Full Paper

Niloo Tara, Brisbane City Council

Maintenance of WSUD Assets – "The good, the bad and the ugly"

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Key Points

- Brisbane City Council Watersmart assets journey
- WaterSmart assets common challenges and issues
- Rectification solutions for Watersmart assets
- Minimum maintenance design solutions

Abstract

Brisbane City Council (BCC) has been implementing Water Sensitive Urban Design (WSUD) approaches in various forms for the last two decades. Like every other form of infrastructure, the stormwater treatment assets constructed as a part of water sensitive urban design (WSUD) require management and maintenance if they are to function as intended. Within BCC, stormwater treatment assets are known as WaterSmart assets. Fully functioning WaterSmart assets help to protect and enhance waterways, as well as contributing to amenity and urban greening.

In recent years, BCC has worked hard to ensure that its WaterSmart assets are managed and maintained appropriately. This work has included developing and updating its WaterSmart Asset Register, undertaking condition assessments of WaterSmart assets and developing a prioritisation method for maintenance and planning purposes. Collectively, these activities have provided a basis from which to quantify and prioritise the future operation, maintenance and rehabilitation needs of the assets.

As a result of this auditing process, Council is currently in the process of rectifying the WaterSmart Assets that require extensive redesign/ maintenance to become functional. This paper will present results of the work undertaken so far, with lessons and case studies to assist other local governments and private asset owners to sustainably manage their stormwater treatment assets.

Keywords

WSUD Assets, Maintenance, Watersmart, rectification, Brisbane, Stormwater Management, Development

Background

Brisbane is the capital city of Australia's fastest growing region, with *Queensland Regional Plan 2009 - 2031* specifying a further 156,000 new dwellings by 2031. All of this growth can put more pressure on the waterways and water sources. Additionally, Brisbane has largely run out of sites for Greenfield development and the majority of the development is occurring in infill areas. To minimise the impact of development, Brisbane City Council has a strong focus on WSUD implementation. *City plan 2014*, *Watersmart Strategy* (2010) all seek achieve the livability of Brisbane by managing water sustainably.

Brisbane has been designing and constructing Watersmart solutions since the early 1990's. Initially BCC developed its own guidelines and tools for these assets but now refers to the Healthy Land and Water guidelines and fact sheets to help with the delivery of WSUD. BCC now only provides standard drawings to guide developers when building these assets.

Implementing WaterSmart stormwater principles in general has had various positive impacts on management of stormwater runoff and the health of Brisbane's waterways by minimising the impacts of development. However, but it has also generated with substantial challenges and issues. This paper focuses on the journey

from acquiring these assets to developing a program of works for maintenance and rectification of the assets. It highlights the common challenges that Council faced from the initial hand over to lifecycle management of the assets. This paper also briefly touches on a current Council project for development of an adopted strategy for stormwater management to further minimise any impacts of rapid growth and development.

Introduction

Since the inclusion of water quality requirements into the development approval process, a large number of WaterSmart assets have been integrated into developments across Brisbane City. The majority of these WaterSmart assets are no longer the responsibility of the developer and are now Council's responsibility for long-term maintenance. This has resulted in a number of challenges to Council due to:

- Absence of a streamlined process to capture the spatial location, as-constructed drawings and maintenance requirement for each asset;
- Gaps in the of clear hand-over process for developer-contributed assets, including informing relevant parties when the assets are being handed over to Council;
- Designs not being standardised, meaning that every single development has utilised different designs and, overall, design inadequacies have not been addressed early enough to influence on ground outcomes and;
- Budget planning processes not accurately addressing the maintenance requirements of different asset types.

Due to these challenges, have resulted in a large number of developer-contributed assets have been handed to Council in a poor or non-functioning condition. Furthermore, once WaterSmart assets are handed over to Council, there is no process in place for recording their existence in an asset register. This has resulted in many WaterSmart systems not being maintained, as Council is unaware of their existence and, therefore, maintenance budgets are not being appropriately allocated. Subsequently, the unmaintained and non-functioning WaterSmart assets are resulting in numerous complaints from the community and complaints from the Asset Services maintenance teams who ultimately have to service the asset.

Since 2014, various departments within BCC; such as Strategic Asset Management (SAM), Natural Environment, Water and Sustainability (NEWS), City Project Office (CPO and Development Services (DS) in BCC have been working toward rectifying these listed issues and below is a list of the achievements to date:

1. A Watersmart asset register was created to capture spatial asset locations, along with specific asset data, condition assessment. This work was initiated in 2014 and more than 90% of the assets registered to date;
2. Development of a streamlined process, along with clear procedures and guidelines for construction, installations and handover through Development Assessment phase through to asset maintenance by Council;
3. Development of erosion and sediment control plan requirements and guidelines for protection of watersmart assets during construction via *city plan 2014*;
4. Development of web-based standard drawings for watersmart assets to standardise the design and type of assets being received by Council since 2014; and
5. Development of a clear budget planning process for securing more accurate maintenance budgets for maintenance, renewal and rectification.

Overall, within Brisbane Local Government Area (LGA) over 4000 watersmart assets are registered, with a diverse range of systems and sizes. Of these assets, about 50% are belong to BCC. Currently the asset register include 1918 assets of approximately 90% of the assets have been surveyed. Below Figure 1 presents the asset type distribution for the assets that are management by BCC and the Figure 2 shows the condition of most common watersmart asset types in Brisbane.

Figure 1: WaterSmart Asset type distribution in BCC

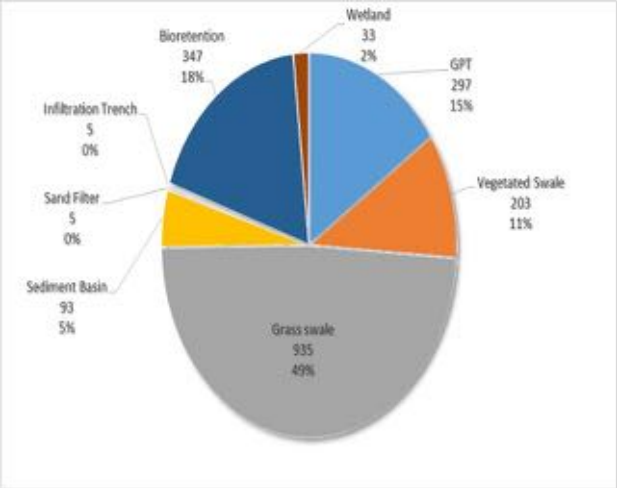
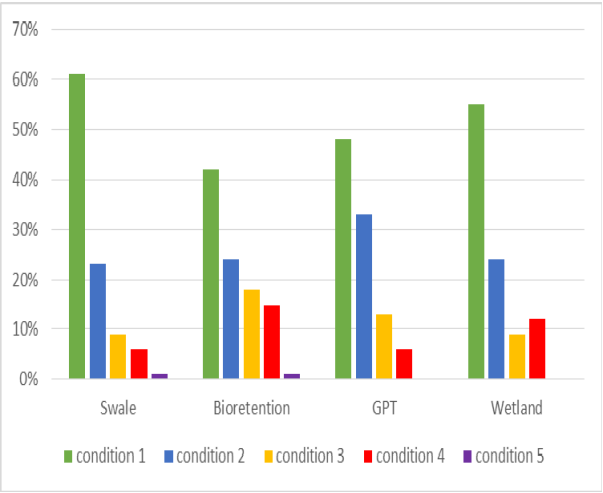


Figure 2: Asset condition assessment results



Approximately, 20%of the assets are not in functional condition (4 & 5) and majority of these assets are bioretention systems. The majority of swales (vegetated or turfed) are in good condition. Wetland are generally operational but most of them are functioning as lakes, not a wetland. Currently the Council maintenance budget for Watersmart asset maintenance is around $2.2 M which is predominately spent on GPTs and trash racks. The development of an asset database and condition assessment for each asset enables council to request for additional funding for maintenance of these assets. It also enables Council to also streamline and improve processes and working relationships between different parts of Council.

The high portion of assets in condition 4 and 5 initiated a new program of works in BCC which focused on rectification and rehabilitation activities for these assets. These assets, in their existing condition are not performing the role they were designed for and generally require a substantial redesign to become functional. This new program is called “Schedule 84: Rectification of WaterSmart assets”. The following section explains the program objectives and policy linkages of this program.

Schedule 84: Rectification of WaterSmart Assets

Program Objectives:

To rehabilitate (renew or upgrade) existing Brisbane City Council Water Smart Assets (developer contributed, and Council created assets) to their primary function, supporting the following Natural Environment, Water and Sustainability (NEWS) outcomes:

- water quality and hydrologic conditions within the catchment/sub-catchment.
- associated environmental outcomes (urban cooling, urban forest, biodiversity etc.).
- Amenity and aesthetics of water smart assets

- Community perception, awareness and understanding of water smart assets (environmental education).
- Public safety of water smart assets.
- Economic value and sustainability of water smart assets.

Program Strategic Alignment:

The Water Smart Asset Rehabilitation Program (Schedule 84) aligns with the following Brisbane City Council plans/strategies:

Corporate Plan 2016/17 – 2020/21

1.5 Sustainable Water Management

- Ensure our built environment minimises adverse impacts and maximises the benefits the community receives from our local water resources.
- Council integrates sustainable water smart initiatives into its operations.

City Plan 2014:

3.5 Theme 3; 3.5.2 Element 3.1 Brisbane's environmental values:

- S01 Brisbane's Greenspace System's biodiversity, recreational and cultural values and functions are protected, restored and enhanced.
- SO7 Brisbane's waterways, wetlands and foreshores are protected, in particular their natural drainage, stormwater conveyance, visual amenity, landscape character, recreational, cultural and biodiversity values.
- S011 Water quality is protected from adverse impacts of development.

Brisbane: Clean, Green, Sustainable:

2. *Focus on ensuring our waterways, river and bay are healthy, safe and accessible*:

- Continue to undertake waterway and water smart asset maintenance, rehabilitation and enhancement works, with a focus on priority catchments.
- Apply best practice asset management principles and policies to waterways and WaterSmart assets.

Total Water Cycle Management Plan:

- 3.3.2 Maintenance, rehabilitation and enhancement works. Undertake waterway and water smart asset maintenance, rehabilitation and enhancement works. Focus on priority catchments and locations to revitalise creek systems, enhance urban green spaces and improve connections.

Water Smart Strategy:

Well-designed subtropical city:

- 3. Systems and processes are in place to support the effective, integrated management and implementation of on-ground solutions: Implement and use best practice asset management systems for all of Council's natural and built assets, including waterways and new and emerging natural or 'soft' infrastructure solutions such as bioretention basins and stormwater gardens.

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Common Issue and Challenges with Watersmart Assets in Brisbane

Common challenges observed with Watersmart assets in Brisbane (mainly bioretention) are classified below in 3 main categories.

Design

- System is designed based the theoretical models only and often the system is not integrated into open space and landscape;
- System is not functional due to inlet or outlet is located incorrectly;
- System has safety issues due to a drop larger than 300 mm; and
- System hydraulics is not working.

Construction

- System not being built as per design specifications; and
- Sediment runoff during the construction (the subdivision) blocked the filter media.

Maintenance

- No maintenance concluded since construction;
- Excess sediment at the inlet;
- Excessive weed and vegetation growth; and
- Lack of vegetation survived on the surface of the system.

Recommended Solutions:

In order to comply with the program objectives the developed solutions can range from

- Stay the same system/ function with reduced maintenance require and ascetically more pleasing
- Transform to another system with lower water quality benefits but less maintenance requirements and ascetically more pleasing.

Case Studies

Dannenberg Street, Bald Hill Rectification: cost $80K

This site was submitted to council as part of the Roghan Road development in a suburb to Brisbane's North. It was constructed more than 10 years ago. The basin were designed to attenuate peak runoff flows to pre-development levels and improve discharge water quality to meet reduction targets from the Brisbane City Council Stormwater Quality Management Guidelines.

Asset Challenges

- Ponding water at the inlet;
- Algal biofilm in low flow channel;
- Low flow channel not adequately conveying low flows to the outlet;
- Build-up of sediment in low flow channel;
- Potential blocking of outlet pipes due to gross pollutants; and
- Weed infestation and encroachment of planting within the basin.

Implemented solutions

- Desilt the swale and regrade the channel to improve the drainage;
- Planting within and on the banks of the swale;
- Clear the sediment build up and weed growth;
- Improve the drainage by providing subsoil drainage; and
- Change the outlet grate.

Before and after photos are provided below to show rectification works implemented on the other side.

Before	After
Inlet arrangement with ponding water	
	

Weed and vegetation establishment within the detention basin.	
	
Outlet arrangement showing leaf litter build up	
	NEW photo be attached 

Case Study 2. Pressland Street, Carseldine Rectification: cost $120K

This site was handed over to Council around 2012, as a part of a development located in Brisbane's northern suburbs. It comprised of 33 residential and four streetscape bioretentions built as part of the development. Since construction of the assets completed and the lot development was completed, there has been a number of complaints submitted to council about this site, consequently, it is listed under schedule 84 program as a high priority.

Asset Challenges

- Aesthetically displeasing and unsafe pool fencing around systems (visual impairment);
- Visibility and safety risk for motorists;
- Difficult to access and maintain; and
- Overgrown with weeds etc.

Implemented solutions

- Remove the pool fencing;
- Remove the mountable kerb and replace with flush kerbing;
- Provide a field inlet cover to each inlet ;
- Fill the system with topsoil and grade the system toward an outlet to function as a swale

Before and after photos are shown below.

Before	After
Pool fencing around the system due to the drop from the kerb	Removed the fencing by creating safe batters
	
Weed and vegetation overgrown in bioretention basins	Turfing the system – generally maintained by the residents
	

Case Study 3: Westbury Place, Carindale rectification $30K

This site consists of an offline bioretention basin located to the north of Greendale Way and east of Westbury Place. The basin is constructed at depth using a terraced approach to ensure hydraulic connectivity from the source drain running North East-South West along Greendale Way. A grated concrete pit was constructed with a lip approximately 800 mm above the finished filter service, which acts as an overflow weir. An underdrainage network of pipes below the filter layer also returns treated water back to the same pit and into the minor drainage network.

Site challenges

- Excessive extended detention;
- Clogged filter media;
- Devoid of plants;
- No inlet scour protection, energy dissipation measures or flow spreaders;
- Large set-down from inlet pipe to filter media finished surface; and
- Standard outlet pit grate that could be prone to blockage.

Implemented solutions

- Remove the weeds;
- Remove the Geofab covering the surface of the bioretention;
- Reduce the extended detention depth by lowering the outlet;
- Place outlet protection;
- Change the outlet to a dome type ; and
- Replant the system by adding nutrient to the soil.

Before and after photos are provided below.

Before	After
Weed infested bioretention	Cleared system during construction
	
Outlet type changed from flat to Dome to improve overflow	
	

Case Study 4: Raroka Street, Carseldine ($30K)

A series of eight streetscape bioretentions handed over to council in 2014 as part of a fairy small development of 9 lots. The total area required for stormwater management device is 47 m2 but because this development is relatively small, the only way to accommodate this area is to divide it into a number of systems.

Site challenges

- Sediment build up at the inlet;
- Excessive weed growth;
- Stormwater gully located just upstream the system; and
- Steep street 4%>.

Site Solutions:

- Decommission the systems that has a stormwater gully just upstream; and
- Refunction the system from a bioretention to a self-watering garden

Before and after photos are shown below.

Before	After
Weed infested bioretention	
	

Conclusions and Next Steps

Through the journey from guideline development and asset database creation to budget planning and rectification, there have been many lessons that may be of interests to other watersmart asset managers. With the rate of development in Brisbane, the challenges associated with asset maintenance and rectification need to be addressed before more assets are handed over to Council.

In order to address the current challenges and plan for future assets Brisbane is implementing the following strategy:

- Revising standard drawings by providing information on filter media improvements and specific vegetation species that survive in Brisbane conditions;
- Review of the current strategy for WSUD and development of alternative solutions for asset delivery;
- Revise design guidelines in *City Plan 2014*;
- Stronger erosion and sediment control compliance efforts during construction;
- Constantly improving communication and engaging with different stakeholders during off maintenance periods; and
- Looking at innovative, low cost solutions to deliver watersmart assets

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