RECENT EXPERIENCES PLANNING FOR STORMWATER VOLUME TARGETS

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ABSTRACT

Over the last 5-10 years, stormwater and waterway managers in Australia have begun to update their stormwater management requirements and guidance to include volumetric targets. These targets are typically expressed as volumes of stormwater to be harvested or infiltrated for every additional hectare of impervious surface created as a result of urban development.

This paper will examine case studies from Melbourne and Sydney in Australia to compare and contrast the methods adopted for identifying a suitable volumetric target, and what the results have meant for industry acceptance and implementation.

Traditional stormwater quality targets, that have been applied to developments in Melbourne and Sydney, have required percentage reductions across a suite of pollutants: typically total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS) and gross pollutants. While volumetric requirements have also been included as a requirement, they have not typically been rigorously enforced.

Pollution reduction requirements have been a part of the development landscape for many years. In Melbourne, the Victorian Planning Provisions enshrined this requirement in 2006. Pollutant reduction requirements are commonly met by constructing treatment wetlands, which receive and treats runoff from the newly urbanised area. While this reduces pollutant loads, there are significant increases in the volumes of stormwater being conveyed downstream.

Recent research has identified increased volumes of stormwater as the single biggest threat to waterway health in urban areas (Russel *et al*., 2020). Melbourne Water's Healthy Waterways Strategy (2018) states that "*Stormwater runoff from impervious surfaces via pipes to streams is the main reason for altered flow regimes and poor water quality*". Impacts include the destruction of the waterway's physical form, loss of habitat, amenity and increased levels of pollutants reaching waterways the coastal areas they feed.

This recognition has led researchers and water authorities to try and understand the level of volumetric reduction required to protect waterway values. The question of 'values' is an important one as it ultimately influences the volume of stormwater that may need to be removed from the urban catchment. In Metropolitan Melbourne, the Healthy Waterways Strategy has adopted target to protect the nine waterway values defined in that strategy, including macroinvertebrates, physical form and other key species of fish and frogs.

This 'whole of ecology' approach has led to the adoption of targets that essentially aim for a pre-development hydrology in an urbanised landscape. From a research perspective the targets have evolved from the work of Zhang (2001) who "quantified the increase in total volume resulting from urban stormwater runoff, by comparing annual streamflow volumes from undeveloped catchments with the volumes that would run off impervious surfaces under the same rainfall regimes".

This work was the basis of curves that summarised the volume of runoff that would need to be removed from urbanised catchments that were originally forest, grassland or somewhere in-between. Two methods were proposed to achieve these targets: stormwater harvesting (the black curve in Figure 1) and infiltration (grey curve). The curves in Figure 1 show that in Metropolitan Melbourne, where rainfall can range from approximately 600-800mm per Anum, that harvesting targets can range from roughly 4 – 5 ML/impervious ha/year

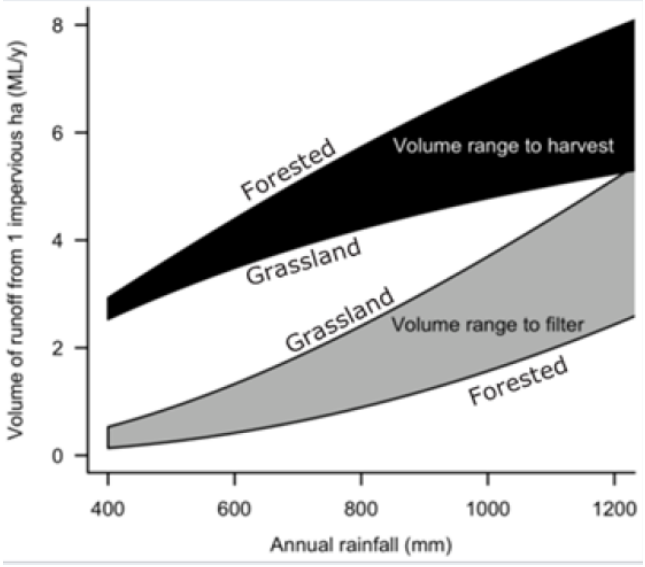

Figure 1: Impervious runoff volumes to be harvested and infiltrated to approach pre-development hydrology (Wals et asl, 2012)

In New South Wales (NSW) the Department of Planning and Environment (DPE) developed volumetric targets to be applied across the Western Growth areas of Sydney to protect the Wianamatta-South Creek and specifically for "managing stream bed and bank erosion", or the physical form of the waterway. The Wianamatta-South Creek stormwater management targets (2022) state that it is "not feasible to limit post-development stormwater flow volumes to the existing (or pre-development) mean annual flow volumes (0.9 ML/ha/year)". This conclusion was arrived at through a process that began by calibrating MUSIC modelling software (industry standard WSUD software) to the catchments being developed. Using MUSIC, the flow duration curves for pre (calibrated) and post development scenarios were modelled. A range of feasible Water Sensitive Urban Design strategies – from regional to lot scale – were then modelled to understand if WSUD could be applied to the developed catchment to mimic pre-development hydrology.

The conclusion was that flow events up to the 96th percentile could be matched, limiting flow volumes to 1.5 – 2.5 ML/impervious ha/year. The conclusion from the IWM plans prepared for Western Sydney is that the most efficient way to achieve the targets is via a centralized, regional stormwater network that will provide treated stormwater to industrial lots and to the landscape.

While sub-catchment targets are defined within Metropolitan Melbourne's Healthy Waterways Strategy, there is no direction as to how these will be achieved.

Sydney and Melbourne adopted different approaches that yielded different results. Melbourne's targets are typically higher and consequently more technically challenging to meet. The reason for the higher targets is the foundational pursuit of a pre-development hydrology to protect all waterway values, including macroinvertebrates while not considering feasibility in detail. This compares to the Sydney approach model that seeks to protect the physical form of waterways (a lesser ambition in terms of flow reduction)

while also considering feasibility. The Sydney approach also examined a range of WSUD options and combinations that could theoretically achieve the targets.

While the Sydney Strategy first identified possible and then ultimately a preferred approach, the stormwater industry in Melbourne did not initially establish how these targets might be met. Over time it became clear that the volume reduction targets cannot be met with on-lot or precinct scale interventions alone and a regional approach is likely required. While this conclusion is the same as Sydney, conceptualising a regional scheme to collect approximately 75% of total average annual runoff resulted in an arguably more expensive scheme.

The critical issue is implementation. In this presentation we will compare experiences to date and provide learnings for the New Zealand industry and those who may be interested in pursuing similar approaches. For example:

- Sydney Water have begun the process of incorporating scheme infrastructure into the Developer Contributions Plans (DCP) for the catchment. As such developers have a formal requirement and process by which to contribute to the scheme and Sydney Water will begin to collect funds for constructing time critical infrastructure.
- Conversely in the growth areas of Melbourne, where the targets theoretically apply, there is no existing requirement for developers. The drainage schemes prepared by Melbourne Water that define the need for wetlands, constructed waterways and retarding basins, do not yet include any mention or requirement for the volumetric reduction of stormwater. Without this, the area of catchment that might one day have its stormwater collected in a regional scheme is reducing with time as urban development proceeds at pace.

Using recent experiences in Melbourne and Sydney our presentation will focus on the core question:

What targets are the right targets and what are you trying to protect?

Theoretically, the values within the Healthy Waterways Strategy (Melbourne), from macroinvertebrates to fish and platypus, are likely to require different stormwater reduction targets. It would be valuable to be able to understand the magnitude of volume reduction required to protect each of those values and what it would cost to meet those targets. This requires a more in-depth ecological analysis of the impact of urban river flow regimes on waterway form, relevant species and the cultural and social values the waterways provide.

However, if the magnitude of volume reduction can be partitioned in this way, an informed decision (and discussion with the communities invested in those waterways) could be made that considered both what can feasibly be protected and what that might cost. In doing so there may be a greater likelihood of industry acceptance and adoption. Providing high level estimates of the cost of protecting particular values (or a collection of values) to communities during strategy development allows stakeholders to make informed decision about the trade-offs they may or may not be willing to make to realise their aspirations for urban waterways.

Keywords

Stormwater, Targets, Case Study, Melbourne, Sydney, Waterway Values.