comments
Mamre Road	1,000	11.0	11,000	40.0	1,000	25.5	25,500	14,500	Existing width of corridor is 40m. Which is considred adequate
Abbotts Road	425	8.0	3,400	30.6	425	22.0	9,350	5,950	Width from DCP.
Aldington Roa	380	8.0	3,040	30.6	380	22.0	8,360	5,320	Width from DCP.
Totals	**1,805**		**17,440**		**1,805**		**43,210**	**25,770**	

Table 2 Proportion of MRP total Impervious Areas arising from upgrades of Westlink Stage 1 MOD 5 Roads

Mamre Road Precinct IN1 Zoning (ha)	Adopted Imperviousness	Impervious Area (ha)	Increase in Impervious Road Corridor (ha)	Percentage of Total Area
850	85%	723	2.58	0.30%

As summarised in Table 2 the increase only relates to a very small (0.30%) proportion of the overall impervious area within the catchment. As acknowledged by the agencies, this remaining catchment will be serviced by the SW stormwater infrastructure when it is commissioned in a few years.

Given the scale and speed of the development across MRP, it is considered that the relative impacts on flows and water quality in Wianamatta South Creek arising from these proportionately small increases in impervious areas are quite likely to be negligible.

In terms of the potential cumulative impacts of adopting this 'do nothing' approach we have also estimated that the expected additional impervious area arising from the upgrade of all existing roads within the MRP (Mamre Road, Abbotts Road and Aldington Road) is approximately 13.3 ha and this represents 1.84% of the total impervious area expected across the Precinct. Even at this increased scale, the relative interim impacts are likely to be negligible. We do not believe any concession on this requirement would have significant consequences if the same approach was applied to road upgrades across the Precinct.

We trust this assessment will assist ESR and the Department in considering this proposal. Please don't hesitate to contact the undersigned if you have any questions.

Yours faithfully

PETER MEHL
Director

Encl:

ATTACHMENT A AT&L letter to LOG regarding Stormwater Targets dated 30 May 2023

Attachment A

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30 May 2023

Land Owners Group
Level 28
200 George Street
Sydney NSW 2000

Your Ref:

Our Ref: LTR008-03-20-747 Wianamatta South Creek Stormwater Targets.docx

Attention: Mamre Road Land Owners Group

Email:

Dear all,

RE: WIANAMATTA SOUTH CREEK STORMWATER TARGETS

1. Introduction

This letter describes an assessment undertaken by AT&L to estimate the threshold point at which the new operational phase stormwater quantity flow volume targets set for new developments within Wianamatta-South Creek would be exceeded assuming no interim stormwater quantity flow measures (other than on site detention and rainwater tank re-use) were implemented ahead of a regional scheme.

An assessment of stormwater quality controls that are likely to be required in advance of a regional stormwater management scheme has also been included in this assessment.

The analysis undertaken by AT&L assumes waterway health compliance (in terms of flow volume) may be demonstrated at a Wianamatta-South Creek catchment level rather than requiring demonstration of compliance on an individual site level. We understand catchment level compliance to be the overall intent of the Wianamatta-South Creek waterway health guidelines and the approach undertaken by Sydney Water as part of the proposed regional scheme. We therefore propose a Wianamatta-South Creek catchment approach is appropriate for adoption in the interim in advance of delivery of a regional stormwater and recycled water scheme.

This assessment has been undertaken for three scenarios:

- Scenario 1 – 'Existing Catchment': Analysis of the catchment under existing conditions.
- Scenario 2 – 'Developed catchment – MARV only': an assessment of different catchment impervious (%) to assess the developable area if MARV were the sole metric for approval and disregard the requirements to achieve the flow percentile targets.
- Scenario 3 – 'Developed catchment - MARV and flow percentiles': an assessment of the allowable impervious % increase before exceeding the MARV and flow percentile targets or objectives set for the Wianamatta-South Creek.

2. Existing Documents

AT&L have utilised two publicly available documents published by the NSW Government to inform the existing catchment attributes. These are:

- Advisian, *Wianamatta South Creek Catchment Flood Study Existing Conditions* (Revision I, May 2022), henceforth referred to as "the Flood Study". This document has been utilised to determine the area of the catchment that drains to Wianamatta-South Creek and its tributaries upstream of the Warragamba Pipelines, which is the downstream-most point of the catchment that includes the Western Sydney Aerotropolis and the western portion of the Mamre Road Precinct (excluding the catchment that drains to Ropes Creek).
- NSW Department of Planning and Environment, *Wianamatta South Creek stormwater management targets* (September 2022), henceforth referred to as "the SMT guideline". This document provides detailed technical information for the creation of a calibrated MUSIC model for the Wianamatta-South Creek catchment. The SMT guideline determined the existing MARV value of 0.9ML/ha/yr and flow duration curves based on comparison to stream gauge data at two points in South Creek. The SMT guideline also recommended the 2.0ML/ha/yr MARV target and flow percentile targets for 1st and 2nd order watercourses that have ultimately been adopted in the Mamre Road Precinct DCP.

3. MUSIC Modelling

AT&L have created a MUSIC model to replicate the existing conditions within the Wianamatta - South Creek catchment upstream of the Warragamba pipelines utilising the catchment areas derived from the Flood Study and the % impervious from the SMT guideline. Refer to **Figure 1** for the Wianamatta-South Creek catchment extent upstream of the Warragamba Pipelines (study catchment area).

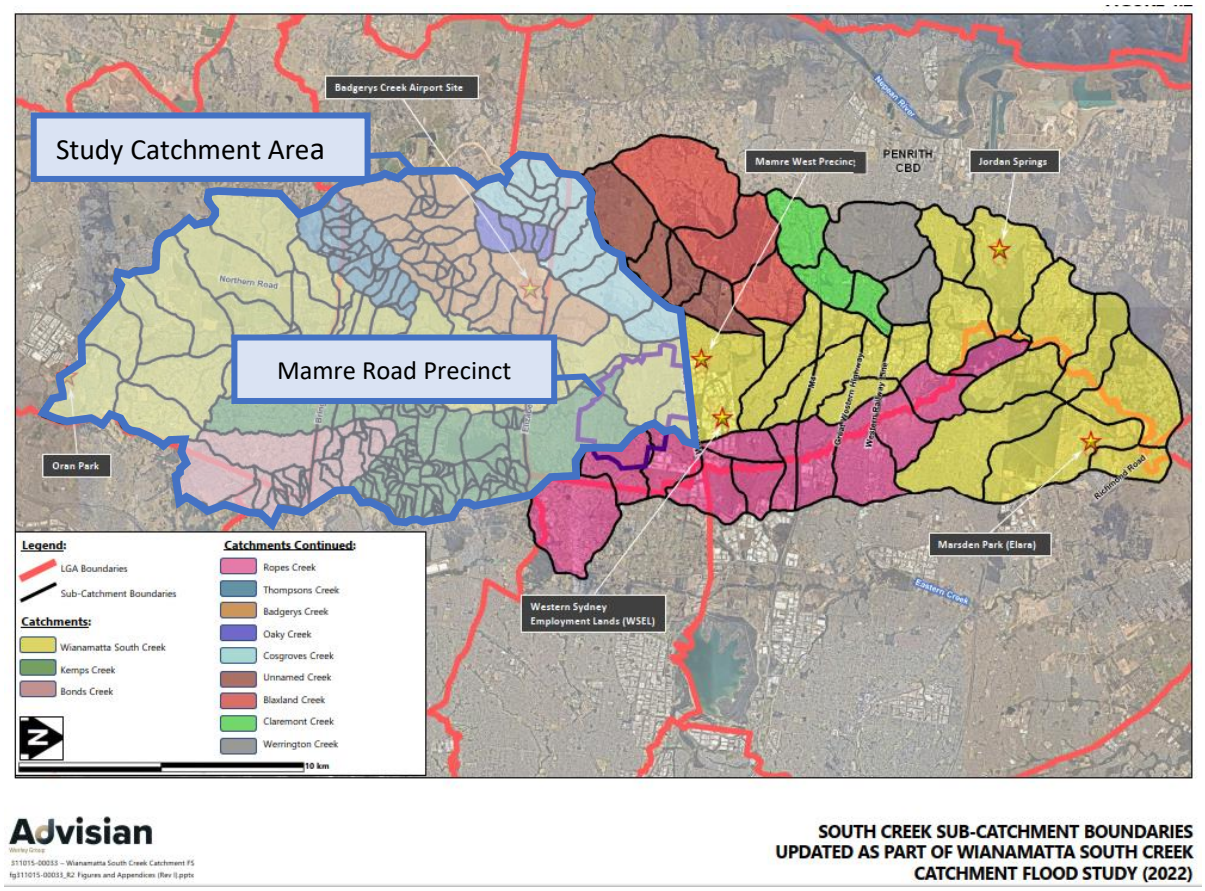

Figure 1: Extract from The Flood Study with catchment break down (Advisian, 2022)

A summary of the study catchment area parameters are as follows:

- Total Wianamatta-South Creek catchment area upstream of Warragamba Pipelines = approximately 21,416 ha (based on data included in the Flood Study)
- Total catchment impervious percentage of 10% (2,147 ha) (based on data included in the SMT guideline).

4. MUSIC Modelling Results – Stormwater flow volume

4.1. Scenario 1 – Existing catchments

The modelling for this scenario was undertaken to establish baseline parameters of the existing catchment condition. The 'Existing Catchment (Baseline)' was then analysed against the MARV and flow duration curve spreadsheet contained within the *MUSIC Modelling Toolkit – Wianamatta* (September 2022). A summary of the MUSIC model results is presented in Table 1.

Table 1*: *Scenario 1 – Existing Catchment Comparison

	Impervious (%)	MARV	Flow percentile targets achieved (Y/N)	Total Impervious Area (ha)
Existing Catchment (Baseline)	10	0.89	Y	2141.6
Sensitivity check - % impervious adopted in Advisian Flood Study	16	1.24	N	3426.6

The table above demonstrates that the baseline MARV for the catchment is approximately 0.9 ML/ha/year. This is consistent with guidance provided by Sydney Water in the *Mamre Road Flood, Riparian Corridor and Integrated Water Cycle Management Strategy* (October 2020).

4.2. Scenario 2 – Developed Catchments – MARV

The modelling for this scenario has been undertaken to estimate the threshold point at which the new operational phase stormwater quantity flow targets (MARV only) set for new developments within Wianamatta-South Creek would be exceeded for the study catchment area assuming no interim stormwater quantity flow measures (other than on site detention and rainwater tank re-use) were implemented upstream of the Warragamba pipelines ahead of a regional scheme.

MUSIC modelling of various scenarios has established a linear relationship between MARV and % imperviousness of the catchment. A summary of these findings is provided in **Table 2** and **Figure 2**.

Table 2: Scenario 2 - MARV only

Impervious percentage of the catchment (%)	Total Impervious Area (ha)	Total Developed area at 85% impervious (ha)	MARV
20	0.20 x 21416 = 4283.3	4283 / 0.85 = 5,038	1.48
29	**0.29 x 21416 = 6210.7**	**6210 / 0.85 = 7305**	**2.00**
30	0.30 x 21416 = 6424.9	6424 / 0.85 = 7558	2.06
40	0.40 x 21416 = 8566.5	8566 / 0.85 = 10077	2.64
50	0.50 x 21416 = 10708.1	10708 / 0.85 = 12598	3.23

Note the 85% considers a minimum of 15% imperviousness is required across all developments. Note this does not consider roads therefore is a conservative assumption.

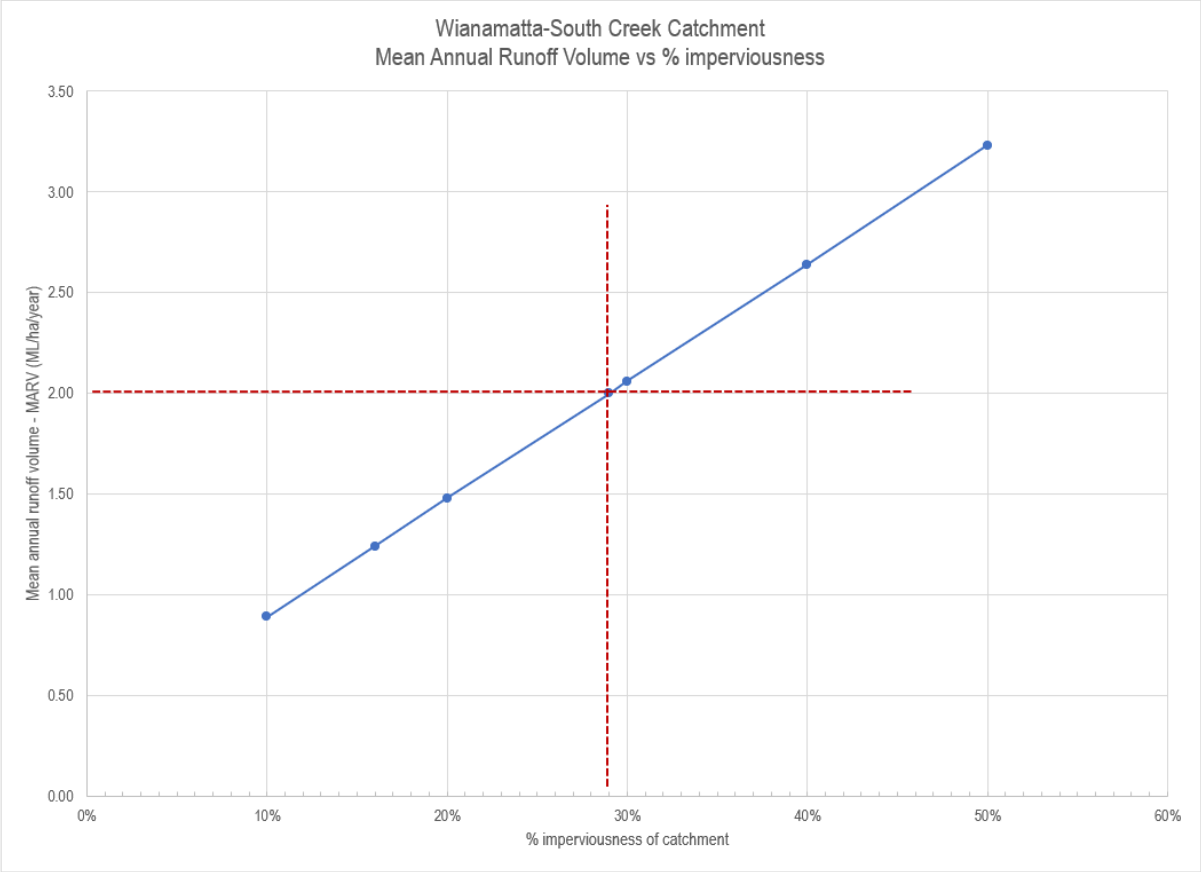

Figure 2: MARV vs % imperviousness in the Wianamatta-South Creek catchment

If a MARV of 2.0 ML/ha/year was the sole metric for measuring compliance against the stormwater volume targets adopted in the Mamre Road Precinct DCP, then the total allowable impervious area for the catchment would be 29% Imperviousness assuming no interim stormwater quantity flow measures (other than on site detention and rainwater tank re-use) were implemented onsite ahead of a regional scheme. This represents an increase of 19% from the 'Existing Catchment (Baseline)' as noted within the SMT or an increase of approximately 4,069ha of impervious area within the wider Wianamatta-South Creek Existing Catchment upstream of the Warragamba pipelines.

- This translates to approximately 4,780 ha of developable land (21,416 ha x (29% - 10%) / 85% development imperviousness) within the Wianamatta-South Creek catchment upstream of the Warragamba Pipelines able to be developed prior to exceeding a MARV threshold of 2ML/Ha/Yr when measured within Wianamatta-South Creek at the Warragamba Pipelines.

4.3. Scenario 3 – Developed Catchments – MARV and flow percentiles **targets**

The modelling for this scenario has been undertaken to estimate the threshold point at which the new operational phase stormwater quantity flow targets (both MARV and percentile targets) set for new developments within Wianamatta-South Creek would be exceeded for the study catchment area assuming no interim stormwater quantity flow measures (other than on site detention and rainwater tank re-use) were implemented upstream of the Warragamba pipelines ahead of a regional scheme. A summary of the MUSIC model results is presented in **Table 3.**

Table 3: Scenario 3 Assessment against DCP Targets

	Impervious (%)	**MARV**	Flow percentile **targets** achieved (Y/N)	**Total Impervious Area (ha)**	**Developed area at 85% impervious (ha)**
Existing Catchment (Calibrated)	10	0.89 ✓	Y	2,141.6	2,141 / 0.85 = 2,518
Developed Catchment	**13**	**1.07 ✓**	**Y**	**2,784.1**	**2,784 / 0.85 = 3,275**
Developed Catchment	20	1.48 ✓	N	4,283.2	4,283 / 0.85 = 5,039
Developed Catchment	29	2.00 ✓	N	6,210.6	6,210 / 0.85 = 7,307
Developed Catchment	40	2.64 **X**	N	8,566.4	8,566 / 0.85 = 10,078

As summarised within **Table 3** and depicted within **Figure 3** below, an increase of approximately 3% or 642ha of impervious area could be delivered prior to exceeding either of the MARV or percentile flow **targets** for new developments within the Wianamatta-South Creek study catchment area assuming no interim stormwater quantity flow measures (other than on site detention and rainwater tank re-use) were implemented upstream of the Warragamba pipelines ahead of a regional scheme. This translates to approximately 750 ha of developable land (21,416 ha x (13% - 10%) / 85% development imperviousness) able to be developed without any interim stormwater quantity flow measures (other than on site detention and rainwater tank re-use) within the Wianamatta-South Creek catchment upstream of the Warragamba Pipelines prior to exceeding the DCP flow MARV or percentile **targets**.

Flow duration curves for various scenarios are presented in **Figure 3**. This shows:

- Flow percentiles **targets** would be achieved for the 75-percentile and 50-percentile for all scenarios
- Flow percentile **targets** would not be achieved for the 90-percentile if the catchment is developed beyond 13% impervious.

We however note that the flow percentiles **targets** (as included within the SMT and DCP) are stated within the SMT to be based on 1st and 2nd order streams and differ from the flow percentiles **objectives** for ≥3rd order streams as also noted within the SMT and the predecessor Wianamatta-South creek performance criteria. Refer Section 4.4 of this letter for analysis against flow percentile **objectives**.

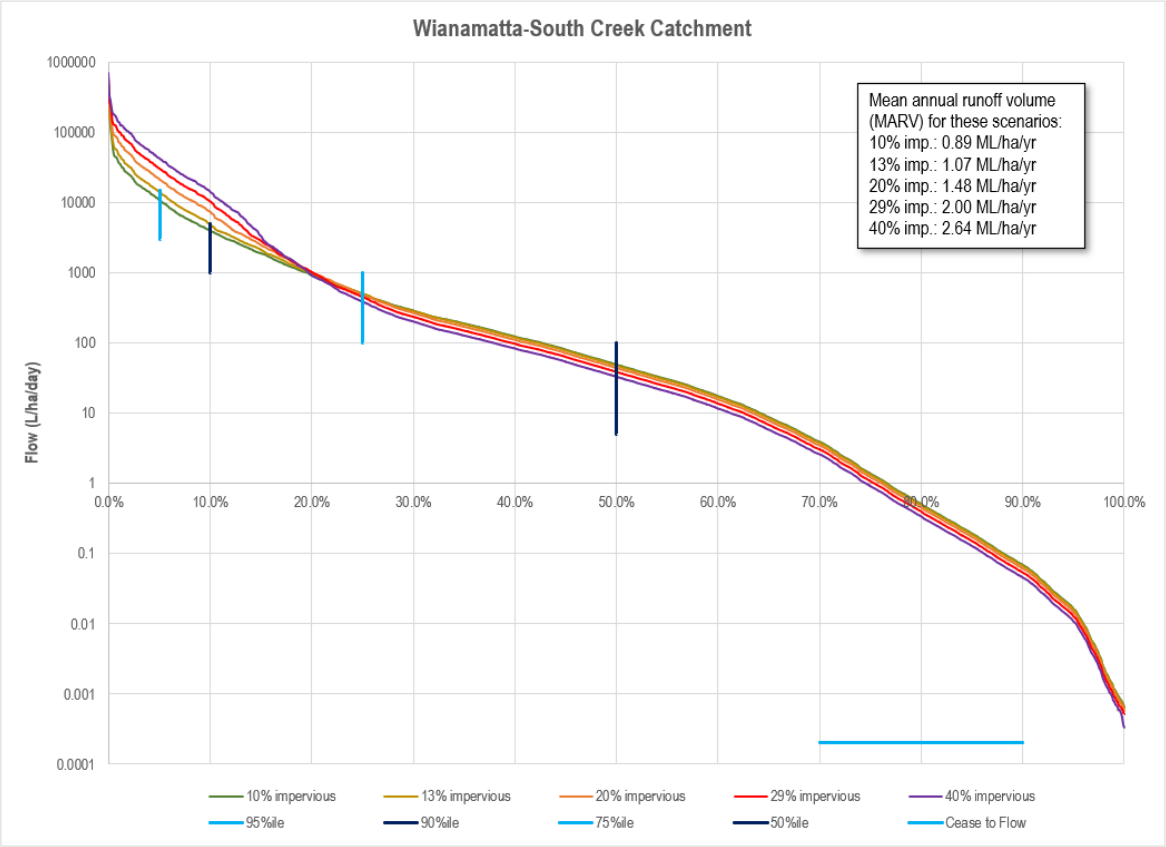

Figure 3: Flow duration curves for various % impervious scenarios

A summary of MARV and flow percentiles for the scenarios presented in the flow duration curve is presented in **Table 4**.

Table 4: MARV and flow percentiles for various % impervious scenarios

% impervious	MARV	90%ile (L/ha/day) (DCP **Target** 1000 – 5000)	50%ile (L/ha/day) (DCP **Target** 5-100)	10%ile (L/ha/day) (DCP **Target** 0)
10% (existing)	0.89 ✓	4,010 ✓	49 ✓	0.069 ✓ (Practically)
13%	1.07 ✓	4,880 ✓	48 ✓	0.067 ✓ (Practically)
20%	1.48 ✓	7,400 **X**	44 ✓	0.061 ✓ (Practically)
29%	2.00 ✓	10,500 **X**	39 ✓	0.055 ✓ (Practically)
40%	2.64 ✓	14,400 **X**	33 ✓	0.046 ✓ (Practically)

4.4. Catchment analysis relative to Wianamatta-South Creek flow **objectives**

Further to the MUSIC model results presented above for Scenario 2 and Scenario 3, following are points of discussion pertaining to development of the catchment with respect to the flow related **objectives** for the Wianamatta-South Creek catchment.

- The SMT states: *"**Waterway objectives** are recognised in NSW Government policy as the community environmental values and long-term goals for managing waterways. In this context, they are the*

environmental standards for delivering healthy waterways, riparian corridors and other water dependent ecosystems."

- The NSW DPE (September 2022) guideline titled *Performance criteria for protecting and improving the blue grid in the Wianamatta–South Creek catchment* presents flow related **objectives** for the catchment, (refer to extract below). It is noted that the high-spell (90th percentile daily flow volume) flow **objective** documented in the Performance criteria guideline for ≥ 3rd order streams is 10,091.7 ± 769.7 L/ha/day (i.e., a range of 9,322 to 10,861.4 L/ha/day).

Table 6 Ambient stream flows to protect waterway and water dependent ecosystems in the Wianamatta–South Creek catchment

Flow related objectives		
	Current* (apply to 1st and 2nd order streams)	**Tipping point** (apply to ≥3rd order streams)
Median daily flow volume (L/ha/day)	71.8 ± 22.0	1,095.0 ± 157.3
Mean daily flow volume (L/ha/day)	2,351.1 ± 604.6	5,542.2 ± 320.9
High spell (L/ha/day) >90th percentile daily flow volume	2,048.4 ± 739.2	10,091.7 ± 769.7
Freshes (L/ha/day) ≥ 75th and <90th percentile daily flow volume	327.1 to 2,048.4	2,642.9 to 10,091.7
Cease to flow (proportion of time/y)	0.34 ± 0.05	0.03 ± 0.01
Cease to flow – duration (days/y)	39.2 ± 8	3.9 ± 1.2
Baseflow index	0.13 ± 0.02	0.30 ± 0.02

* gauging station data (1990–2019) in South Creek at Elizabeth Drive (212320)

- The Mamre Road Precinct DCP (first exhibited in November 2020 and subsequently adopted on 19 November 2021) present the same flow related **objectives** as those adopted in the Performance criteria document (refer to extract from the DCP below).

Flow-related objectives for waterways and water dependent ecosystems

	1st or 2nd order streams	3rd order streams or greater
Daily Flows (L/Ha)		
Median Daily Flow Volume (L/ha)	71.8 ± 22.0	1095.0 ± 157.3
Mean Daily Flow Volume (L/ha)	2351.1 ± 604.6	5542.2 ± 320.9
High Spells (L/Ha)		
≥ 90th Percentile Daily Flow Volume	2048.4 ± 739.2	10091.7 ± 769.7
Frequency (number per year)	6.9 ± 0.4	19.2 ± 1.0
Average Duration (days per year)	6.1 ± 0.4	2.2 ± 0.2
Freshwater Flows (L/Ha)		
≥ 75th and ≤ 90th Percentile Daily Flow Volume	327.1 to 2048.4	2642.9 to 10091.7
Frequency (number per year)	4.0 ± 0.9	24.6 ± 0.7
Average Duration (days per year)	38.2 ± 5.8	2.5 ± 0.1
Cease to Flow		
Proportion of Time per Year	0.34 ± 0.04	0.03 ± 0.007
Duration (days per year)	36.8 ± 6	6 ± 1.1

- As presented in **Table 4**, under all scenarios up to 29% imperviousness across the study catchment area (equivalent to approximately 4,780 hectares of new development across the catchment), the 90-percentile flow in Wianamatta-South Creek just upstream of the Warragamba Pipelines would be about 10,500 L/ha/day, which is within the range of 10,091.7 ± 769.7 L/ha/day that was the performance criteria and waterway flow objective for ≥3rd order water courses as adopted in the Mamre Road Precinct DCP and defined originally within the DPE Performance criteria document.
- Adopting the ≥90-percentile flow **objective** for Wianamatta-South Creek (≥3rd order watercourse) as included in the Mamre Road Precinct DCP would allow development to proceed to a scale of up to 29% imperviousness across the study catchment area (approximately 4,780 hectares upstream of the Warragamba Pipelines) without exceeding the MARV target, ≥90-percentile flow **objective** for ≥ 3rd order streams adopted by NSW DPE and the 75th, 50th & 10th percentile flow **targets** . As outlined above and given the categorisation of South Creek as a ≥3rd order stream, the objectives of the MRP DCP and performance criteria as originally endorsed by NSW DPE for ≥3rd order streams are still met with a 29% imperviousness assuming no interim stormwater quantity flow measures (other than on site detention and rainwater tank re-use) were implemented ahead of a regional scheme.
- The only interim dispensation required would be to adopt the performance **objective** ('tipping point') not the **target**.

5. MUSIC Modelling Results – Stormwater quality

High-level MUSIC model results of the Wianamatta-South Creek study catchment area indicate that even under existing conditions the catchment does not meet the allowable mean annual load targets adopted in the Mamre Road Precinct DCP. An estimate of mean annual loads under existing catchment conditions (10% impervious) and under future conditions (at higher rates of imperviousness across the catchment) is summarised in **Table 5**.

Table 5: Estimated mean annual loads under existing conditions compared to DCP targets

Parameter	DCP Target – allowable mean annual load	Existing condition (10% impervious)	Future development (20% impervious)	Future development (29% impervious)
Gross pollutants	< 16 kg/ha/yr	14.5 ✓	35.0 **X**	50.9 **X**
Total suspended solids (TSS)	< 80 kg/ha/yr	229 **X**	466 **X**	640 **X**
Total phosphorus (TP)	< 0.3 kg/ha/yr	0.39 **X**	0.80 **X**	1.12 **X**
Total nitrogen (TN)	< 3.5 kg/ha/yr	1.82 ✓	3.48 ✓	4.76 **X**

To satisfy the stormwater quality targets adopted in the Mamre Road Precinct DCP in the absence of regional stormwater management measures, developments will need to provide stormwater quality management measures either on-lot, estate-wide or a combination of both.

It is acknowledged that the DPE *Technical guidance for achieving Wianamatta-South Creek stormwater management targets* includes at least 15 examples WSUD strategies for large-format industrial (LFI) developments that would demonstrate compliance with the adopted stormwater quality and flow volume targets. It is also noted that six out of the 15 strategies presented in the DPE's Technical Guidance Report incorporate a regional stormwater harvesting scheme.

A high-level stormwater quality management strategy, similar to the LFI strategy numbered B1 ("Lot and streetscape") in the Technical Guidance, has been developed and assessed by AT&L to provide an indication to the Mamre Road LOG of the extent and nature of stormwater quality measures that development sites in the Mamre Road Precinct would need to implement in the absence of regional measures. Nominal parameters assumed in the MUSIC model are as follows:

1) It is assumed that 55% of a typical LFI development estate would be warehouse roof area, and that all of the roof area would drain to a rainwater tank (NB: practically this may require more than one tank to achieve given the scale of the buildings and nature of the building roof drainage). The remaining 45% of a development estate would comprise hardstand, landscaped areas and estate roads.
2) Rainwater tanks would be provided at a rate of at least 150 kL per hectare of warehouse roof area.
3) Rainwater reuse for non-potable supply would be applied at a rate of 375 litres per hectare (of warehouse roof area) per day for toilet flushing and applied to 50% of on-lot landscape areas at a rate of 600mm per year (applied as per the DPE Technical guidance).
4) Conventional bio-retention systems or raingardens would be required at a rate of 100 m^2 per hectare of development estate (i.e., 1% of the site area). It is noted that these areas may be significantly reduced assuming propriety bio-retention products were supportable.
5) Constructed wetlands would be required at a rate of 200 m^2 per hectare of development estate (i.e., 2% of the site area).

MUSIC modelling results for both the MRP DCP Waterway Health water quality Option 1 (pollutant reduction rate) and Option 2 (allowable mean annual load) for the strategy outlined above are presented in **Table 6** below. It is noted that the SMT and the MRP DCP only requires strategies to demonstrate compliance against one of the target options, and in this case the example strategy outlined above would demonstrate compliance against the Option 1 targets.

Table 6: MUSIC model results against stormwater quality targets adopted in the Mamre Road Precinct DCP

Parameter	*Option 1 target (pollutant load reduction)*	Result	Option 2 target (allowable mean annual load)	Result
TSS	*> 90%*	95.0% ✓	< 80 kg/ha/yr	50 ✓
TP	*> 80%*	80.0% ✓	< 0.3 kg/ha/yr	0.32 **X**
TN	*> 65%*	66.8% ✓	< 3.5 kg/ha/yr	3.90 **X**
Gross pollutants	*> 90%*	98.5% ✓	< 16 kg/ha/yr	2.50 ✓

It should be noted that the high-level stormwater quality management strategy outlined in dot points 1-5 above is only one of a matrix of stormwater quality management strategies for incorporating on lot / estate measures to achieve compliance across the study catchment area assuming **no** interim stormwater quantity flow measures (other than On Site Detention and rainwater tank re-use) were implemented ahead of delivery of a regional scheme. Identification of these would be subject to a separate body of work.

6. Conclusion

AT&L have undertaken an assessment to determine the maximum imperviousness and resultant development that may be delivered within the Wianamatta-South Creek catchment upstream of the Warragamba Pipelines prior to exceeding the waterway health targets or objectives. This assessment has been completed assuming developments would be required to incorporate stormwater quality management measures at an on-lot or estate-wide scale to demonstrate compliance against the adopted stormwater quality control targets however **no** interim stormwater quantity flows measures (other than on site detention and rainwater tank re-use) were implemented ahead of delivery of a regional scheme and compliance for water quantity was demonstrated at a Wianamatta-South Creek catchment basis. In this regard we understand catchment level compliance to be the overall intent of the Wianamatta-South Creek waterway health guidelines and the approach undertaken by Sydney Water as part of the proposed regional scheme. We therefore propose a Wianamatta-South Creek catchment compliance approach is appropriate for adoption in the interim in advance of delivery of a regional stormwater and recycled water scheme.

A summary of the findings presented within this letter are provided below:

- The 'Existing catchment (baseline)' has a 10% total catchment imperviousness, achieves a MARV of 0.89ML/HA/Year though does **not** meet the water quality targets as adopted within the MRP DCP.
- The adopted flow percentile **targets** within the NSW Department of Planning and Environment, *Wianamatta South Creek stormwater management targets* and within the MRP DCP are based on 1st and 2nd order watercourse.
- The portion of Wianamatta-South Creek adjacent to the Mamre Road Precinct is a ≥3rd order watercourse.
- The results below are in relation to the Wianamatta-South Creek study catchment area upstream of the Warragamba pipelines and assumes that developments would be required to incorporate stormwater quality management measures at an on-lot or estate-wide scale to demonstrate compliance against the adopted stormwater quality control targets however **no** interim stormwater quantity flows measures (other than on site detention and rainwater tank re-use) are to be implemented (including the reservation or sterilisation of land) ahead of delivery of a regional scheme.
    - 13% total catchment imperviousness equivalent to around 750 hectares of new large-format industrial development could be delivered upstream of the Warragamba pipelines in advance of a regional scheme without exceeding the MRP DCP water quantity (flow) MARV target and percentile flow **targets**.

- 29% total catchment imperviousness equivalent to around 4,780 hectares of new large-format industrial development could be delivered upstream of the Warragamba pipelines in advance of a regional scheme without exceeding the MRP DCP water quantity (flow) MARV target, ≥90-percentile flow **objectives** for ≥ 3rd order streams adopted by NSW DPE or the 75th, 50th & 10th percentile flow **targets.**

- Using a rationale similar to that for the broader Wianamatta-South Creek catchment, approximately 257 hectares of development could be delivered in the Ropes Creek catchment upstream of the Warragamba Pipelines in advance of a regional scheme without exceeding the MRP DCP water quantity (flow) MARV target, ≥90-percentile flow **objectives** for ≥ 3rd order streams adopted by NSW DPE or the 75th, 50th & 10th percentile flow **targets.**
- In terms of stormwater quality, in the absence of regional stormwater scheme measures, developments would need to incorporate stormwater quality management measures at an on-lot or estate-wide scale to demonstrate compliance against the adopted stormwater quality control targets. By providing measures on-lot or estate-wide, it is assumed that any future regional stormwater management scheme to be implemented by Sydney Water would require far less by way of specific water quality management measures, such as the regional wetlands that have been incorporated into the Mamre Road Precinct Stormwater Scheme Plan. This should therefore significantly reduce the scale and cost of delivering the regional scheme.

Yours sincerely,

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