WATER SENSITIVE SA

Water sensitive urban design (WSUD) assets

Inspection and maintenance guidelines

Constructed wetlands

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Image: City of Charles Sturt

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This guideline is adapted from:

- Blacktown City Council (2019) *Water sensitive urban design (WSUD) inspection and maintenance guidelines*. Developed with assistance from E2Designlab Pty Ltd. A previous version was developed with assistance from Alluvium Consulting Australia Pty Ltd.
- DesignFlow (2022) Maintenance of WSUD assets course material, prepared for Water Sensitive SA.
- E2DesignLab (2016) Detailed design of constructed stormwater treatment wetlands course material, prepared for Water Sensitive SA.
- Melbourne Water (2013) WSUD maintenance guidelines: A guide for asset managers.

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This guide is of a general nature only. Advice from a suitably qualified professional should be sought for your particular circumstances. Depending on each unique situation, there may be occasions where compliance is not achieved.

Water Sensitive SA welcomes feedback on improvements to these guidelines, particularly WSUD assets images in differing conditions for the *Condition assessment audit visual reference sheets*.

Contents

1 Asset description and functional components

Inspection and maintenance guidelines of constructed wetlands must be read in conjunction with *Water sensitive urban design (WSUD) assets: Inspection and maintenance guidelines | Overview*

Constructed wetlands

A (constructed) stormwater treatment wetland is an engineered system that uses the natural ecosystem services of vegetation, algae and soil organisms to provide secondary treatment to stormwater.

Similarly to natural wetlands, constructed wetlands also act as a biofilter and/or can remove a range of pollutants (such as organic matter, nutrients, pathogens, heavy metals) from the water. Constructed wetlands are designed to remove water pollutants such as suspended solids, organic matter and nutrients (nitrogen and phosphorus).

Each constructed wetland is unique. Designs will differ in accordance with the catchment characteristics and site constraints as well as the desired outcomes, including the level of stormwater treatment, habitat provisions and other ecosystem services. These guidelines provide a generic framework for assessing constructed wetland conditions and may need to be tailored to fit the wetland being assessed. For example, the condition score descriptors of plant cover (Form 02) may differ for different constructed wetlands or functional components. Ideally, each constructed wetland will have its own management and maintenance plan that will specify its targets.

Functional components

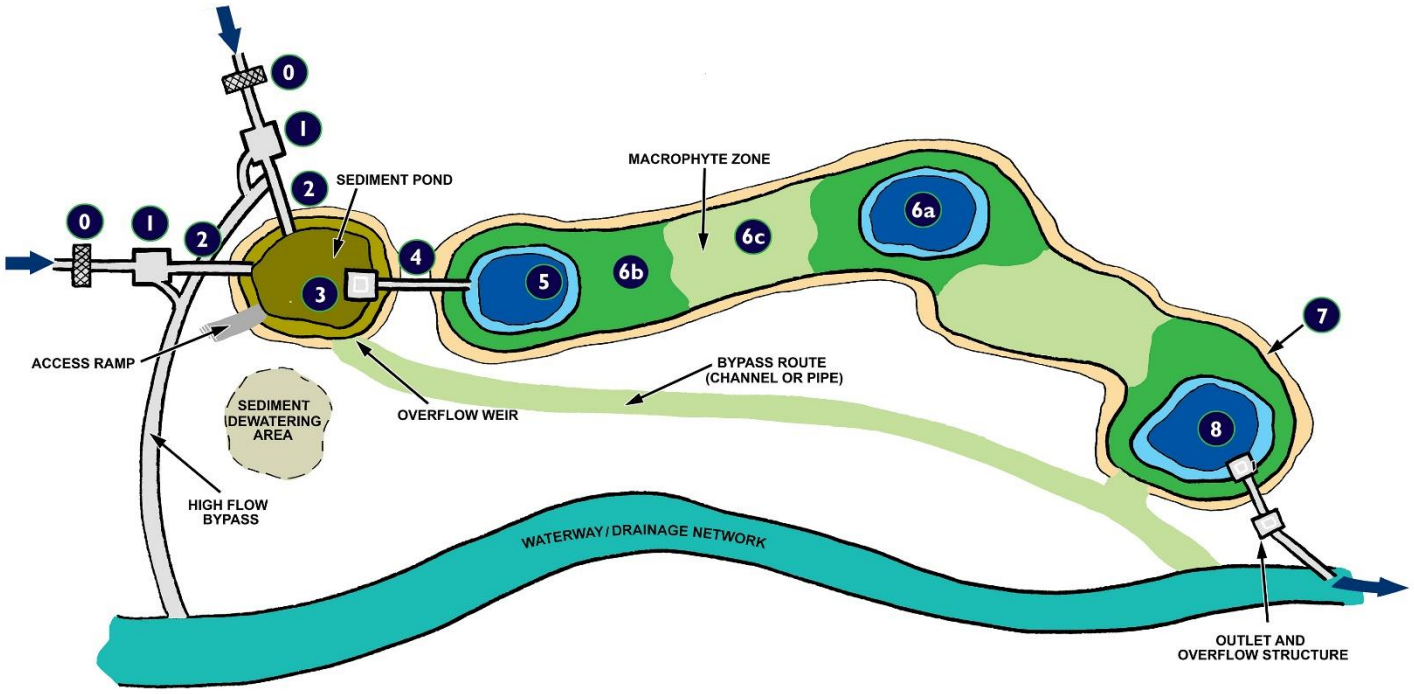

Figure 1.1 Components of constructed wetland – plan view (Source: Adapted from E2Designlab)

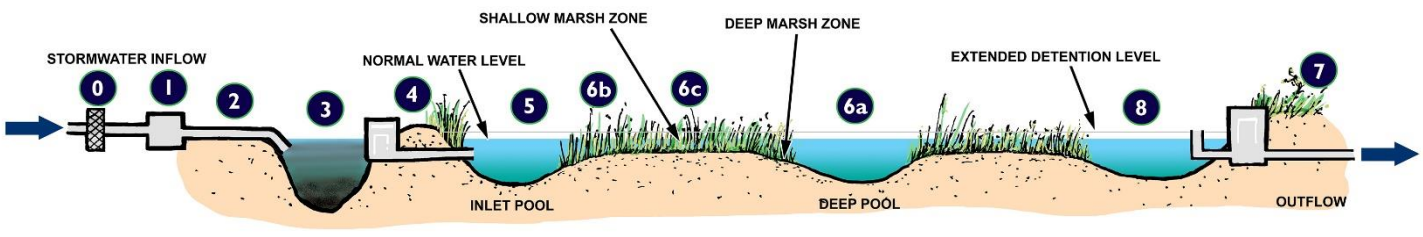

Figure 1.2 Components of constructed wetland – elevation (Source: Adapted from E2DesignLab)

Constructed wetlands comprise the following functional components (Figure 1.1 and Figure 1.2):

0. **Pre-treatment** devices e.g. gross pollutant traps, coarse sediment traps. Subject to a separate assessment, not covered in these guidelines.
1. **High-flow bypass** An inlet device that allows a certain flow of water through, but diverts higher flows around the constructed wetland to avoid re-suspension of sediments and damage to wetland plants.
2. **Inlet pipe/weir** A device/structure that admits stormwater runoff into the sedimentation basin.
3. **Sediment basin/pond** are ponds with open water that intercept stormwater and slow it down to allow the coarse sediment to fall to the bottom, typically 125 µm or larger carried by stormwater.
4. **Transfer pipe/weir** An orifice/barrier that controls the flow characteristics of stormwater entering the constructed wetland.
5. **Inlet pond/zone** An area of open water that provides a further sedimentation pond by reducing the velocity of stormwater inflows, traps coarse sediments, and protects the sensitive macrophyte zone.
6. **Macrophyte zone** A shallow area densely planted with aquatic plants and the main part of the constructed wetland, which provides filtration of suspended solids and removal of nitrogen and phosphorus. Plant life can include submerged, semi-submerged and floating plants. This zone usually includes a range of shallow and deep-water levels and may include areas that are only wet during rainy seasons (ephemeral zones):
   a. deep pools | 350-700mm below normal water level (+EDD = 700-1050mm)
   b. deep marsh | ≤150-350mm below normal water level (+EDD = 500-700mm)
   c. shallow marsh | <200mm below normal water level (+EDD = 500mm)

   A minimum 80% of the macrophyte zone at normal water level is ideally ≤350mm (i.e. shallow and deep marsh), although design objectives may differ from project to project.
7. **Batters** Landscaped areas that connect the wetland water surface with the surroundings at a gentle slope. Batters should be densely vegetated to aid water treatment and help prevent erosion. Vegetated batters also play an important role for bug and animal life living around the wetland.
8. **Outlet and overflow** The outlet of a constructed wetland is usually a partially submerged pipe or weir that drains to an outlet pit. The outlet pit contains an orifice plate or weir that controls the water level in the wetland. The outlet is usually set to allow for a typical detention time of 72 hours. Constructed wetlands usually include an overflow weir that directs excess flow into the outlet pit or downstream of the wetland. This collects flows in excess of the system's capacity and directs them into the stormwater drainage network.

2 Inspection and maintenance forms and activities

Routine inspection requirements typically involve:

- Check for sediment and debris build-up in inlets and outlets
- Check for evidence of erosion
- Monitor sediment accumulation in sediment basin and inlet pond
- Check water levels in inlet pond and macrophyte zone(s) via gauge (if present) or riser pipe/weir
- Inspect integrity of hydraulic structures
- Check vegetation health and cover
- Check weed ingress within wetland areas
- Monitor weed growth within the batters
- Monitor for litter accumulation
- Monitor for algal growth
- Check for damage to inspection pipes, inlet and outlet structures, and other structure
- Monitor for presence of fish (e.g. carp)
- Monitor for impacts of fauna (e.g. birds and dogs)

Routine (proactive) maintenance requirements typically involve:

Activity	Frequency
▪ Clean blocked inlets and outlets	After significant rain events
▪ Remove weeds on batters by hand or mechanically harvest (over abundant species). Only use herbicides approved for use in proximity to waterways	Every 4 weeks during high-growth season[1]
▪ Remove litter and debris from the open water and macrophyte areas	After significant rain events
▪ Re-profile in minor eroded areas	As required
▪ Prune plants	Every 8-12 weeks during high-growth season[1]
▪ Remove algae (prioritise high amenity/ primary contact sites)	As required

[1] Fortnightly during high-growth season for high amenity sites

Major inspection requirements typically involve:

Inlet pond

- Annual – monitor sediment accumulation in the sediment basin and inlet pond (Note: shallow water and vegetation growth is an indicator of sediment build-up)
- 2-5 years – dewater and remove sediment

Macrophyte zone

- Check maintenance valves and pumps (if relevant)
- Check presence of fish (e.g. carp)
- Check impact of fauna (e.g. birds, dogs)
- Check bed and bank erosion
- Check for indications of water loss through seepage
- Monitor algal growth (summer)

Major maintenance or rectification activities may involve:

Inlet pond

- Dewater and desilt with excavator (or similar)

Macrophyte zone

- Remove sediment if constructed wetland base design levels have been compromised
- Re-profile banks to address significant erosion
- Re-profile bed of wetland to re-establish design levels and eliminate erosion/preferential flow paths in shallow areas
- Replant banks, as required
- Replant wetland to ensure diverse range of species
- Remove algae in high amenity sites only, or where there is a risk of primary contact

Inlet and outlet structures

- Rectify weir, inlet or outlet structure invert levels to ensure design water levels within the constructed wetland are achieved.

Details of the routine inspection and maintenance activity to maintain the amenity of constructed wetlands can be found in form:

01: Inspection and maintenance sheet | Constructed wetlands – routine (proactive)

Routine inspections include the performance of a condition assessment audit to inform asset management planning. The condition assessment score matrices are detailed in form:

02: Condition assessment audit – descriptive reference sheet | Constructed wetlands

01: Inspection & maintenance sheet | Constructed wetlands – routine (proactive) & major

Date	_____	**Purpose of visit**	**Rainfall conditions**
Location	_____	☐ Routine inspection	☐ Rainfall today (_____mm)
Asset name	_____	☐ Response to complaint	☐ Rainfall in last 3 days (__mm)
Asset ID	_____	☐ Other (specify)	☐ No recent rainfall
Inspected by (name /company)			

INSTRUCTIONS

Prior to maintenance activities occurring, rate asset functional component condition score (from 0 to 5) as per the scoring system below and circle the relevant score.

If score = 0, generate Works Request to refer matter to relevant Council team to decommission the asset or investigate further.
If score = 1, no action is required.
If score = 2, action may be required in some circumstances.
If score = 3, undertake the necessary maintenance and record action taken in right hand side column.
If score = 4 or 5, generate Works Request to refer matter to relevant Council team for rectification works and potential redesign.

Scoring

0 – Asset has been decommissioned, no longer exists or was not able to be rated due to serviceability issues
1 – As new
2 – Working well, PI met
3 – Routine (proactive) maintenance required
4 – Major maintenance/minor rectification works required
5 – Major rectification required

Actions

If further action is required, raise a Works Request for relevant department.
Provide reason for 0 rating/not rated.

Functional component		Performance indicator (PI)	Existing condition score and action(s)
1, 2		**High-flow bypass, inlet (riser) pipes and/or weirs**	
1a 2a	Blockage	Limited blockage, free flowing Limited amount of standing water	0 1 2 3 4 5 ☐ Clear accumulated sediment or debris from high-flow bypass structure ☐ Clear accumulated sediment, debris or vegetation from sediment basin inlet pipe ☐ Clear debris from overflow weir(s) ☐ Other (provide details):
1b 2b	Damage	Limited damage	0 1 2 3 4 5 ☐ Repair damaged high-flow bypass structure ☐ Replace damaged high-flow bypass structure ☐ Repair damaged inlet (riser) pipe structure ☐ Replace damaged inlet (riser) pipe structure ☐ Repair damaged inlet weir structure ☐ Replace damaged inlet weir structure ☐ Other (provide details):

Functional component		Performance indicator (PI)	Existing condition score and action(s)
1c 2c	Erosion	Limited and localised erosion	0 1 2 3 4 5 ☐ Re-profile or reinforce eroded areas ☐ Replant bare areas **Information:** Only use approved plant species, refer to original design specifications. ☐ Other (provide details):
3		**Sediment basin**	
3a	Sedimentation (Annual)	Aquatic vegetation and/or weeds covers <10% of sediment basin	0 1 2 3 4 5 ☐ Dewater and desilt sediment basin **Information:** Shallow water and vegetation in sediment basin is an indicator that sediment levels are too high. Desilting of the sediment basin may include removal of over abundant native aquatic plants such as Typha, Phragmites and Azolla. ☐ Undertake sediment contamination test ☐ Dispose of extracted sediment **Information:** Allow 2-3 weeks for sediment to dry on site before disposal. ☐ Other (provide details):
3b	Litter and/or debris (larger than a soft drink can) and/or organic litter	1 piece of litter and/or debris/50m^2 Limited amount of organic litter Limited impact on aesthetics	0 1 2 3 4 5 ☐ Remove litter, excessive debris and/or organic litter **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. Contact with sharp objects is a risk when removing litter. All workers must follow WHS practices to reduce risk, including wearing personal protective equipment. Forks and tongs may be used to pick up litter. ☐ Other (provide details):
4		**Transfer pipes and/or weirs**	
4a	Blockage	Limited blockage, free flowing Limited amount of standing water	0 1 2 3 4 5 ☐ Clear sediment or debris from transfer pipe between sediment basin and wetland ☐ Clear debris from overflow weir(s) ☐ Other (provide details):
4b	Damage	Limited damage	0 1 2 3 4 5 ☐ Repair damaged transfer pipe structure ☐ Replace damaged transfer pipe structure ☐ Repair damaged weir structure ☐ Replace damaged weir structure ☐ Other (provide details):
4c	Erosion	Limited and localised erosion	0 1 2 3 4 5 ☐ Re-profile or reinforce eroded areas ☐ Replant bare areas **Information:** Only use approved plant/turf species, refer to original design specifications. ☐ Other (provide details):

Functional component		Performance indicator (PI)	Existing condition score and action(s)
4d	Plant cover (including weeds)	Limited plant cover (<5%) Limited woody plant seedlings >30cm height cover (<2%) No declared invasive weeds	0 1 2 3 4 5 ☐ Remove weeds by hand from the weir ☐ Treat weeds that cannot be removed by hand with targeted-use herbicides (spot spray or wipe on herbicide) **Information: Herbicides must be approved for use in proximity to waterways**. This will minimise potential impact on desirable species and reduce likelihood of chemical residue within soil profile or local waterways. **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
5		**Inlet pond/zone**	
5a	Sedimentation (Annual)	Aquatic vegetation and/or weeds cover <10% of inlet pond/pool	0 1 2 3 4 5 ☐ Dewater and desilt inlet pond **Information:** Check as-constructed plans for design depth. Shallow water and vegetation in inlet pond is an indicator that sediment levels are too high. Desilting of the inlet pond may include removal of over abundant native aquatic plants such as Typha, Phragmites and Azolla. ☐ Undertake sediment contamination test ☐ Dispose of extracted sediment **Information:** Allow 2-3 weeks for sediment to dry on site before disposal. ☐ Other (provide details):
5b	Litter and/or debris (larger than a soft drink can) and/or organic litter	1 piece of litter and/or debris/50m^2 Limited amount of organic litter	0 1 2 3 4 5 ☐ Remove litter, excessive debris and/or organic litter **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. Contact with sharp objects is a risk when removing litter. All workers must follow WHS practices to reduce risk, including wearing personal protective equipment. Forks and tongs may be used to pick up litter. ☐ Other (provide details):
5c	Weeds	Limited aquatic weed cover (<5%) No declared invasive weeds	0 1 2 3 4 5 ☐ Remove aquatic weeds by hand that are negatively affecting the hydraulics of the wetland ☐ Mechanically harvest aquatic weeds that are negatively affecting the hydraulics of the wetland. **Information:** Aquatic weeds include water lilies, water hyacinth, alligator weed, salvinia, cabomba, arrowhead and parrot's feather. ☐ Spot spray or wipe herbicide onto environmental weeds using only herbicide that is safe for use in waterways **Information: Herbicides must be approved for use in proximity to waterways**. This will minimise potential impact on desirable species and reduce likelihood of chemical residue within soil profile or local waterways. **Information:** Weeds in the macrophyte zone are defined as exotic (not Australian) plants or native plants that are overabundant. Declared weeds are exotic plants that must be managed by law. Alert weeds are exotic plants that must be managed by law, and it is a legal requirement to notify PIRSA of their presence. These include water hyacinth, alligator weed, salvinia, elodea, giant arrowhead and parrot's feather. Native plants such as Typha, Phragmites and Azolla may become overabundant.

Functional component		Performance indicator (PI)	Existing condition score and action(s)
			Information: When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
6		**Macrophyte zone**	
6a	Sedimentation (Annual)	Deep pools: 600-700 mm below normal water level Deep marsh: 300-350mm below normal water level Shallow marsh: 150-200mm below normal water level	0 1 2 3 4 5 ☐ Dewater and desilt deep pools **Information:** Shallow water and vegetation in deep pools is an indicator that sediment levels are too high. ☐ Undertake sediment contamination test ☐ Dispose of extracted sediment **Information:** Allow 2-3 weeks for sediment to dry on site before disposal ☐ Other (provide details):
6b	Plant health	Healthy plants, free from disease and growing vigorously	0 1 2 3 4 5 ☐ Remove dead or diseased vegetation **Information:** Some plants die off over winter and grow vigorously in spring and summer. ☐ Replant bare areas **Information**: Only use approved plant species, refer to design specifications. ☐ Replant individual bare areas by dividing and translocating existing mature vegetation with rhizomatous root systems from high-density stands in a similar inundation zone **Information**: Exceptions include areas of shallow open water for aesthetic, recreation or safety reasons. **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
6c	Plant cover	>90% of wetland perimeter vegetated Aquatic plants cover >80% of wetland area <20m^2 gaps within planted areas	0 1 2 3 4 5 ☐ Replant bare areas **Information**: Only use approved plant species, refer to design specifications. Bare ground can provide important bird habitat. Refer to constructed wetland management plan before planting bare areas. ☐ Replant individual bare areas by dividing and translocating existing mature vegetation with rhizomatous root systems from high-density stands in a similar inundation zone. ☐ Mechanically harvest aquatic plants that are negatively affecting the hydraulics of the wetland. **Information:** Condition rating should be adjusted in accordance with design specifications, which may dictate an alternate approach to wetland plant cover, e.g. more open water for aesthetic reasons. **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
6d	Litter, debris (larger than a soft drink can), and/or organic litter	1 piece of litter and/or debris/50m^2 Limited organic litter Limited impact on aesthetics	0 1 2 3 4 5 ☐ Remove litter, excessive debris, and/or organic litter **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. Contact with sharp objects is a risk when removing litter. All workers must follow WHS practices to reduce risk, including wearing personal protective equipment. Forks and tongs may be used to pick up litter. ☐ Other (provide details):

Functional component		Performance indicator (PI)	Existing condition score and action(s)
6e	Weeds	No alert or declared weeds Overabundant native plant cover (<5%)	0 1 2 3 4 5 ☐ Remove weeds that are negatively affecting the hydraulics of the wetland by hand or machine ☐ Mechanically harvest weeds that are negatively affecting the hydraulics of the wetland. ☐ Spot spray or wipe herbicides onto weeds using only herbicide safe for use in waterways **Information: Herbicides must be approved for use in proximity to waterways**. This will minimise potential impact on desirable species and reduce likelihood of chemical residue within soil profile or local waterways. **Information:** Weeds in the macrophyte zone are defined as exotic (not Australian) plants or native plants that are overabundant. Declared weeds are exotic plants that must be managed by law. Alert weeds are exotic plants that must be managed by law, and it is a legal requirement to notify PIRSA of their presence. These include water hyacinth, alligator weed, salvinia, elodea, giant arrowhead and parrot's feather. Native plants such as Typha, Phragmites and Azolla may become overabundant. **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
6f	Algal blooms (in areas of primary contact risk)	<5% of open water covered in algal blooms	0 1 2 3 4 5 ☐ Test for blue-green algae if site presents risk of primary contact ☐ Remove algae with a net or vacuum ☐ Oxygenate wetland with an aeration system (e.g. fountain or similar) ☐ Dose with microbial products designed to outcompete algae **Information:** Algae are naturally occurring organisms and often occur in mixed communities. Relative abundances will fluctuate with season and inflows. Action to remove algae will depend on toxicity, site amenity value and level of primary contact risk. **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
6g	Water level	Maximum water level is <350mm above normal water level or does not exceed top of extended detention depth Time to draw down to normal water level after rainfall is ≤6 days	0 1 2 3 4 5 ☐ Modify inlet invert ☐ Modify high-flow bypass ☐ Modify invert of outlet or overflow weir **Information:** Refer to action in *6a Sedimentation* if water levels have declined due to sedimentation. Inundation >50% of plant height for extended periods of time may be detrimental to plant health. ☐ Other (provide details):
6h	Odour	No detectable odours in close proximity to wetland	0 1 2 3 4 5 ☐ Oxygenate wetland with an aeration system (e.g. fountain or similar) ☐ Remove excess decomposing organic matter **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
6i	Erosion (bed of shallow wetland zones) (Annual)	No erosion and/or preferential flow path	0 1 2 3 4 5 ☐ Dewater, desilt and re-profile shallow wetland zones ☐ Other (provide details):

Functional component		Performance indicator (PI)	Existing condition score and action(s)
6j	Pest fish (Annual)	Limited numbers of pest fish caught in traps (e.g. carp, gambusia)	0 1 2 3 4 5 ☐ Divert inflows or pump out wetland for minimum nine weeks to kill pest fish. Remove dead fish, if required ☐ Install carp exclusion screens on wetland inlet structures **Information:** Drying for at least 4-5 weeks every two years will control large carp, but small carp and gambusia will persist. ☐ Other (provide details):
6k	Damage (valves/ pumps) (Annual)	Good working order	0 1 2 3 4 5 ☐ Service valves/pumps ☐ Replace valves/pumps ☐ Other (provide details):
7		**Batters**	
7a	Erosion	Limited and localised erosion	0 1 2 3 4 5 ☐ Re-profile or reinforce eroded areas ☐ Replant bare areas **Information:** Only use approved plant species, refer to original design specifications. ☐ Other (provide details):
7b	Plant/turf health	Good plant/turf health, free from disease and growing vigorously	0 1 2 3 4 5 ☐ Remove dead or diseased vegetation ☐ Replant bare areas **Information:** Only use approved plant species, refer to original design specifications. **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
7c	Plant/turf cover	Good plant/turf cover (80-90%) >2 metres width of vegetation along lower batters	0 1 2 3 4 5 ☐ Replant bare areas **Information:** Only use approved plant species, refer to original design specifications. **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
7d	Litter and/or debris (larger than a soft drink can)	1 piece of litter and/or debris/50m^2	0 1 2 3 4 5 ☐ Remove litter and excessive debris **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. Contact with sharp objects is a risk when removing litter. All workers must follow WHS practices to reduce risk, including wearing personal protective equipment. Forks and tongs may be used to pick up litter. ☐ Other (provide details):

Functional component		Performance indicator (PI)	Existing condition score and action(s)
7e	Weeds	Limited weed cover (<10%) Limited woody weed cover (<2%) No declared invasive weeds	0 1 2 3 4 5 ☐ Remove weeds by hand ☐ Treat weeds that cannot be removed by hand with targeted-use herbicides. **Information: Herbicides must be approved for use in proximity to waterways**. This will minimise potential impact on desirable species and reduce likelihood of chemical residue within soil profile or local waterways. **Information:** When working in and around water, ensure appropriate Work Health and Safety procedures are in place. ☐ Other (provide details):
7f	Vehicle or pedestrian damage	Limited compaction and/or rutting (<5%)	0 1 2 3 4 5 ☐ Re-profile batters to eliminate minor compaction or rutting ☐ Re-profile moderate to significant compaction and rutting ☐ Replant bare areas **Information:** Only use approved plant species, refer to original design specifications. ☐ Install a temporary protective barrier while vegetation establishes ☐ Create a preferred pedestrian route to minimise damage ☐ Other (provide details):
8		**Outlet, overflow weir/spillway/pit and rock protection**	
8a	Blockage (outlet/ overflow weir/ spillway/pit)	Limited blockage No standing water	0 1 2 3 4 5 ☐ Unblock outlet pipes ☐ Remove sediment ☐ Other (provide details):
8b	Damage (overflow weir/ spillway/pit and rock protection	Limited damage	0 1 2 3 4 5 ☐ Repair damaged outlet structure ☐ Replace damaged outlet structure ☐ Other (provide details):
8c	Erosion	Limited and localised erosion	0 1 2 3 4 5 ☐ Re-profile or reinforce eroded areas ☐ Place and suitably compact fill in minor erosion areas (requiring <1m^3 soil) and re-profile affected area ☐ Place and suitably compact fill to remediate moderate or significant erosion areas ☐ Replant bare areas **Information:** Only use approved plant species, refer to original design specifications. ☐ Other (provide details):
9		**Other structure, e.g. decks, platforms, handrails, bollards, access ramps**	
9a	Damage to or removal of structure/s (Annual)	Limited damage	0 1 2 3 4 5 ☐ Repair damaged structure/s ☐ Replace significantly damaged or removed structure/s ☐ Other (provide details):

Waste and soil disposal general

Note 1: Waste and soil disposal procedures must adhere with South Australian EPA and local authorities requirements.

Note 2: For challenges that fall outside this maintenance guide, refer to *Rectifying vegetated stormwater assets (Draft)* (Water by Design, 2012, developed with assistance from DesignFlow, Brisbane).

Functional component		Inspection frequency (months)	Very good (condition score – 1)	Good – Performance indicator (PI) met (condition score – 2)	Fair (condition score – 3)	Poor (condition score – 4)	Very poor (condition score – 5)
1, 2		**High-flow bypass, inlet (riser) pipes and/or weirs**					
1a 2a	Blockage	3 (and after significant rain events)	No blockage	Limited blockage, free flowing Limited amount of standing water	Minor blockage causing slight bypass of flows or restricted inflows Minor amount of standing water	Moderate blockage causing significant bypass of flows or restricted inflows Moderate amount of standing water	Complete blockage causing total bypass of inflows Significant amount of standing water
1b 2b	Damage	3 (and after significant rain events)	No damage	Limited damage	Minor damage	Moderate damage Minor risk to structural integrity of asset, public safety or asset function	Significant damage Moderate to significant risk to structural integrity of asset, public safety or asset function
1c 2c	Erosion	3 (and after significant rain events)	No erosion	Limited and localised erosion	Minor erosion	Moderate erosion Minor risk to structural integrity of asset, public safety or asset function	Significant erosion Moderate to significant risk to structural integrity of asset, public safety or asset function
3		**Sediment basin**					
3a	Sedimentation	Annual	Free of plants and weeds	Aquatic vegetation and/or weeds cover <10% of sediment basin	Aquatic vegetation and/or weeds cover 10-20% of sediment basin Basin depth between 500-800mm	Aquatic vegetation and/or weeds cover 20-50% of sediment basin Basin depth between 200-500mm	Aquatic vegetation and/or weeds cover >50% of sediment basin Basin depth <200mm
3b	Litter, and/or debris (larger than a soft drink can), and/or organic litter	3 (and after significant rain events)	No litter, debris and/or organic litter	1 piece of litter and/or debris/50m^2 Limited amount of organic litter Limited impact on aesthetics	2-3 pieces of litter and/or debris/50m^2 Minor amount of organic litter Minor impact on aesthetics and/or causing some visible blockage of flows	4-5 pieces litter and/or debris/50m^2 Moderate amount of organic litter Moderate impact on aesthetics and/or causing moderate visible blockage of flows	Significant amount of litter, debris and/or organic litter Significant impact on aesthetics and/or complete blockage of flows

Functional component		Inspection frequency (months)	Very good (condition score – 1)	Good – Performance indicator (PI) met (condition score – 2)	Fair (condition score – 3)	Poor (condition score – 4)	Very poor (condition score – 5)
4		**Transfer pipes and/or weirs**					
4a	Blockage	3 (and after significant rain events)	No blockage	Limited blockage, free flowing Limited amount of standing water	Minor blockage causing slight bypass of flows or restricted inflows Minor amount of standing water	Moderate blockage causing significant bypass of flows or restricted inflows Moderate amount of standing water	Complete blockage causing total bypass of inflows Significant amount of standing water
4b	Damage	3 (and after significant rain events)	No damage	Limited damage	Minor damage	Moderate damage Minor risk to structural integrity of asset, public safety or asset function	Significant damage Moderate to significant risk to structural integrity of asset, public safety or asset function
4c	Erosion	3 (and after significant rain events)	No erosion	Limited and localised erosion	Minor erosion	Moderate erosion Minor risk to structural integrity of asset, public safety or asset function	Significant erosion Moderate to significant risk to structural integrity of asset, public safety or asset function
4d	Plant cover (including weeds)	3	No visible plant cover No woody plant seedlings No declared invasive weeds	Limited plant cover (<5%) Limited woody plant seedlings >30cm height cover (<2%) No declared invasive weeds	Minor plant cover (5-10%) Minor woody plant seedlings >30cm height cover (2-5%) Minor declared invasive weed cover (<2%)	Moderate plant cover (10-20%) Moderate woody plant seedlings >30cm height cover (5-20%) Moderate declared invasive weed cover (2-5%)	Significant plant cover (>20%) Significant woody plant seedlings >30cm height cover (>20%) Significant declared invasive weed cover (>5%)
5		**Inlet pond/zone**					
5a	Sedimentation	Annual	Free of plants and weeds	Aquatic vegetation and/or weeds cover <10% of inlet pond/pool	Aquatic vegetation and/or weeds cover 10-20% of inlet pond/pool Pond/pool depth between 500-800mm	Aquatic vegetation and/or weeds cover 20-50% of inlet pond/pool Pond/pool depth between 200-500mm	Aquatic vegetation and/or weeds cover >50% of inlet pond/pool Pond/pool depth <200mm
5b	Litter and/or debris (larger than a soft drink can) and/or organic litter	3 (and after significant rain events)	No litter, debris and/or organic litter	1 piece of litter and/or debris/50m^2 Limited amount of organic litter	2-3 pieces of litter and/or debris/50m^2 Minor amount of organic litter	4-5 pieces litter and/or debris/50m^2 Moderate amount of organic litter	Significant amount of litter, debris and/or organic litter

Functional component		Inspection frequency (months)	Very good (condition score – 1)	Good – Performance indicator (PI) met (condition score – 2)	Fair (condition score – 3)	Poor (condition score – 4)	Very poor (condition score – 5)
5c	Weeds	3 (and after significant rain events)	No visible aquatic weed cover No declared invasive weeds	Limited aquatic weed cover (<5%) No declared invasive weeds	Minor aquatic weed cover (5-10%) No declared invasive weeds	Moderate aquatic weed cover (10-30%) and/or declared invasive weeds present	Significant aquatic weed cover (>30%) and/or declared invasive weeds present
6		**Macrophyte zone**					
6a	Sedimentation	Annual	Deep pools: ~700mm below normal water level (+EDD = 700-1050mm) Deep marsh: ~350mm below normal water level (+EDD = 500-700mm) Shallow marsh: <200mm below normal water level (+EDD = 500mm)	Deep pools: 600-700 mm below normal water level Deep marsh: 300-350mm below normal water level Shallow marsh: 150-200mm below normal water level	Deep pools: 500-600 mm below normal water level Deep marsh: 250-300mm below normal water level Shallow marsh: 100-150mm below normal water level	Deep pools: 400-500mm below normal water level Deep marsh: 200-250mm below normal water level Shallow marsh: 50-100mm below normal water level	Deep pools: <400mm below normal water level Deep marsh: <200mm below normal water level Shallow marsh: <50mm below normal water level
6b	Plant health	3 (and after significant rain events)	Very healthy plants, densely planted	Healthy plants, free from disease and growing vigorously	Fair plant health Plants are mildly stressed Signs of disease, pests, wilting, brown foliage in 10-20% of plants	Poor plant health Plants are moderately stressed Signs of disease, pests, wilting, brown foliage in 20-40% of plants	Very poor plant health Plants are dying back Signs of disease, pests, wilting, brown foliage in >40% of plants
6c	Plant cover	3 (and after significant rain events)	100% of wetland perimeter vegetated Aquatic plants cover >80% wetland area No gaps in planted areas	>90% of wetland perimeter vegetated Aquatic plants cover >80% of wetland area <20m^2 gaps within planted areas	80-90% of wetland perimeter vegetated Aquatic plants cover 70-80% of wetland area 20-40m^2 gaps within planted areas	70-80% of wetland perimeter vegetated Aquatic plants cover 60-70% wetland area 40-60m^2 gaps within planted areas	<70% of wetland perimeter vegetated Aquatic plants cover <60% wetland area >60m^2 gaps within planted areas
6d	Litter, debris (larger than a soft drink can), and/or organic litter	3 (and after significant rain events)	No litter, debris and/or organic litter	1 piece of litter and/or debris/50m^2 Limited organic litter Limited impact on aesthetics	2-3 pieces of litter and/or debris/50m^2 Minor amount of organic litter Minor impact on aesthetics and/or causing minor blockage of flows	4-5 pieces of litter and/or debris/50m^2 Moderate amount of organic litter Moderate impact on aesthetics and/or causing moderate blockage of flows	Significant amount of litter, debris and/or organic litter Significant impact on aesthetics and/or causing significant blockage flows

Functional component		Inspection frequency (months)	Very good (condition score – 1)	Good – Performance indicator (PI) met (condition score – 2)	Fair (condition score – 3)	Poor (condition score – 4)	Very poor (condition score – 5)
6e	Weeds	3 (and after significant rain events)	No alert or declared weeds No overabundant native plants	No alert or declared weeds Overabundant native plant cover (<5%)	No alert weed cover. Limited declared weed cover (<1%) and/or overabundant native plant cover (5-10%)	Limited alert weed cover (1%) and/or minor declared weed cover (1-2%) and/or overabundant native plant cover (10-20%)	Minor alert weed cover (>1%) and/or minor declared weed cover (>2%) and/or overabundant native plant cover (>20%)
6f	Algal blooms (in areas of primary contact risk)	Summer-Autumn	No algal blooms	<5% of open water covered in algal bloom	5-20% of open water covered in algal bloom or toxic algae detected	20-50% of open water covered in algal bloom or toxic algae persists	>50% of open water covered in algal bloom or toxic algae dispersing to other sites
6g	Water level	3 (and after significant rain events)	System is at normal water level Time to draw down to normal water level after rainfall is ≤6 days	Maximum water level is <350mm above normal water level or does not exceed top of extended detention depth Time to draw down to normal water level after rainfall is ≤6 days	Maximum water level is <350mm above normal water level or does not exceed top of extended detention depth Time to draw down to normal water level after rainfall is 6-8 days	Maximum water level exceeds top of extended detention depth Time to draw down to normal water level after rainfall is 8-10 days	Maximum water level has reached top of freeboard Time to draw down to normal water level after rainfall is >10 days
6h	Odour	3 (and after significant rain events)	No detectable odours	No detectable odours in close proximity to wetland	Minor detectable odours in close proximity to wetland, may include musty, rotten eggs, septic or fishy smells	Moderate detectable odours 25m downwind of wetland, may include musty, rotten eggs, septic or fishy smells	Significant detectable odours 50m downwind of wetland, may include musty, rotten eggs, septic or fishy smells
6i	Erosion (bed of shallow wetland zones)	Annual	No erosion Wetland receiving water evenly	No erosion and/or preferential flow path	Minor erosion and/or preferential flow path	Moderate erosion and/or preferential flow path Minor risk to asset function	Significant erosion and/or preferential flow path Moderate to significant risk to structural integrity of asset, public safety or asset function
6j	Pest fish	Annual	No pest fish species (e.g. carp)	Limited numbers of pest fish caught in traps (e.g. carp, gambusia)	Minor damage to plants and/or minor increases in turbidity from carp mumbling and/or minor numbers of gambusia visible	Moderate damage to plants and/or moderate increases in turbidity from carp mumbling and/or moderate numbers of gambusia visible	Major damage to plants and/or highly turbid water from carp mumbling and/or visible schools of gambusia
6k	Damage (valves/pump)	Annual	No damage	Good working order	Signs of minor wear and tear (pressure drop, flow reduction, start-up seizure, power supply issues)	Signs of moderate wear and tear (pressure drop, flow reduction, start-up seizure, power supply issues)	Signs of significant wear and tear (pressure drop, flow reduction, start-up seizure, power supply issues)

Functional component		Inspection frequency (months)	Very good (condition score – 1)	Good – Performance indicator (PI) met (condition score – 2)	Fair (condition score – 3)	Poor (condition score – 4)	Very poor (condition score – 5)
7		**Batters**					
7a	Erosion	3 (and after significant rain events)	No erosion	Limited and localised erosion	Minor erosion	Moderate erosion Minor risk to structural integrity of asset, public safety or asset function	Significant erosion Moderate to significant risk to structural integrity of asset, public safety or asset function
7b	Plant/turf health	3	Excellent plant/turf health, densely planted	Good plant/turf health, free from disease and growing vigorously	Fair plant/turf health Minor signs of disease, pests, wilting in <10% of plant/turf	Poor plant/turf health Moderate signs of disease, pests, wilting in 10-25% of plant/turf	Very poor plant/turf health Signs of disease, pests, wilting in >25% of plant/turf
7c	Plant/turf cover	3	Excellent plant/turf cover (>90% cover)	Good plant/turf cover (80-90%) >2 metres width of vegetation along lower batters	Fair plant/turf cover (50-80%) 0.5-2 metres width of vegetation along lower batters	Poor plant/turf cover (30-50%) <0.5 metre width of vegetation along lower batters	Very poor plant/turf cover (<30%) No vegetation along lower batters
7d	Litter and/or debris (larger than a soft drink can)	3	No litter and/or debris	1 piece of litter and/or debris/50m^2	2-3 pieces of litter and/or debris/50m^2 Minor impact on aesthetics	4-5 pieces of litter and/or debris/50m^2 Moderate impact on aesthetics	Significant amount of litter and/or debris Significant impact on aesthetic
7e	Weeds	3	No visible weed cover No woody weeds No declared invasive weeds	Limited weed cover (<10%) Limited woody weed cover (<2%) No declared invasive weeds	Minor weed cover (10-20%) Minor woody weed cover (2-5%) Minor declared invasive weed cover (<5%)	Moderate weed cover (20-40%) Moderate woody weed cover (5-20%) Moderate declared invasive weed cover (5-20%)	Significant weed cover (>40%) Significant woody week cover (>20%) Significant declared invasive weed cover (>20%)
7f	Vehicle or pedestrian damage	3	No compaction or rutting	Limited compaction and/or rutting (<5%)	Minor compaction and/or rutting (5-10%)	Moderate compaction and/or rutting (10-20%) If not addressed could lead to loss of structural integrity of asset	Significant compaction and/or rutting (>20%) Posing risk to structural integrity of asset, public safety or asset function

Functional component		Inspection frequency (months)	Very good (condition score – 1)	Good – Performance indicator (PI) met (condition score – 2)	Fair (condition score – 3)	Poor (condition score – 4)	Very poor (condition score – 5)
8		**Outlet and overflow weir/spillway/pit and rock protection**					
8a	Blockage (outlet/ overflow weir/ spillway/pit)	3 (and after significant rain events	No blockage	Limited blockage No standing water	Blockage causing minor obstruction of outflows	Blockage causing moderate obstruction of outflows	Blockage causing significant obstruction of outflows
8b	Damage (overflow weir/ spillway/pit and rock protection)	3 (and after significant rain events	No damage	Limited damage	Minor damage	Moderate damage Minor risk to structural integrity of asset, public safety or asset function	Significant damage Moderate to significant risk to structural integrity of asset, public safety or asset function
8c	Erosion	3 (and after significant rain events)	No erosion	Limited and localised erosion	Minor erosion	Moderate erosion Minor risk to structural integrity of asset, public safety or asset function	Significant erosion Moderate to significant risk to structural integrity of asset, public safety or asset function
9		**Other structure, e.g. decks, platforms, handrails, bollards, access ramps**					
9a	Damage to or removal of structure/s	Annual	No damage	Limited damage	Minor damage	Moderate damage Minor risk to structural integrity of asset, public safety or asset function	Significant damage Moderate to significant risk to structural integrity of asset, public safety or asset function