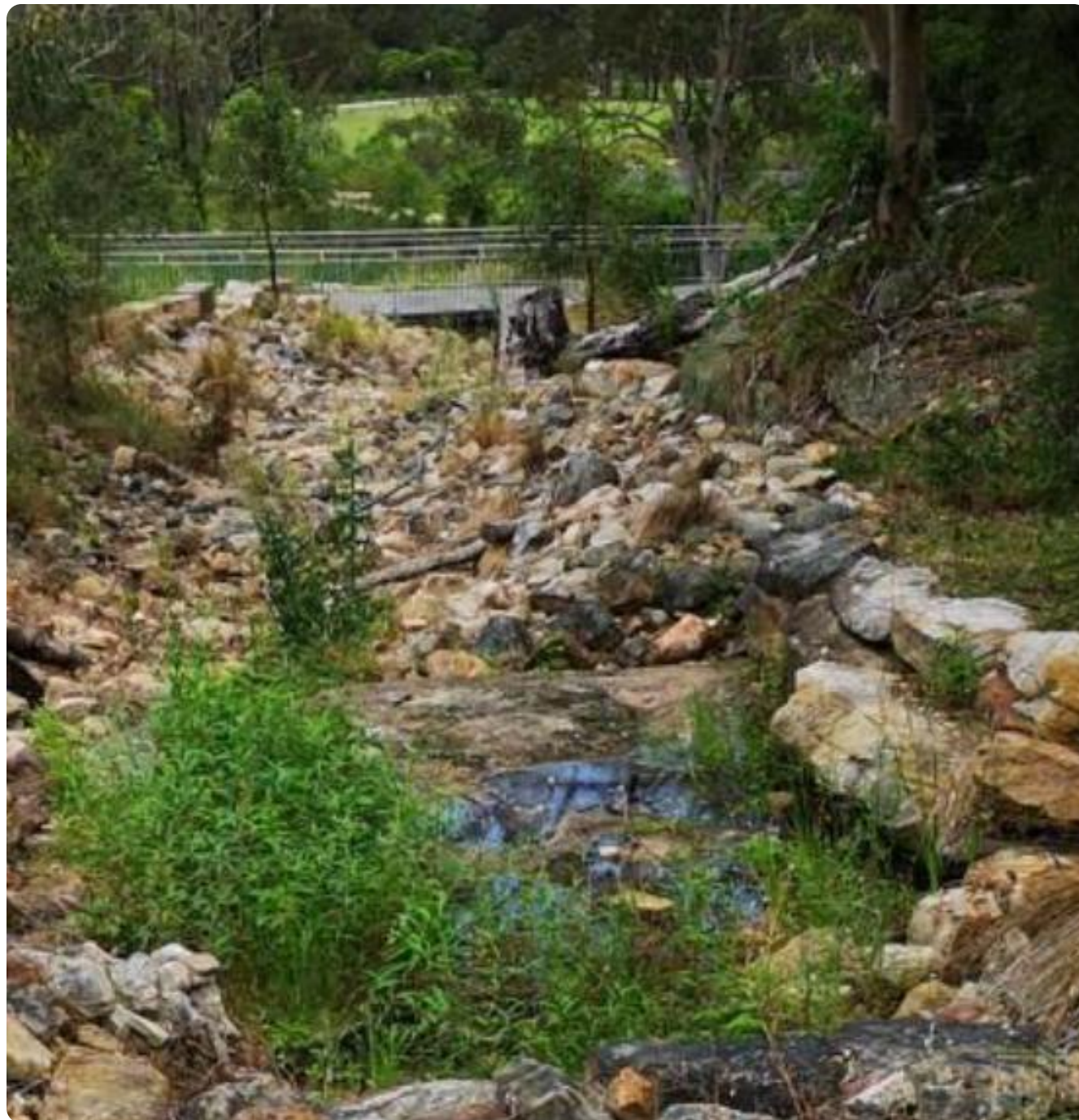


Beyond the Planting: Keeping WSUD Systems Functional Over Time

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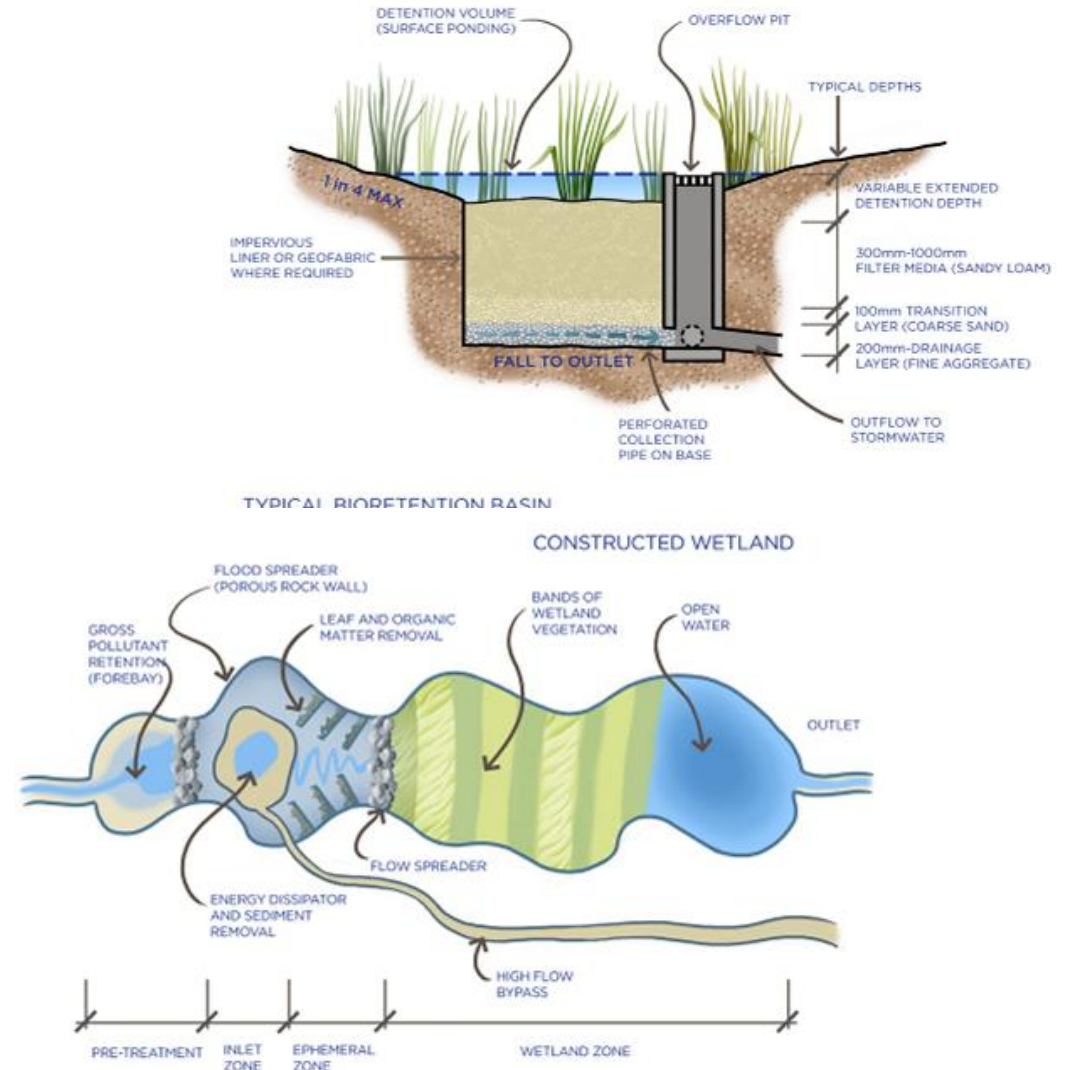
WSUD System - Tertiary

Bioretention Basins: These are shallow, landscaped depressions that treat stormwater by filtering it through multiple layers of soil, sand, and vegetation, effectively trapping sediments and nutrients while enhancing infiltration and overall water quality.

Constructed Wetlands: These are engineered systems featuring, plant-filled ponds designed to treat stormwater by reducing flow velocity, enabling sediment deposition, and utilizing plants and microorganisms to eliminate contaminants before the water continues downstream.

Living infrastructure behaves differently

- WSUD assets combine hydraulic, biological, and ecological processes.
- Performance evolves with time and environment, e.g. vegetation health, sediment management, and flow control.
- Without active maintenance, treatment capacity and visual quality decline.





Purpose of the Review

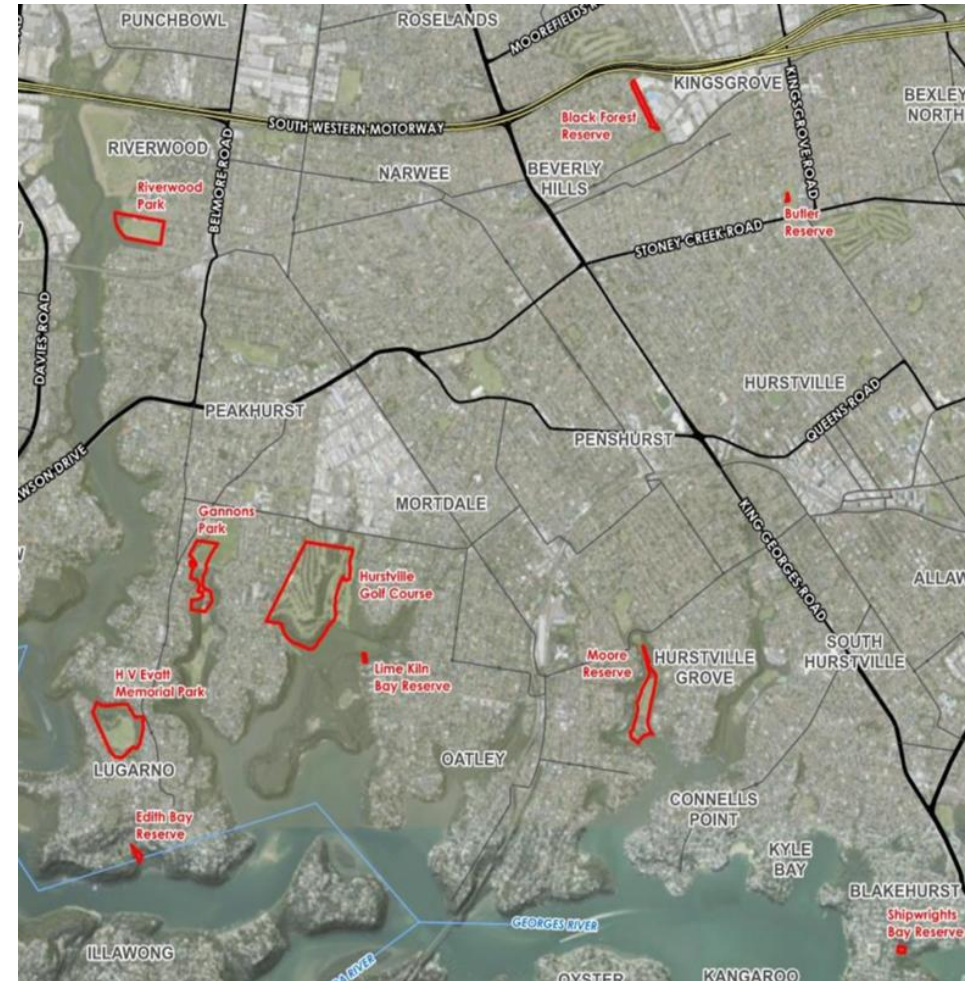
How system health was reviewed:

- Field inspections and visual condition assessments.
- Vegetation and ecological condition checks- evaluation of plant diversity, coverage, and aesthetic considerations.
- Soil and Water Sampling (non-event based).
- Review of hydraulic function and flow paths.
- Conceptual MUSIC modelling to verify design assumptions.
- Compare field conditions with design intent.

Goal:

and proposing.

Compilation of observations, identifying technical deficiencies and identify actions to maintain functionality and extend asset life.





Operational Issues

- Responsibility for maintenance sometimes unclear. Nonstandard maintenance approach.
- Inspection frequencies vary or are reactive.
- Records of construction and maintenance not always retained. - **altered or adjusted after construction** without proper review or approval
- Vegetation deterioration from access constraints or competing land uses.
 - High turbidity and occasional stagnant zones.
 - Weed encroachment around drainage areas.
- Treatable Flow bypass - Temporary construction. diversions left in place.
- Sediment accumulation reducing filtration depth or settling.





Recognising Early Warning Signs

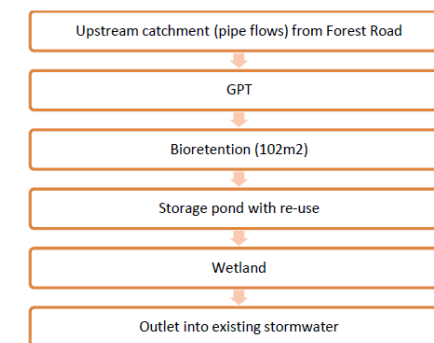
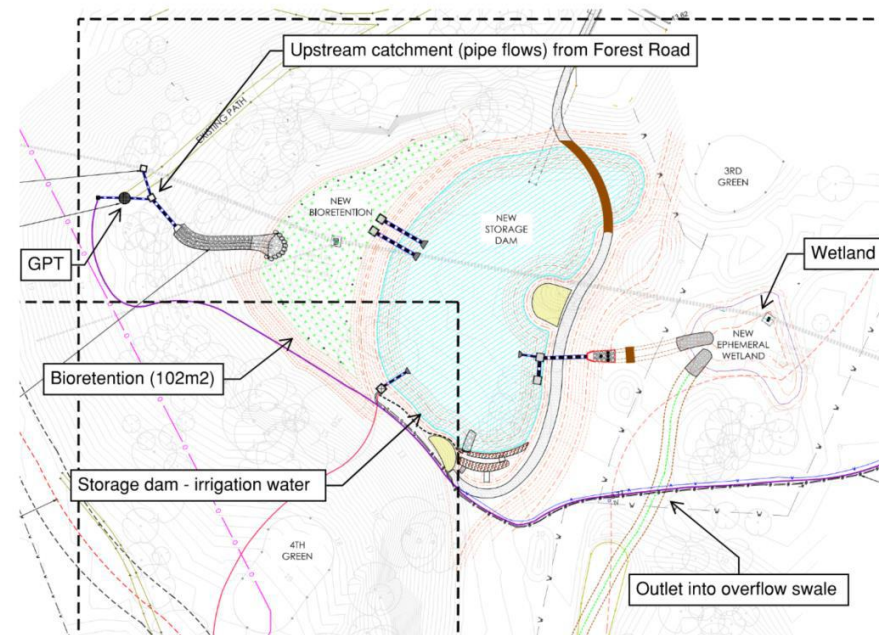
- Vegetation deterioration.
- Turbidity or stagnant water body.
- Algae or odour – stagnation or poor circulation.
- Invasive weeds replacing natives.
- Erosion or sediment build-up .
- Systems designed to retain water becoming dry for extended periods.
- Stakeholder engagement or maintenance response





Design Considerations

- Catchment delineation: account for upstream inflows – Precinct Level Infrastructure
- Maintenance access: continuous movement, safe, and reach of maintenance equipment.
- Functional zoning: separate treatment areas from recreation.
- Incremental treatment approach: treatment train reduces end-of-pipe reliance.
- Bypass mechanism is not considered in the modelling.



Plan provided by Mallory McLennan - GRC



Emerging Risks

- Reduced treatment efficiency, negative waterway health
- Algal growth or odour from stagnant zones.
- Invasive species dominance.
- Increased rehabilitation costs.
- The challenge with stormwater lies in its ability to transport excess nutrients and pollutants into our waterways, causing significant harm.
- Moreover, the substantial volumes of stormwater flowing into waterways post-rainfall exacerbate erosion along creek beds and banks.





Building a Maintenance Framework

Short-term:

- Routine inspections/Maintenance, debris removal.
- vegetation management plan, Buffer planting and weed control.
- Invasive Species eradication plan.

Long-term:

- Monitoring.
- Renewal Trigger
 - Major Maintenance Work: GPTs, media replacement.
 - Capital Work – Retrofit or redesign
- Precinct-wide integration and community engagement.





Example



Water sensitive urban design (WSUD) inspection and maintenance guidelines



Reference: BCC- Water sensitive urban design inspection and maintenance Guideline 2023

REFERENCE SHEET - Biofilter						
Functional component	Part C number	Required frequency (months)	Good (condition score - 1)	Moderate (condition score - 2)	Poor (condition score - 3)	
Surrounds and other infrastructure						
Damage or removal of structures	6	6	Stable structures. No damage to surrounding structures. No safety risks.	Minor damage. Does not pose risk to structural integrity or asset function.	Major damage. Poses risk to structural integrity, public safety or asset function.	
1 Inlet						
1a Blockage	3	6	No blockage.	Partial blockage of inlet causing some bypass of flows or restricted inflows.	Blockage of inlet causing significant bypass or restriction of inflows.	
1b Erosion	9	6 (and after major rain events)	No erosion.	Minor erosion. Does not pose risk to structural integrity, public safety or asset function (e.g. limited short circuiting of flows).	Major erosion. Poses risk to structural integrity, public safety or asset function (e.g. short circuiting of the majority of flows).	
2 Inlet sediment pits and forebays						
2a Blockage	3	6	No blockage.	Partial blockage of inlet causing some bypass of flows or restricted inflows.	Blockage of inlet causing significant bypass or restriction of inflows.	
2b Permeability and clogging	20	6	No clogging of sediment pit. Pit can drain so that there is no standing water.	Some clogging of the drainage holes. Some evidence of standing water. Any standing water present is draining very slowly.	Clogging of drainage holes is preventing the pit from draining. Standing water is not draining.	
3 Batters						
3a Erosion	9	6 (and after major rain events)	No erosion. Batters are densely planted.	Minor erosion. Some planting of batters. Does not pose risk to structural integrity, public safety or asset function (e.g. limited short circuiting of flows).	Major erosion. Batters have little to no planting. Poses risk to structural integrity, public safety or asset function (e.g. short circuiting of the majority of flows).	
3b Plant health	22	6	Healthy vegetation.	Vegetation is stressed. Poor health (e.g. signs of disease, pests, wilting) in <20% of plants.	Vegetation is dying back. Poor health (e.g. signs of disease, pests, wilting) in >20% of plants.	
3c Plant cover	21	6	Good vegetation cover in planted areas (>80% cover or >6 plants per m ²).	Moderate vegetation cover in planted areas (50-80% cover).	Poor vegetation cover in planted areas (<50% cover).	
3d Litter and debris	17	6	No litter present.	Some litter present. Diminished aesthetics and/or causing some visible blockage.	Large amount of litter present. Heavily impacting aesthetics and/or blocking flows.	
3e Vehicle or pedestrian damage	33	6	No compaction, plant loss, or vandalism impacting system function.	Minor compaction and/or plant loss. Does not pose risk to structural integrity or asset function.	Significant compaction and/or plant loss. Poses risk to structural integrity, public safety or asset function.	
3f Weeds	36	6	Limited weed cover (<10%) and no declared invasive weed species.	Low/moderate weed cover (10-50%) and no declared invasive weed species.	High weed cover (>50%) and/or declared invasive weed species present.	
4 Biofilter surface						
4a Erosion	9	6 (and after major rain events)	No erosion. Filter surface receiving water evenly.	Minor erosion. Does not pose risk to structural integrity, public safety or asset function (e.g. limited short circuiting of flows).	Major erosion. Poses risk to structural integrity, public safety or asset function (e.g. short circuiting of the majority of flows).	
4b Extended detention depth	10	12	Design extended detention depth provided (design extended detention is typically between 100-300 mm).	50-75% of design extended detention provided (design extended detention is typically between 100-300 mm).	Less than 50% of design extended detention provided (design extended detention is typically between 100-300 mm).	
4c Leaf litter	16	3	Minimal leaf litter present or covers <20% of surface.	Some wet and decaying leaf matter present (covering 20-50% of surface). Aesthetic issue. Some obstruction of flow paths.	Large amount of wet and decaying leaf matter present (covering >50% of the surface). Impacting vegetation growth. Obstructing flow paths and blocking inlets or outlets.	

Sheet 1 of 2



Client Perspective

I think the principals behind the commissioning of the report are relevant for key stakeholders including the importance of ongoing maintenance, management and renewal of living stormwater treatment systems.

Far to often constructed wetlands, raingardens and bioretention ponds are built with great intentions however, they often suffer over time as they are not renewed with the same consistency as hard infrastructure such as footpaths, playgrounds etc.

- Mallory McLennan



Key Takeaways

Beyond the Planting

- **Routine inspection schedules**
- **Practical and Maintainable Design**— consider adequate maintenance access, catchment, and flow.
- **Maintain consistently & Plan for renewal** – living assets need care – vegetation and filters have lifecycles. Defined renewal triggers- Major Maintenance and Capital work.
- Clear accountability and budget allocation.
- **Integrate teams** – design, environment, and maintenance must collaborate.



Photo taken by Mallory McLennan - GRC



Acknowledgements

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Thank you

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