

## State Environment Protection Policy (Waters) Review Discussion Paper

Responses to questions in the discussion paper by the Waterway Ecosystem Research Group, The University of Melbourne

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This response document has been prepared by Assoc Prof Chris Walsh, Prof Tim Fletcher, Dr Nick Bond, Dr Yung En Chee, Dr Geoff Vietz, and Dr Fiona Ede: all senior staff of the Waterway Ecosystem Research Group. Our research group has strong interdisciplinary interests in the interaction of ecological, social and economic systems, and particular expertise in issues related to catchment hydrology, freshwater ecology and biodiversity conservation and restoration.

We welcome this opportunity to submit a response to the SEPP (Waters) Review Discussion Paper.

### 1. *What is your understanding of your roles and responsibilities under Water SEPPs?*

As a research group, we do not have any specific roles and responsibilities beyond those that apply to us as individuals. Our aims as a research group are to understand the interactions between landscapes and waterway ecosystems. We seek to identify the elements of stream and river ecosystems that determine their ecological health, and much of our research is targeted at identifying land use and water management practices that degrade or protect stream ecosystems. Our research has primarily involved working with local, state, and federal governments, water corporations, industry and agencies to develop new practices that can protect and restore stream ecosystems.

### 2. *What aspects of Water SEPPs does your organization currently use? How could Water SEPPs be improved to assist your organization's day-to-day operations and longer-term strategic planning?*

The water quality and biological objectives of the current SEPP (WoV) have been central to our research and its effectiveness at driving innovation and improvement in land and water management. Our ongoing catchment-scale experiment in the Little Stringybark Creek catchment (described in detail below) is demonstrating the feasibility of restoring streams degraded by urban stormwater runoff.

A primary driver of the collaboration and investment by our government partners in seeking innovative approaches to environmental protection was the chronic failure of urban streams to meet existing SEPP objectives (i.e. authorities were interested in solutions because they perceived a problem).

A critical aspect of new approaches to effectively protecting streams in urban areas is recognition and proper accounting of the economic and social benefits they provide in tandem with protection of streams. The robust quantification of such benefits is an emerging field. Their realization will require innovative institutional and policy adjustments to ensure equitable sharing of benefits and costs, and this in turn will require leadership and longer-term strategic planning.

Any move to set 'easier-to-achieve' targets in a revised SEPP, even if they are pitched as short-term, increases the risk of reduced incentive to find innovative solutions across policy spaces to achieve the multiple benefits of new approaches to urban water management. Lowering targets risks further deterioration of waterways, making their eventual improvement that much more difficult and expensive to achieve.

The Water SEPPs could thus be improved by using objectives that are mechanistically linked to a) ecological functions that determine beneficial uses, and b) management actions that address the stressors causing degradation.

3. *Do you have any concerns about the proposed working title of SEPP (Waters)?*

No. The linking of surface and ground waters into one policy is an improvement.

4. *What is the best way to reflect what is feasible versus what is aspirational in the context of a 10-year policy cycle?*

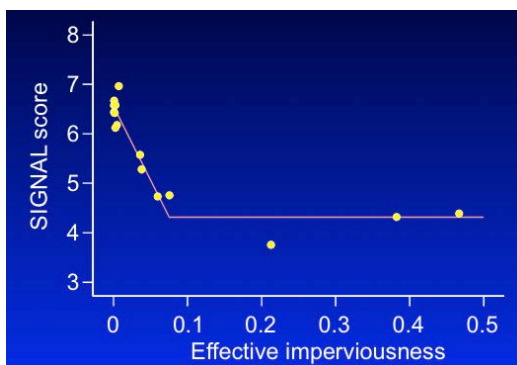
The motivation for this question seems to be that previous objectives have been perceived as difficult-to-achieve in the short term, and have therefore not been widely adopted. In our experience, the existing objectives that some might consider aspirational have been important drivers of innovation over the last decade (see comment on Q2; for more information about the process of gaining support for and developing the Little Stringybark Creek project, see the series of open access papers in the forthcoming issue of the journal *Freshwater Science*(1-5)).

An alternative interpretation of low uptake could be that the existing objectives were not adequately linked to appropriate attainment clauses, so that managers were not adequately guided in the appropriate management actions.

Any objectives, whether they be short-term or longer-term, need to be based on ecological understanding so that objectives match the desired beneficial uses. Objectives also need to be matched to management actions explained in the attainment clauses. The reference-based objectives of the existing SEPP (WoV) arguably met the first of these criteria. The urban objectives of the existing SEPP (WoV) did not: they were set at arbitrary points below the rural objectives, and management actions to achieve them were not articulated (6).

The question of feasibility as posed in this question makes it difficult to separate the challenges of increasing the percentage of sites that meet objectives (as portrayed in Fig 3 of the discussion paper) and the challenge of achieving the objectives in any one stream. The former challenge is primarily one of resourcing and prioritization. It seems unlikely that setting lower targets will free up additional resources of management agencies to address threats and degrading processes to a larger number of reaches. Conversely, having clear, evidence-based attainment clauses to guide managers to achieve objectives will allow more judicious investment in activities that will maximize the number of improved reaches at the minimum cost.

The premise that interim short-term objectives are required rests on an assumption of a linear response to management activities. Non-linear responses are arguably more common, often with step responses observed once thresholds have been passed (e.g. the response of streams to conventional urban drainage: Fig. 1). In such cases, a steady increase in the number of reaches across Victoria meeting objectives would be better achieved by targeted, intensive investment in a small number of streams than by lower-level investment spread broadly. If such a strategy were adopted, then 10-year objectives should be set at a level that could feasibly be achieved in a particular stream (if meeting the objective meant meaningful improvement in beneficial uses).



*Fig. 1. SIGNAL score (a biotic index based on stream macroinvertebrate assemblage composition, used in the current SEPP (WoV), and many other instream ecological indicators decline steeply with effective imperviousness (EI: the proportion of a catchment covered by roofs and roads drained by lined stormwater drainage systems). Beyond 5-10% EI (or less) stream ecosystems show similar levels of degradation.*

There is evidence that objectives near those of the existing SEPP (WoV) are achievable within 10 years. Here are two examples.

- a) Contemporary stream research in Victoria is demonstrating that relatively rapid responses of biological communities in degraded rural streams following restoration of riparian zones, which serve to protect stream ecosystems. In Arthurs Creek to the north-east of Melbourne, extensive riparian planting and implementation of farming practices to protect riparian zones has shifted, in less than 10 years, the macroinvertebrate assemblage from measurably degraded, typical of rural streams in cleared landscapes to a condition that is similar to that observed in comparable forested catchments (Fig. 2).

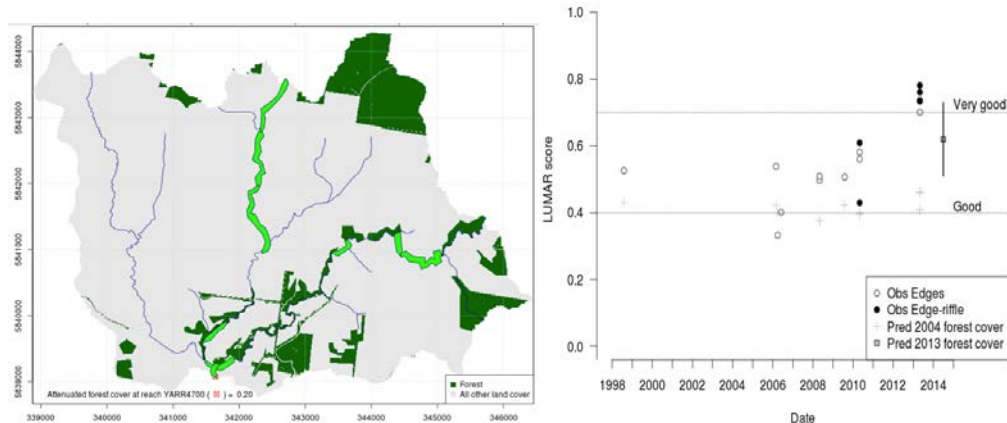


Fig. 2. A. Increase in forest cover along Arthurs Creek from 2004 (dark green) to 2013 (additional forested areas outlined in light green). B. Increase in LUMaR score since 2006, based on macroinvertebrate samples collected by Melbourne Water. LUMaR is a new index for the Melbourne region that is based on predictions of family distributions using urban and forest cover impacts as predictor variables. It is a better indicator of stream condition than SIGNAL or AUSRIVAS scores in the Melbourne region (7). Observed LUMaR scores are illustrated as circles, and show that before riparian reforestation in the late 2000s, scores were close to values predicted for the creek assuming an attenuated (weighted) forest cover (AF) of 0.2 (light grey crosses). By 2013, LUMaR scores had increased to slightly better than was predicted for AF = 0.3 (the value of AF achieved by the riparian planting). The 'Very good' line is indicative of scores achieved by sites in forested catchments of the region, comparable to the Forests and Parks objective, while the 'Good' line is comparable to the rural objectives of the current SEPP (WoV)

- b) Little Stringybark Creek is a stream draining the eastern edge of the Melbourne metropolitan area at Mt Evelyn. It was similarly degraded (based on water quality and ecological indicators) to other metropolitan streams of Melbourne, and would normally be considered highly modified.

The works we implemented in the LSC catchment (dispersed retention of stormwater for harvest, evapotranspirational loss, and treatment by filtration, beginning in 2008) have resulted in substantial improvements to the water quality of the stream. The drop in total phosphorus reported tentatively in Figure 3 of (1) has now persisted for 18 months, and has been accompanied by similar improvements in nitrogen and suspended solids. Table 1 shows that before our experimental treatment was complete (2004-2012), LSC failed SEPP objectives for the relevant rural stream segment. In the 18 months since we completed retention works in the catchment, LSC has easily met the objectives for P and N in rural streams, and come close to the objectives for forested streams, and is close to the TSS objective for rural streams.

We have not yet seen predicted declines in EC or improvement in ecological indicators, but we would expect such responses to lag behind changes in the water quality and hydrology responses we have observed over the last 18 months. Nevertheless, the decline in nutrient concentrations suggests that objectives appropriate to rural rivers (or even forested rivers) are not unrealistic for urban streams, if the primary degrading process is addressed.

Table 1. Comparison of SEPP objectives (Yarra segment) for Little Stringybark Creek (LSC) prior to completion of experimental remediation treatment and 18 months following the treatment.

Indicator (all mg/L)	Objective (Forests, maximum)	Objective (Rural eastern, maximum)	LSC before completion of treatment (2004-2012)	LSC 18 months post-treatment (2014-2015)
Total Phosphorus, TP (baseflow [~50th %ile])	0.03	0.05	0.07	0.035
Total Nitrogen, TN (baseflow [~50th %ile])	0.2*	0.6	1	0.5
Total Suspended Solids, TSS (50th %ile)	5	20	6.2	7.5
Total Suspended Solids, TSS (90th %ile)	10	40	105	54

\*It could be argued that a more appropriate objective for forested streams of the Mountain ash forests of the Dandenong and Yarra Ranges should be higher (our forested reference streams have median TN concentrations of 0.8 mg/L)

Thus, from available evidence, existing objectives for Forests and Parks are likely to be achievable within 10 years in rural streams, if appropriate actions such as riparian fencing and afforestation are applied, along with additional measures such as associated water treatment systems for intensive agricultural practices. Similarly, existing objectives for rural streams are likely to be achievable following adequate retention of urban stormwater runoff in catchments of degraded urban streams (and further improvement is likely if riparian restoration is feasible as well).

We see no evidence that any lower objectives are required to achieve the aims of the SEPP. We are concerned that lowering objectives could remove incentives for innovation in environmental protection that could bring with it many other societal benefits (e.g. reduced potable water demand, improved landscape amenity and urban microclimate, etc).

5. *Do you support the proposed SEPP (Waters) objective of "this policy is to protect and improve the quality of Victoria's waters while providing for economic and social development"?*

Yes, we appreciate that economic and social development are important overarching policy objectives. We believe these objectives can be obtained while also protecting and restoring high water quality standards. We also note that investments towards such standards can have a net positive return when a suite of quantifiable benefits are costed.

Restoration can be considerably more expensive than protection and as such there is a future economic benefit of greater current investment in protection. Furthermore, there are myriad social and economic benefits from activities that protect waterways. For example, stormwater harvesting in the urban environment can provide alternative water supplies, reduce the urban heat island effect, and reduce expensive and ongoing channel stability works (8).

6. *Do you support the need to balance economic and social development with overall protection and improvement of water quality for Victoria's water environments?*

Yes, see our response to the previous question, but also see the following response in which we question if the SEPP is the appropriate instrument to be determining the appropriate balance.

7. *What are the challenges of balancing economic and social development with protecting and improving water quality? How should we manage the appropriate trade-offs between them?*

While we agree that environmental protection needs to be weighed against, and as much as possible aligned, with economic and social development we question if the SEPP is the appropriate policy to be identifying and making judgments on trade-offs.

Deliberations on trade-offs associated with policy choices should be transparent and informed by rigorous quantification of the environmental, social and economic benefits and costs. Conventional practice under a development-dominant paradigm has generally underestimated the benefits of environmental protection and the costs of failing to protect it. Social and economic valuation that adequately deals with these problems is a complex, emerging field (e.g. 8). Given that the government has chosen to conduct the SEPP review with 'minimal science', it seems unlikely that an adequate environmental, social and economic assessment is possible as part of this review, even if such an assessment were appropriate. The SEPP review would be better to set targets for environmental protection that are achievable and that protect beneficial uses, providing guidance on what is required to achieve them. It seems inappropriate to pre-empt what society might consider an acceptable environmental outcome for a particular stream. Such a pre-emption runs the risk of stifling innovation for greater societal benefit by underestimating the costs of degraded environments, overestimating the costs of environmental protection measures, failing to recognize co-benefits and thus constructing an inaccurate picture of trade-offs.

It might be argued that replicating the restoration effort applied to the Little Stringybark Creek project would be prohibitively expensive. It is true that to run the project as a short-term experiment in the context of existing regulations required a substantial investment. However, the nett annualized cost per property of meeting the stormwater management objectives required to realize the observed improvements in LSC was ~10% of the cost charged by water authorities for removal and treatment of wastewater. (Importantly, the nett cost only accounts for the value of water harvested, not other benefits provided by retention of stormwater in catchments, such as improved flood mitigation, urban cooling etc., and in receiving waters such as Port Phillip Bay, in terms of maintaining seagrass nursery habitats for fisheries, swimming opportunities etc.).

Appropriate environmental protection objectives to encourage stormwater management for stream protection could provide stimulus for the creation of new markets to allow trade of the multiple benefits of such stormwater management. Objectives that set a lower target for streams perceived as being 'highly modified' would deprive the community of such economic opportunities. They would also ensure perpetuation of inaction towards ecologically successful restoration of currently degraded streams.

8. *Do you foresee any problems or opportunities that may arise from creating one consistent SEPP to apply to all Victorian waters? Are there other options for streamlining the policies that we should consider?*

We don't see any problem in this approach. Indeed, there are arguments that such an approach create an equity and certainty which is preferred by many stakeholders, including developers.

9. *Are there any specific types of water environments, for example, a wastewater treatment lagoon, where you think beneficial uses should not be protected?*

Meso- and large-scale human-constructed freshwater environments that have become an important resource for wildlife such as the Melbourne Water Western Treatment Plant and Bairnsdale Wastewater Treatment Plant have well-established environmental values and beneficial uses that should be protected.

Stormwater wetlands are increasingly popular for treating urban runoff, and since they have many features of natural wetlands, can provide habitat and resources for wildlife. However, they accumulate pollutants as part of the stormwater treatment process and are potentially 'ecological traps' (9). Stormwater wetlands may turn out to only provide beneficial uses in the short-term, while creating ecological liabilities in the longer term. Careful consideration needs to be given as to whether such water environments warrant protection.

10. *Do you think the current measures for classifying surface water and groundwater segments are still appropriate? Are there other measures that should be explored?*
11. *Are there any problems with the spatial arrangements or segment boundaries in the existing Water SEPPs?*
12. *What do you think are the advantages or problems with the new approach to segments or subsegments?*

The human induced sub-segments are unnecessary – particularly that for urban waterways. Such an approach is likely to be counter-productive over the longer term, allowing further degradation, missing out on “opportunistic” improvements that can accrue at minimal cost as part of ongoing redevelopment works, and making any future improvements more expensive and less feasible.

The current Yarra schedule includes an additional western streams segment, which makes physiographic sense, but this is lost in the proposed segments. It would be good to retain this (and perhaps more broadly divide the cleared hills and coastal plains based on runoff).

13. *Are there any features of the landscape that you would like to see as a standalone segment?*

There are specific waterway types that warrant special protection. While they may not easily be classified as standalone segments, ephemeral stream and rare types of waterways such as chain-of-ponds require special protection and could be singled out for attention in segments.

14. *Do you believe that all beneficial uses set out in Table 2 should still be protected under the new SEPP (Waters)? Where do you think a beneficial use would not apply?*

The existing beneficial uses seem reasonable. We question why important uses such as the fish passage and indigenous riparian vegetation, that are important throughout the state are restricted to the Yarra segment.

15. *What method or approach could be used to apply the beneficial uses to segments?*
16. *Are there additional beneficial uses that you believe should be protected? Are there any that you think should no longer be protected?*
17. *What do you think about the current indicators, the approach for deriving objectives and the proposed changes?*

We reiterate that objectives are most meaningful when they are mechanistically linked to a) ecological functions that underpin beneficial uses, and b) management actions that target the stressors causing degradation.

Biota are a fundamental objective (i.e. something people care about in its own right) so biologically-based indicators or indices are appropriate (as well as being useful indicators of water quality and broader ecological health). While there are problems with the applicability of some indices (e.g. of AUSRIVAS scores; see (6)), analogous but more robust indices can and should be developed. The LUMaR index for the Melbourne region shows promise in this regard (7).

Geomorphic indicators can also be readily applied to protect streams from physical degradation that affects both biota and infrastructure. For example, flows

that mobilise bed sediments can be mechanistically determined and used as targets for stormwater attenuation and harvesting (10)

18. *How have nutrient load targets been useful in driving environmental investment outcomes? Would you like to see a different approach, and if so, what might that be?*

Loads targets are appropriate for large receiving waters, and their consideration is critical in recognising the role of high volume events in delivering dissolved and suspended constituents to receiving waters. At the same time, the dominance of loads reduction targets for Port Phillip Bay has seen the proliferation of large stormwater treatment wetlands that have produced no detectable benefit to running waters, and in many cases have obliterated streams by being built on existing waterways. There is thus a risk of perverse outcomes in focusing on loads reduction targets without also considering other ecological risks and benefits. The creation of a separate urban segment with reduced objectives would increase the risk of such perverse outcomes.

19. *What is the preferred method for management of at-risk areas? Are there activities that need greater intervention or regulation? What would the intervention be, or example, voluntary or mandatory codes of practice, regulation via licencing?*

There is a need for strong regulation of urban stormwater runoff in greenfield, urbanizing areas. Recent work evaluating stormwater management options for urban developments in the headwaters of Merri Creek demonstrate that with sufficient foresight and planning, much higher standards of environmental protection are possible and potentially cost effective. However, this will only come about following careful planning and sufficient regulation of subsequent developments. As noted previously, the often strong threshold relationships in the response of aquatic ecosystems to land-use change requires that achievement of pre-determined targets will be critical in realizing the benefits of increased environmental protection (11). We suggest contacting Lauren Mittiga at Melbourne Water for further information about this work.. We would argue that such regulation applied more widely is necessary to achieve the long-term improvement of streams in urban catchments at low cost (or more likely, nett benefit, given the water savings, flood mitigation and load reduction benefits that accrue from such an approach).

The preservation of riparian areas and upland drainage lines as parklands in greenfield developments can provide significant benefits for retaining of runoff from urban developments. There appears to be little protection for riparian zones under present legislation, despite the interest in floodplain space provision stated by the Victorian Waterway Management Strategy. If the SEPP addressed this it would strengthen the potential protection of water quality and quantity as well as meet the SEPP objective of aligning with appropriate strategies.

20. *What do you think the role of SEPP (Waters) should be in identifying and filling knowledge gaps over the life of the policy? How can we assure an adaptive approach within SEPP (Waters)?*

The two examples (one rural and one urban) of significant stream health improvements due to interventions demonstrate that understanding of what environmental outcomes are feasible and economically viable will (and should) change over time, as a result of innovation. The SEPP needs to be embedded in a framework that pro-actively seeks to learn from such insights, and indeed attempts to encourage and drive such innovation.

## References

1. C. J. Walsh, T. D. Fletcher, D. G. Bos, S. J. Imberger, Restoring a stream through retention of urban stormwater runoff: a catchment-scale experiment in a social-ecological system. *Freshwater Sci.* **35**, XXX (2015) <http://www.jstor.org/stable/pdfplus/10.1086/682422.pdf>.
2. T. Prosser, P. J. Morison, R. A. Coleman, Integrating stormwater management to restore a stream: perspectives from a waterway management authority. *Freshwater Sci.* **35**, XXX (2015)
3. M. J. Burns, E. Wallis, V. Matic, Building capacity in low-impact drainage management through research collaboration. *Freshwater Sci.* **35**, XXX (2015) <http://www.jstor.org/stable/pdfplus/10.1086/682421.pdf>.
4. D. G. Bos, H. L. Brown, Overcoming barriers to community participation in a catchment-scale experiment: building trust and changing behavior. *Freshwater Sci.* **35**, XXX (2015) <http://www.jstor.org/stable/pdfplus/10.1086/682421.pdf>.
5. C. J. Walsh, T. D. Fletcher, Stream experiments at the catchment scale: the challenges and rewards of collaborating with community and government to push policy boundaries. *Freshwater Sci.*, XXX (2015) <http://www.jstor.org/stable/pdfplus/10.1086/682394.pdf>.
6. C. J. Walsh, Biological indicators of stream health using macroinvertebrate assemblage composition: a comparison of sensitivity to an urban gradient. *Mar. Freshwater Res.* **57**, 37 (2006)
7. C. J. Walsh, J. A. Webb, "Predicting stream macroinvertebrate assemblage composition as a function of land use, physiography and climate: a guide for strategic planning for river and water management in the Melbourne Water region." *Melbourne Waterway Protection and Restoration Science-Practice Partnership Report 13-1* (Department of Resource Management and Geography, The University of Melbourne, Melbourne, 2013).
8. G. J. Vietz, I. D. Rutherford, C. J. Walsh, Y. En Chee, B. E. Hatt, in *Australian Stream Management conference, Catchments to Coast* G. J. Vietz, I. D. Rutherford, R. M. Hughes, Eds. (Townsville, Queensland, 2014), pp. 518–524.
9. R. Hale, R. Coleman, V. Pettigrove, S. E. Swearer, Identifying, preventing and mitigating ecological traps to improve the management of urban aquatic ecosystems. *Journal of Applied Ecology*, (2015)
10. R. J. Hawley, G. J. Vietz, Addressing the urban stream disturbance regime. *Freshwater Sci.* **36**, XXX (2016)
11. C. J. Walsh, N. Bond, T. D. Fletcher, "Possible ecological futures for Merri and Darebin creeks." *Melbourne Waterway Science-Practice Partnership Report 13-2* (The University of Melbourne, Melbourne, 2013).