A multi-functional, multi-compartment constructed wetland to support urban waterway restoration

Focus
The study illustrated the performance of a multi-compartment constructed wetland in Perth, WA: Wharf Street Constructed Wetland (WSCW). The wetland aimed to restore a degraded urban drainage system to improve urban liveability by preventing stormwater nutrients enter the Canning River whilst also providing public space and improving local amenity.

Approach
WSCW is managed by the City of Canning (WA), and covers a surface area of ~1ha. It is comprised of two Surface Flow (SF1 and SF2) and two laterite-based Subsurface Flow (SSF1 and SSF2) compartments (Figure 1). Performance was assessed by computing nutrient attenuation as standardized delta concentration (SDC) for base flow (Figure 2) and event flow (Figure 3 & 4) conditions. The long-term average attenuation was then computed.

Findings

Site: Wharf Street Constructed Wetland

Figure 1: Overview of WSCW indicating multiple compartments and different sampling points. Water enters through WDRRAIN, WHL3 and WHBC points. The SDC was computed comparing the INLET and OUTLET of each compartment: SF1: WHDRAIN and WHW1; SSF1: WT2 and WT3; SSF2: WHW2 and WT5; SF2: WHBC and WHW3

Figure 2: Long-term (2009-2014) nutrient attenuation by the different compartments during base flow conditions. Attenuation computed as SDC (+100% indicates complete removal).

Figure 3: Event sampling (17-21 June, 2014) demonstrates nutrient variation throughout a storm and reduction in concentration between the inlet and outlet

Figure 4: The degree of nutrient attenuation during a storm varies based on storm magnitude

Summary
5yr average estimate of nutrient attenuation by WSCW under different flow conditions:

<table>
<thead>
<tr>
<th></th>
<th>Base flow</th>
<th>High flow</th>
<th>Storm event</th>
</tr>
</thead>
<tbody>
<tr>
<td>TN</td>
<td>32%</td>
<td>46%</td>
<td>41%</td>
</tr>
<tr>
<td>TP</td>
<td>60%</td>
<td>48%</td>
<td>66%</td>
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</tbody>
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In addition, the restoration improved the ecological services of the urban waterway by providing a diverse area for habitat and recreational activities.

Findings

The degree of nutrient attenuation during a storm varies based on storm magnitude.

Acknowledgement: Peter Adkins, DPaW