

8 February 2020

Russell Hogan  
c/o: Mirvac  
Email: [russell.hogan@mirvac.com](mailto:russell.hogan@mirvac.com)

**Attention: Russell Hogan**

Dear Russell

**RE: APPLICATION OF FILTERRA BIOFILTRATION SYSTEMS WITHIN ASPECT INDUSTRIAL ESTATE, KEMPS CREEK**

This correspondence has been prepared in response to your correspondence dated 11 January 2021 in relation to Council's submission regarding the potential use of Filterra biofiltration systems within the Aspect Industrial Estate. Specifically, Council states:

In relation to the treatment of stormwater, it is proposed that a 1,600m<sup>2</sup> bioretention system pre-treated with an Ocean Save OS-2324 be implemented. It is also proposed to use a proprietary filter media called Filterra. The use of Filterra is not currently supported and additional information to demonstrate its performance and compliance with Section 4.6 of Council's WSUD Technical Guidelines is required.

In response to this request, the following pages provide information demonstrating compliance with Section 4.6 of Council's *WSUD Technical Design Guidelines*. Additional information regarding the application of Filterra biofiltration systems (including recommended approval conditions for Council to consider) is also provided.

It is also worth noting that Blacktown City Council recently (on 1 February 2021) provided interim approval for the application of Filterra biofiltration systems within Blacktown City. Several other nearby Councils have also confirmed approval of their use for public and private sites, including Campbelltown City Council, Wollondilly Shire Council, Northern Beaches Council, Fairfield City Council, Liverpool City Council, and City of Sydney.

**NSW Office**

PO Box 444, Alexandria, NSW 1435

**Tel:** 1300 354 722

**Fax:** 1300 971 566

**QLD Office**

PO Box 5292 Stafford Heights QLD 4053

**Tel:** 1300 354 722

**Fax:** 1300 971 566

**VIC Office**

PO Box 583 Ascot Vale VIC 3032

**Tel:** 1300 354 722

**Fax:** 1300 971 566

**Email:** [enquiries@oceanprotect.com.au](mailto:enquiries@oceanprotect.com.au)

IES Stormwater P/L trading as Ocean Protect  
ABN: 79 101 258 182

[www.oceanprotect.com.au](http://www.oceanprotect.com.au)

I trust this is suitable for your current purposes. I would welcome the opportunity to discuss further with you and/ or Council to provide further clarification and/ or answer any questions, if necessary.

Yours faithfully



**Brad Dalrymple**  
**Principal Environmental Engineer**

**Attached files:**

- Dalrymple B, Wicks M. 2020. *A review of the application of Filterra® Biofiltration Systems in Australia.*
- *MUSIC model Aspect Mamre Road Music model (By OP).sqz*
- *Filterra Technical Design Guide (Ocean Protect, 2020)*
- *Filterra Stormwater Bioretention Filtration System – Operation & Maintenance Manual (Ocean Protect, 2020)*

## Compliance with Section 4.6 of Council's WSUD Technical Guidelines

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Figure 1 provides Section 4.6 of Council's *WSUD technical guidelines*. The text below describes how each of these requirements is complied with.

It should, however, be noted that a Filterra biofiltration system is very similar to a typical 'bio-filtration measure' (using 'sandy loam' filter media). A key difference, however, is that Filterra biofiltration systems utilise a filter media blend that can treat flows at a significantly higher flow rate than typical biofiltration filter media and the media is produced to strict quality control procedures. Whilst the Filterra filter media is manufactured by Ocean Protect (and also available via Contech Engineering), all other components of Filterra biofiltration systems (e.g. vegetation, mulch, under-drainage) are readily available from others, and maintenance can easily be done by suitably qualified personnel external to Ocean Protect.

### 4.6. Approved use of Proprietary Stormwater Treatment Devices

Council may consider approving the use of certain proprietary devices in place of bio-filtration measures, however prior to approval the following information must be provided for Council's consideration:

- The proposed reduction efficiencies need to be justified by rigorous scientific testing and results are published in a credible engineering/scientific journals
- Pollutant reduction parameters independently verified using a method to suit local or regional conditions (comparison between climate, pollutant concentrations and soluble pollutants)
- Information on the performance under dry weather flows (to account for potential pollutant leaching)
- Information on the assumed high-flow bypass rate and details about how it was determined, and
- The modelled pollutant reduction efficiency reflects the published figures.

Figure 1 Section 4.6 of Council's *WSUD Technical Guidelines*

### ***The proposed reduction efficiencies need to be justified by rigorous scientific testing and results are published in a credible engineering/scientific journals***

Section 2.5 of the attached report *A review of the application of Filterra® Biofiltration Systems in Australia* (Dalrymple et al 2020) provides a summary of recent examples of Filterra biofiltration systems operating in 'real world' conditions where treatment performance monitoring has been undertaken. As outlined in this table, rigorous scientific testing has been undertaken for Filterra biofiltration systems over three (3) locations – a total of 86 'real world' sampling events.

One of these systems is located in Kingswood at Western Sydney University – less than 10km from the proposed development area, and within the Penrith City Council area. To date, a total of twenty eight (28) events have been sampled and analysed since monitoring began in June 2018. The methodology and results of this study are provided in Appendix B of Dalrymple et al (2020), and have also been peer reviewed by two independent third party reviewers – with their peer review reports provided in Appendices E and F of the aforementioned report. A journal paper describing the methodology and results of this study has been recently sent to the *Australasian Journal of Water Resources* for review and potential publication.

The performance monitoring for the Filterra biofiltration system at North Carolina State University has been published in the following journal paper:

Smolek A P, Anderson A R, Hunt W F (2018). *Hydrologic and Water-Quality Evaluation of a Rapid-Flow Biofiltration Device*. Journal of Environmental Engineering 144(2), February 2018.

The Smolek et al (2018) is available at <https://ascelibrary.org/doi/10.1061/%28ASCE%29EE.1943-7870.0001275>. This paper is also summarised in Table 2-3 of the Dalrymple et al (2020) report, but (in short) describes the monitoring and results for a 22-month period (for 34 qualifying events).

I am subsequently confident that the aforementioned criteria is complied with.

### ***Pollutant reduction parameters independently verified using a method to suit local or regional conditions (comparison between climate, pollutant concentrations and soluble pollutants)***

As outlined above, performance monitoring has been undertaken for a Filterra biofiltration system at Kingswood, less than 10km from the proposed development site. The methodology and results of this study are provided in Appendix B of Dalrymple et al (2020), and have also been peer reviewed by two independent third party reviewers – with their peer review reports provided in Appendices E and F of the aforementioned report.

The two independent third party reviewers were Ralf Pfleiderer (from RPEC) and Damian McCann (from AWC). In summary, key findings from the peer reviewers were:

- Monitoring undertaken (up until April 2020, when the reviews were undertaken) complied with the *Stormwater Quality Improvement Device Evaluation Protocol* (Stormwater Australia, 2018 Version 1.3) and the City of Gold Coast's *Development Application Requirements and Performance Protocol for Proprietary Devices* (April 2015)
- Appropriately designed, installed, established and maintained Filterra biofiltration systems would be expected to provide a suitable stormwater treatment function in a range of other areas across Australia, including Victoria and Queensland
- The treatment performance of Filterra biofiltration systems can be modelled using MUSIC's bioretention node. The treatment node properties should be adjusted according to Table 3-1 in *A review of the application of Filterra® Biofiltration Systems in Australia*.

I am subsequently confident that the aforementioned criteria is complied with.

### ***Information on the performance under dry weather flows (to account for potential pollutant leaching)***

As outlined above, Section 2.5 of the attached report *A review of the application of Filterra® Biofiltration Systems in Australia* (Dalrymple et al 2020) provides a summary of three recent examples of Filterra® biofiltration systems operating in 'real world' conditions where treatment performance monitoring has been undertaken.

All three of the Filterra biofiltration systems were operating in 'real world' conditions where treatment performance monitoring has been undertaken included performance monitoring under 'dry weather' and 'high' flows. Section B.3.3 of the report describes the climatic conditions during the sampling period (to date) for the Kingswood site, and shows that several of the sampling events included low rainfall events following periods of zero/ low rainfall (i.e. 'dry weather') and sampling events during high rainfall periods (and subsequent high flow rates).

I am subsequently confident that the aforementioned criteria is complied with.

### ***Information on the assumed high-flow bypass rate and details about how it was determined***

For design/ modelling purposes, it is recommended that the design saturated hydraulic conductivity for Filterra biofiltration systems is 3550mm/hour. This is a conservative value, and we would expect higher values in typical systems. The design saturated hydraulic conductivity (3550mm/hour) is slightly above our lower 95<sup>th</sup> percentile saturated hydraulic conductivity of approximately 3300mm/hour. Based on longer-term field monitoring, we would expect typical values (for systems that have been operating for several years or more) to be approximately 4500mm/hour.

The peer review report by Damian McCann supports this. Specifically, Mr McCann's report (provided in Appendix G of Dalrymple et al (2020)) states:

AWC have been asked to consider the applicability of the results from this trial to other regions, including Melbourne, Brisbane, Moreton Bay Regional Council, Gold Coast, Sunshine Coast, Toowoomba, Noosa, Townsville and Mackay. It is our opinion that Filterra biofiltration systems designed, installed, established and maintained in line with the trial system and design treatable flow rates evaluated here (1.42L/s), are likely to provide stormwater treatment performance at these other locations similar with that observed at the trial site. This is probably a conservative treatable flow rate given our observation of up to 2.024L/s being treated during the trial.

I am subsequently confident that the aforementioned criteria is complied with.

### ***The modelled pollutant reduction efficiency reflects the published figures***

As described in Section 3 of the Dalrymple et al (2020) report, it is recommended that the treatment performance of Filterra biofiltration systems be modelled within MUSIC using the bioretention treatment node, with appropriate properties (as outlined in Table 3-1 of the aforementioned report).

Appendix C of the aforementioned report describes the methodology and results of modelling a Filterra biofiltration system at Western Sydney as a bioretention treatment node (in MUSIC), with comparisons made between MUSIC predictions and monitoring data recorded at the site (over the 27-month monitoring period). In this example, the application of MUSIC (and associated bioretention node) provided a reasonable estimate of the stormwater treatment performance of Filterra biofiltration systems – with MUSIC predicted ER's of 91, 80 and 47% for TSS, TP and TN respectively, compared to observed ER's (from site monitoring) of 80, 83 and 49% respectively. The assessment indicates that the application of MUSIC (and associated bioretention node) may provide a reasonable estimate for the stormwater treatment performance of Filterra biofiltration systems.

MUSIC modelling for the 1600m<sup>2</sup> Filterra biofiltration system proposed at the Aspect Industrial Estate has also been undertaken using a 10-year modelling period of local historic climate data and guideline recommended export characteristics for the upstream catchment). An extract of the model (attached to this correspondence) is given in Figure 2 below.

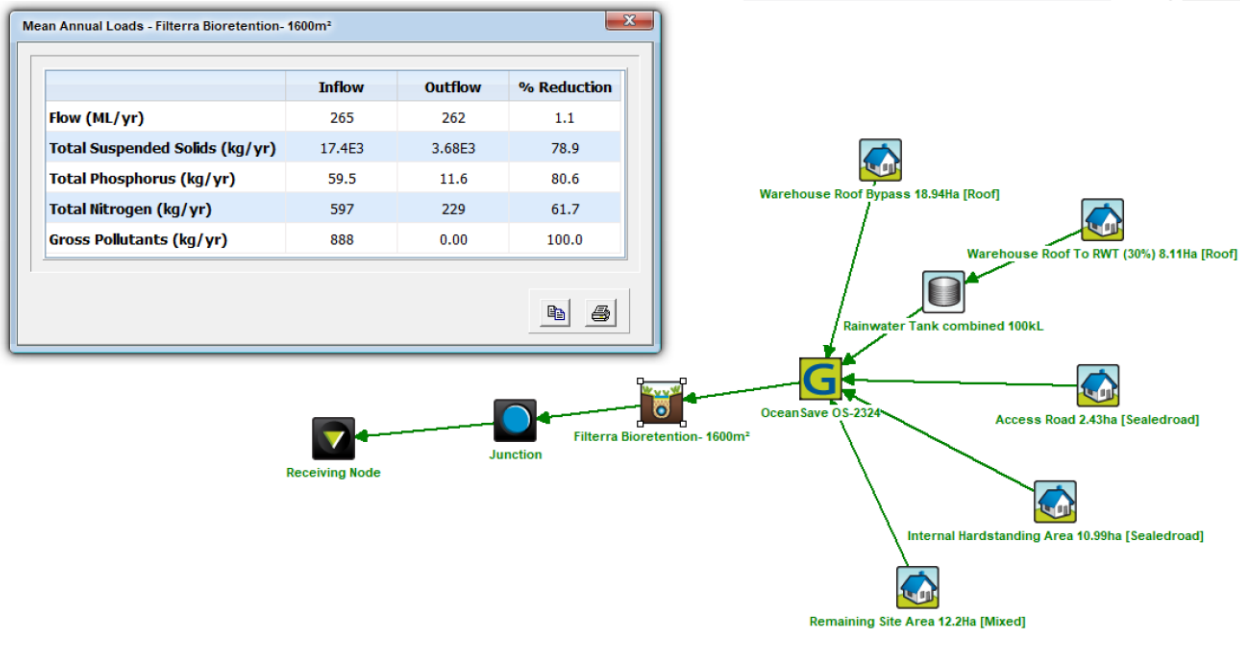


Figure 2 Extract from MUSIC model of proposed development at Aspect Industrial Estate

MUSIC modelling of the proposed development predicts that the 1600m<sup>2</sup> Filterra biofiltration system (over the 10-year modelling period) will achieve 79%, 81% and 62% removal of average annual TSS, TP and TN loads. Again, these are similar to the observed observed ER's (from the monitoring at the Filterra biofiltration system at Kingswood) of 80, 83 and 49% respectively. The average annual TN removal predicted by MUSIC for this project (of 62%) is higher than the observed TN ER (of 49%). However, given that the average annual TN load removal target for the proposed development is 45%<sup>1</sup>, it is largely academic how much above 45% MUSIC predicts average annual TN removal.

The use of the MUSIC bioretention node (with properties consistent with Table 3-1 of the aforementioned report) is also consistent with the advice given in the peer review reports provided by Ralf Pfeleiderer and Damian McCann (provided in Appendices E and F respectively), and summarised in Sections 2.7.2 and 2.7.3 respectively of the aforementioned report. This recommendation is also consistent with the advice given in the eWater (2014) *MUSIC User Guide* and Water by Design (2010) *MUSIC Modelling Guidelines*. Further information in relation to this is provided in Section 3 of the aforementioned report.

I am subsequently confident that the aforementioned criteria is complied with.

<sup>1</sup> Penrith City Council (2017). *Policy document - Waste Water Urban Design (WSUD) Policy*  
[https://www.penrithcity.nsw.gov.au/images/documents/policies/EH%20003%20Water%20Sensitive%20Urban%20Design%20\(WSU D\)%20Policy.pdf](https://www.penrithcity.nsw.gov.au/images/documents/policies/EH%20003%20Water%20Sensitive%20Urban%20Design%20(WSU D)%20Policy.pdf)



## Additional information

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Attached to this correspondence is the report, *A review of the application of Filterra® Biofiltration Systems in Australia* (Dalrymple et al, 2020). This report provides an analysis of the application of Filterra biofiltration systems as a stormwater treatment asset within Australia, including government approvals, case studies, treatment performance monitoring, life cycle cost analyses, and answers to frequently asked questions.

Recommended approval conditions for Council to consider for the use of Filterra biofiltration systems within Penrith City Council are:

- **Sizing and predicted performance:** The treatment performance of Filterra® biofiltration systems should be modelled using eWater’s MUSIC software, with the MUSIC bioretention treatment and appropriate properties as outlined in Table 3-1 of the report *A review of the application of Filterra® Biofiltration Systems in Australia* (Ocean Protect 2020). It should however be noted that, as recommended in the aforementioned report, a Filterra biofiltration system with a filter area equal to 0.3% of the upstream catchment is likely to provide optimal treatment performance. Whilst MUSIC may indicate a Filterra biofiltration system with a smaller area than 0.3% of the upstream catchment may be able to achieve given stormwater quality objectives, it is recommended that a Filterra® biofiltration size of 0.3% of upstream catchment be applied.
- **Application:** Council will accept the application of Filterra biofiltration systems for publicly and privately owned sites.
- **Implementation:** Filterra biofiltration systems must be appropriately designed, constructed, and established in accordance with approval conditions, approved plans, Stormwater Quality Management Plan, *Filterra Technical Design Guide* (Ocean Protect 2019, or subsequent version) and *Filterra Stormwater Bioretention Filtration System Operation & Maintenance Manual* (Ocean Protect 2019, or subsequent version).
- **Integration:** Filterra biofiltration systems must be integrated into the development’s landscape plan and built forms, with appropriate consideration to the safety of the public and personnel responsible for the maintenance of the system. Maintenance access must be clearly shown on detailed design drawings.
- **On-Maintenance:** Unless otherwise agreed by Council, Filterra biofiltration systems are required to remain ‘on maintenance’ for a minimum period of twelve (12) months and until a performance-based inspection has been undertaken with Council.