



Maintenance of WSUD assets by Local Governments in Perth

Prepared for the
Water Sensitive Transition Network

By New WATER Ways Inc

September 2021

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Department of **Planning, Lands and Heritage**
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Building the water sensitive urban design capacity of Government and industry to improve the delivery of urban water management and water sensitive cities.

Our objective areas are:

Knowledge sharing - provide easy access to best practice and supporting WSUD information including trusted science, technical tools, current policy, and existing programs

Safe and healthy communities

Bridging - promote effective partnerships by acting as a bridging organisation for the WA water sector

Green, attractive places

Healthy environments

Education, science and training - make WSUD “normal practice” by facilitating the upskilling of WSUD practitioners to deliver best practice for Western Australia based on trusted and reliable science

Advocacy and leadership - provide leadership and advocacy for the adoption of best management and planning practices for WSUD in Western Australia

1 INTRODUCTION

The cost of Water Sensitive Urban Design (WSUD) asset maintenance has repeatedly been suggested as a barrier to the implementation of these systems, however the findings from a scoping exercise undertaken in 2020 suggest the reasons are more complex than just cost.

This project sought to further explore the key issues and document the current status of selected Perth and Peel local government WSUD asset maintenance practices to underpin recommendations for future research and/or capacity building activities.

1.1 Background

The maintenance of vegetated assets is often raised as a barrier to the implementation of WSUD solutions. This was recognised by the Water Sensitive Transition Network in 2017 and the *Vision and Transition Strategy for a Water Sensitive Greater Perth Implementation Plan 2019–2021* contained two actions as follows:

Action 3.1 - Document and quantify benefits of public and private open space and green infrastructure, including maintenance costs, to support ongoing maintenance commitments by local governments (link to action 4.7)

Target - Gather financial information on lifecycle benefits and costs of WSUD vs conventional drainage/POS with a focus on maintenance and share comparison via a database of information (Research Sub-committee)

Action 4.7 - Share economic valuation methods to support business cases for different scales and beneficiaries (including maintenance of water sensitive systems). (Link to action 3.1)

Target - Life cycle cost/benefit information for a range of treatments at various scales is readily accessible. Develop a business case for maintenance that is used by local governments to obtain support for appropriate levels of resourcing (Technical Capacity and Partnerships sub-committee)

A project was initiated in 2020 which aimed to address Action 3.1 in full and action 4.7 in part.

1.1.1 Key findings from phase one

The phase one project found that local governments are generally not collecting maintenance data (cost or maintenance activities undertaken) and cannot quantify the cost or benefits of WSUD assets. Thus, it was not possible to compare the cost of WSUD system maintenance with the cost of conventional drainage solutions at that time.

The phase one study identified a number of issues that influenced the delivery of WSUD asset maintenance, which included:

1. Skills and knowledge – Maintenance of WSUD assets requires knowledge of both vegetated systems and hard drainage assets so that all functions are understood and are maintained. These skills are traditionally held by separate teams (eg. landscaping and engineering), leading to disconnected maintenance delivery where only one function was only addressed at a time (eg.. either flood protection or general aesthetics).
2. Available resources – There is a general lack of support for spending on services (people) in preference to civil works. This is compounded by budgetary processes that are often disjointed and ad-hoc.

3. Planning, monitoring and audit – There is a lack of planning, tracking and/or recording of maintenance activities that are undertaken. This leads to a lack of understanding regarding what/when activities are required; reduced knowledge transfer and capacity building within maintenance teams and the wider agency; and an inability to justify budgets or quantify benefits.
4. Executive support – Maintenance is more effective in areas where there is an awareness of the multiple outcomes and associated cost benefits that WSUD assets provide and where this aligns with community values and goals.
5. Team integration – There is often a lack of communication between asset management teams and asset design and construction teams, including planning and/or engineering. This reduces the ability of local government teams to learn from experience and identify local preferences for particular designs or methods of construction. There is also a lack of shared learning across the industry, as knowledge on WSUD maintenance acquired by one local government is not shared with other local governments, which reduces the ability of the industry to adapt and improve practices.

The report recommended that consultation was undertaken individually with local governments to further explore the issues.

1.2 Project delivery

A series of workshops were held with eight local governments. It was considered that these local governments represented the variety of development and site contexts across Perth and Peel as follows:

- Armadale, Serpentine-Jarrahdale and Swan – new assets, greenfield development, heavy soils.
- Bayswater, Canning and Victoria Park – infill development, retrofit assets on sandy soils.
- Kwinana - new assets, greenfield development, sandy soils.
- Mundaring - new assets, greenfield development, heavy soils and slope.

Each workshop was attended by staff from planning, engineering, parks, landscape and asset management business groups to enable a comprehensive discussion of the issues faced by each area. The discussion was focussed on images of WSUD assets found within their municipality and sought to explore issues related to maintenance that were associated with each asset type. Participants were also asked to consider the type of information they felt would support improved maintenance practices as follows:

1. providing an evidence-based justification of costs to support inclusion of WSUD assets into the public realm. This could be extended to a cost-benefit analysis that also considers non-monetary benefits if desirable;
2. support for getting budget for maintenance activities;
3. improving knowledge so design and construction practices improve; and/or
4. improving knowledge so maintenance delivery is improved.

The discussion and recommendations from the local government workshops are summarised in the next sections.

2 KEY ISSUES

The following section provides a summary of key issues identified during the local government workshops under the previously identified headings. Although the linkages between the themes is also noted.

2.1 Skills and knowledge

Most local governments have sufficient skills and knowledge to effectively maintain their WSUD assets either through in-house expertise or the use of contractors. The local governments with predominantly older drainage systems noted less opportunities to gain this knowledge (due to lower numbers of WSUD assets in the municipality) but it was generally recognised that there was a need to develop these skills.

However, some disconnection was observed when different teams were assigned to manage different parts of the public realm. For example, the parks team would maintain the lawn; the environmental team would maintain the vegetated areas; and the engineering team would look after the pipes and basins. This was seen to lead to inefficiencies, as different teams would need to travel to each site to undertake similar activities. A greater level of effectiveness was observed where either the staff held a mix of skills and knowledge (i.e. understood the function of the asset and could manage both the water and the vegetation) or the full range of skills were present in a team.

Outcomes were improved where asset management systems, particularly those with GIS interfaces were available. This was because the asset management systems improved the level of awareness of the asset base, its value and provided a tool to facilitate improved planning and communication. However, it was recognised that asset staff need support to access and utilise some of the information.

2.2 Available resources

Limited resources were a common theme, but most obvious in the outer growth local governments. This is largely due to the rate at which assets are being constructed and handed over without any increases in asset management staff numbers. It was considered that asset handover should be accompanied by a schedule of activities undertaken by the developer during the maintenance period and or instructions on maintenance requirements; however, it was recognised that planning to take over the asset should have occurred much earlier – possibly at the approval stage, to provide sufficient time for budget allocation and staff allocation.

While the need for better control of building sites was recognised as being critical, almost no resources are provided for compliance. It was also considered that a maintenance bond for construction of WSUD assets as part of development was important (particularly in flat areas where small changes in landform can significantly impact the direction of planned water flows, thus needing retrofits). A bond would also incentivise adequate maintenance during the construction period (prior to handover) when the impact of fines and cement dust can have an adverse impact on the infiltration capabilities in WSUD systems, and therefore the post development operating ability, if not maintained properly prior to handover.

In addition, where WSUD solutions are incorporated into retrofits or revitalisation projects, this needs to be accompanied by an increase in resources to facilitate the increased level of service. This is occurring in some large projects but is hampered by a lack of knowledge of what the costs are likely to be.

Agencies that had sufficient resources were generally those with staff that actively requested budget and were willing to allocate time and resources for these tasks. This was often justified through links to corporate or community goals.

2.3 Planning, monitoring and audit

Most local governments noted the difficulty with determining the real costs of WSUD asset maintenance. This was generally because specific activities and locations were not recorded. Furthermore, where maintenance is reactive (which was mostly the case), this was acknowledged as costing more than if the activities were scheduled.

Where design responses were considered to be less than optimal, an opportunity was identified to monitor the actual performance of recent developments and use this to inform the assessment of future designs. This would also assist in identifying design aspects that were most effective under a defined set of conditions.

The local governments that were utilising asset registers noted the value of these systems, particularly for understanding their asset base. Some felt the systems could be better utilised, such as including an asset value which could then be depreciated, or by noting proximity to sensitive environmental receptors.

2.4 Team integration

Most local governments had effective processes for engaging planning, engineering, landscape and assets in discussions about new development, although the engagement of the assets team was quite recent in many instances.

One of the largest gaps was in providing feedback to planning and engineering on the actual performance of constructed assets to improve future designs. In some instances, the feedback was only about what maintenance crews didn't like and it was noted that feedback on what worked well would also be useful. Regular surveys (from different teams) getting feedback on the full range of assets would provide a more balanced view of what works effectively.

Where local governments were delivering a coordinated program of asset maintenance and upgrades, other opportunities were noted (e.g. road upgrades with additional soakwell and/or tree pit installations), as this maximised the use of resources, and in some instances, allowed budgets to be combined to deliver additional outcomes.

2.5 Executive support

The allocation of resources to maintain WSUD assets occurred more frequently in local governments where the multiple benefits of vegetated systems were recognised and where these outcomes were supported by other strategies such as biodiversity, Net Zero, urban heat, Public Open Space and/or urban forest strategies. This was further supported where these outcomes were also strongly supported by the community and were included in local government Strategic Community Plans. Implementation of WSUD strategies was more challenging in areas where there was a lack of community support for vegetation and/or trees.

Another success factors recognised by some local governments was the presence of WSUD champions, or staff that had sufficient technical knowledge to deviate from standard designs or criteria. This often required an understanding of real vs perceived risk to the local government which could be supported (or justified) with local knowledge and/or demonstration.

3 DISCUSSION

All the local governments that contributed to this project actively support the implementation of WSUD – both through the planning and development process and as part of asset management (retrofit and revitalisation). There was across-the-board recognition of the multiple benefits of WSUD and that these benefits to the community provided sufficient support for the resourcing of maintenance activities. In some instances however, the magnitude of the resourcing (staff) was not sufficient to cope with the increases in asset numbers or the increased range of skills required.

The larger local governments noted the difficulty in obtaining support for additional staff required to take on the newly created assets. Transitioning to a circular economy ethos may assist in shifting the mindset away from capital expenditure to service expenditure. This is critical so that local governments can invest in people to maintain (and enhance) standards of amenity for the community, rather than build assets for future replacement.

Maintaining vegetated WSUD assets requires a significant shift in the level of service for conventional parks and streets and most local governments noted the opportunity to define and designate a level of service as an indicator of the level of maintenance. It was considered important to identify this at the design phase, in the context of the other assets across the area, so that maintenance budgets could be allocated early. It would also reduce the number of complaints after asset handover, which often occurred if the local government was not able to maintain the asset in a similar state to the developer.

Almost all local governments noted that WSUD designs were most effective where they were bespoke and responded to the local site conditions and urban environment. Local governments with shallow groundwater noted that this generally had the greatest impact on asset function. It was recommended that WSUD asset design in areas with shallow groundwater is supported by a site water balance that accurately predicts changes in groundwater levels.

Local governments in greenfield areas noted that the highest levels of maintenance were generally associated with issues that arose from poor construction. In some instances, this was due to landscape contractors not understanding the importance of levels, which resulted in water flowing in the wrong directions and the need for retrofits (eg. soil levels or vegetation being established too high, so stormwater is not able to flow into/enter WSUD features like raingardens). These local governments also saw the benefit of receiving information on maintenance activities required at asset hand over (similar to that which occurs for irrigation) to assist in planning maintenance needs for the future. A planning condition and/or information in the asset handover checklist could assist with obtaining this information.

However, it was often difficult to plan for future maintenance requirements without an effective asset management system such as Assetic or TechnologyOne, which were GIS-based and could link to the planning approvals system. Although some local governments were transitioning to these types of systems, many others scheduled maintenance via spreadsheets (or not at all), which meant that maintenance activities were often reactive, and therefore time consuming and inefficient.

Some difficulty was noted by local governments with the interaction with Water Corporation infrastructure. Although the significant efforts of the Drainage for Liveability team were noted, this was seen as the exception, with the majority of drainage assets not being maintained at all. It was further complicated where Water Corporation was only responsible for the 10% AEP event and the local government was required to maintain the remainder of the site and function, including management of other storm events. Similarly, many local governments found it challenging to work collaboratively with other infrastructure agencies such as Western Power and Main Roads, and saw this as a lost opportunity to leverage funding for multiple outcomes.

In terms of the information or capacity building to support improved maintenance outcomes, there were no observable patterns in the preferences for options (see section 1.2).

- While there was the highest level of support for “providing an evidence-based justification of costs to support inclusion of WSUD assets into the public realm”, this was a low priority in a few of the local governments.
- Similarly, there was a large variability across the local governments in the level of support for the options of:
 - “support for getting budget for maintenance activities”; and
 - “improving knowledge so design and construction practices improve”.
- The lowest priority across the local governments was “improving knowledge so maintenance delivery is improved”, however it was still seen to be a priority in two local governments.

It is also noted that the choice of topic priority was often largely a response to acknowledging the aspects they did well and therefore didn't need, rather than identifying what they felt would really benefit the organisation. The lack of a pattern or a clear need is potentially a reflection of the skills and knowledge of the WSUD champions and officers within each local government rather than reflecting the different maintenance needs and practices. For example;

- There was no observable pattern on the basis of level of integration or size of Local Government (and asset base), predominant development type (i.e. infill vs greenfield) or site conditions (sand vs clay).
- The local governments that had strong corporate strategy support felt a reduced need for cost-benefit information or information to support budget allocation.
- Those local governments that were actively undertaking a program of retrofits had a reduced need for information to support better design and construction or maintenance practices.

In general, maintenance practices and resourcing seem to be most effective in local governments with strong strategic and corporate support for building sustainable and liveable communities and where asset staff are proactively enhancing and retrofitting their asset base.

While there is a level of support for the gathering of data on life-cycle costing of WSUD asset maintenance that also considers non-financial benefits, it seems local governments would also benefit from a range of capacity building activities that share information on good design, construction and maintenance practices. This training will be most effective where it is provided in the context of the particular site conditions and urban context of the municipality.

4 KEY LEARNINGS

The following is a summary of key learnings:

- Support for WSUD and its ongoing maintenance is enhanced where there is strategic support for the range of benefits and complementary strategies, as well as community support. Educating the community where they live adjacent to a WSUD asset has significant benefits.
- A range of skills is required to maintain WSUD assets beyond traditional park and street maintenance skills. Options for maintenance delivery include skills-based or location based, although cross-disciplinary teams are likely to be the most effective.
- Retrofitting drainage assets into WSUD assets by local government as an in-house project is considered to provide the greatest opportunity for learning and ownership. A coordinated plan of civil and landscape works optimises financial and staff resources.
- Asset management systems improve delivery, particularly where they are integrated with financial systems which track value, as well as maintenance and renewal costs. This allows budgets for maintenance to be incorporated into future business plans.
- Proactive maintenance is more cost effective than reactive maintenance. Maintenance activities should be planned in accordance with agreed levels of service. Levels of service should be agreed prior to approval.
- Design responses should be appropriate (and specific) to site conditions and urban context. Look for opportunities to optimise outcomes rather than compromise to meet guidelines and criteria including access for maintenance and particularly in infill areas where space may be constrained. Ensure designs are supported by accurate context analysis including groundwater movements.
- Maintenance requirements can be minimised through good design and construction. Some of the more supported design elements include:
 - Use of broken kerbs rather than flush kerbs to direct water towards infiltration areas and vegetation. Kerb breaks should be large enough to let a soft drink can in.
 - 600mm unvegetated space at the back of kerb reduces risk to people (but should be greater for higher speed roads).
 - Ensure design is appropriate to soil type and local context.
 - Basins work best where there are trees and good vegetation coverage. Trade off of water quality treatment and even storage capacity should be considered where this will improve the way the basin functions.
 - Biofilters are easier in rear loaded lots due to lack of driveway crossovers. Large biofilters are very difficult to maintain – can't get in. A series of smaller biofilters in parks is often better.
 - Plant trees in biofilters, raingardens and swales (as well as tree pits) as this supports urban forest strategies. Community more likely to maintain a tree than shrubs in a verge.
 - Flat grades and big rocks in living streams result in significant maintenance issues including algae. Optimise through good design of the baseflow channel.
 - Bubble-ups can result in trapped water. Prefer overland or free-draining piped connections. If they are the only solution the need to be cleaned out regularly, particularly where they are collecting builder's sand.

- Biofilter design in commercial areas should consider height of toe (low so cars don't hit them) and location for boot access. Use of grates is supported.
- Permeable pavement is useful to address local flooding issues.
- Access for a ride-on mower is 1.5m (60 inches).
- Vegetation in swales should not require hedging.
- Deeper biofilters are ok with dense vegetation.
- Areas for frequent events should not be grassed.
- Construction phases must include sediment management. These should be extended to house building phases and be supported by compliance monitoring.

4.1 Recommendations

The following recommendations are proposed to improve WSUD asset maintenance delivery in WA.

1. Ensure sustainability and liveability goals are incorporated into high level corporate strategy which includes explicit recognition of the benefits of WSUD.
2. Establish a range of service levels to guide maintenance requirements and ensure level of service is agreed at the approval stage. Support the development of strategic plans to allocate levels across the municipality.
3. Monitor the performance of newly constructed WSUD assets under different site and rainfall conditions to inform the future assessment of designs.
4. Seek to improve feedback loops so asset staff can advise on preferred and non-preferred design and construction practices.
5. Develop Councillor and senior executive support for investment in people rather than projects. The alternative is use of contractors which is not as efficient or effective as utilising in-house skills/staff.
6. Increase programs to educate the community on how WSUD assets operate, and the liveability and amenity benefits they generate.
7. Work with infrastructure agencies to improve coordination of works to enhance outcomes.
8. Prepare "Asset handover packs" for maintenance crew that document what the asset is for and how it works and where the closest environmental receptor is. Include maintenance schedule from developer.
9. Resource compliance officers for building site management to ensure the functioning of newly established WSUD assets are not detrimentally impacted during the construction phase.
10. Continue to work with local governments to build knowledge and skills for the design, construction and maintenance of WSUD assets including consideration of site and development context.

Whole of life cycle costings (both financial and non-financial benefits) would assist in planning for the future. Developing worked examples that document the cost/benefit could assist in supporting individual business cases.

Client: Water Corporation and Water Sensitive Transition Network

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Draft report	V1	SSh	REp	Electronic	30 September 2021

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