Wetland Design Manual

Part A2: Deemed to comply design criteria
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Introduction

This section presents an overview of the design criteria that need to be met to satisfy the Deemed to Comply assessment pathway. Please refer to Part B for more information on the Deemed to Comply approach and the Alternative Approach as part of the design acceptance process. Clear links between the design criteria and core outcomes are illustrated, assisting the designer to check that their design is meeting Melbourne Water’s requirements.

These design criteria are expanded upon in this part of the manual and are also included in the relevant sections of Part C as part of the technical design approach. The Deemed to Comply conditions are also included in the design checklists available on Melbourne Water’s Planning and Building website.

The Deemed to Comply design criteria are prescriptive for a reason and additional design considerations and minimum standards are provided in Part A3 to assist designers plus provide more guidance if the alternative approach is required.

Demonstration of compliance with only some of the Deemed to Comply criteria is required for concept and functional design acceptance. Please refer to the right-side column in the tables provided in this part or the various design checklists for each stage of the design acceptance process to see which conditions apply at each stage:

- Concept design deemed to comply checklist
- Functional design deemed to comply checklist
- Detailed design deemed to comply checklist

Where applicable, crosslinks have been provided to Melbourne Water standard drawings relevant to specific Deemed to Comply design criteria to assist with detailed design documentation.
## Deemed to Comply criteria

### General

| GN1 | The treatment and flow regime performance of the wetland must be modelled in MUSIC, or similar conceptual modelling software as approved by Melbourne Water. |
| GN2 | The meteorological data in the conceptual modelling data or software (i.e. MUSIC) must be:  
- Based on at least 10 years of historical records  
- Recorded at six minutes intervals  
- Sourced from a pluviographic station as close as possible to the wetland site  
- Have a mean annual rainfall depth within 10% of the long term rainfall depth at the rainfall station closest to the wetland site |
| GN3 | The system configuration shown on the design plans must be consistent with the conceptual modelling parameters (e.g. MUSIC) (including the stage/discharge relationship) and sediment pond calculator/calculations. |
| GN4 | Peak design flows must be estimated in accordance with methods in Australian Rainfall and Runoff. |

### Maintenance provisions

| MN1 | Sediment ponds must be able to be drained whilst maintaining the macrophyte zone water level at normal water level. This is achieved by having the sediment pond transfer pit RL 100mm higher than the inlet pool NWL. Refer [Standard Drawing 7251/12/001](#). |
| MN2 | All parts of the base of a sediment pond must be accessible:  
- Within seven metres of a designated hard stand area for excavation vehicles ("edge cleaned") OR  
- Via a maintenance access ramp into the base of the sediment pond. Refer [Standard Drawing 7251/12/005](#). |
| MN3 | The sediment pond base material must extend vertically up the batter by 300 mm and comprise of:  
- Steel reinforced concrete – steel reinforced, minimum 150 mm thick; OR  
- 400 mm compacted rock. Approximately 50% 300mm in size. The remaining 50% made up of 0-100mm graded rock, premixed with 300 dia rocks and spread and tracked so as to form a compacted base. Refer [Standard Drawing 7251/12/004](#). |
| MN4 | ‘Edge cleaned’ sediment ponds must have hardstand areas (e.g. crushed rock) for excavation vehicles. A maintenance track must be provided around the entire perimeter of the sediment pond. Refer Standard Drawing 7251/12/005. | Detailed |
| MN5 | Maintenance access ramps are required on all sediment ponds that cannot be ‘edge cleaned’. The maintenance access ramp into a sediment pond must:  
• Extend from the base of the sediment pond to at least 0.5 metres above TEDD,  
• Be at least 4 metres wide,  
• Be no steeper than 1:5, (1:12 cross fall or flatter)  
• Be capable of supporting a 20 tonne excavator,  
• Constructed of compacted 200 mm deep layer of rock:  
  - Bottom layer is 100mm depth of 0-100mm FCR; top layer is 100mm of 0-40mm NDCR (6% cement stabilised below NWL),  
• Have a barrier to prevent unauthorised vehicle access (e.g. gate, bollard and/or fence).  
Refer Standard Drawing 7251/12/005. | Functional Detailed |
| MN6 | A maintenance access track must be provided to the sediment pond maintenance access ramp and to enable maintenance vehicles to safely access and exit the site. The maintenance access track must:  
• Be at least 4 metres wide,  
• Comprise of compacted 200 mm deep layer of rock. Bottom layer is 100mm depth of 0-100mm FCR; top layer is 100mm of 0-40mm NDCR,  
• Be reinforced to take a 20 tonne vehicle,  
• At the road edge, have an industrial crossover to Council standard and rolled kerb adjoining it,  
• Have a barrier to prevent unauthorised vehicle access (e.g. gate, bollard and/or fence).  
Refer Standard Drawing 7251/12/005. | Concept Functional Detailed |
| MN7 | A hardstand area with a minimum turning circle appropriate to the types of maintenance vehicles to be used must be provided adjacent to the sediment pond maintenance access ramp to enable maintenance vehicles to safely reverse and exit the sediment loading area. (Designers should seek advice from Melbourne Water on the types of maintenance vehicles that will be used.)  
| MN8 | Intersections between pedestrian pathways and site maintenance access tracks should be reinforced to take a 20 tonne vehicle. | Detailed |
Dedicated sediment dewatering areas must be provided and:

- Be accessible from the maintenance ramp/track,
- Have a length to width ratio no narrower than 10:1,
- 1:12 cross fall or flatter.
- Be able to contain all sediment removed from the sediment accumulation volume spread out at a maximum of 500 mm depth,
- Be located above the peak 10 year ARI water level and within 25 metres of each sediment pond,
- Be located at least 15 metres from residential areas, public access spaces (playgrounds, sports fields etc), and consider potential odour and visual issues for local residents,
- Address public safety and potential impacts on public access to open space areas,
- Be free from above ground obstructions (e.g. light poles) and be an area that Melbourne Water has legal or approved access to for the purpose of dewatering sediment.

Refer resetting sediment ponds best practice guideline for additional information.

The wetland must be configured to enable maintenance vehicles to drive around at least 50% of the wetland perimeter. Note: This can be achieved via subdivisional road networks. Vehicular access must be provided as close as possible to wetland structures that may catch debris (e.g. provide access to the closest bank where structures are within the water body).

Sediment ponds

<table>
<thead>
<tr>
<th>SP1</th>
<th>Sediment ponds must be located offline of waterways and online to the pipe or lined channel they are treating water from. Refer to Part A3 of this Manual for guidance on offline configurations.</th>
</tr>
</thead>
</table>
| SP2 | Sediment ponds must be located at each point stormwater enters the "wetland system" unless:
- The catchment of the incoming stormwater is < 5% of the total wetland catchment OR
- The incoming stormwater has already passed through a bioretention system or wetland immediately upstream |
| SP3 | Sediment ponds must be sized to:
- Capture 95% of coarse particles ≥ 125 µm diameter for the peak three month ARI |

1 A waterway is defined as either a natural or constructed waterway. Melbourne Water’s Development Services Schemes define a ‘Constructed Waterway’ as reaches of a waterway that are required to be fully or partially constructed to service new development.
- ≤ than 1.6m deep
- Provide adequate sediment storage volume to store five years of sediment. The top of the sediment accumulation zone must be assumed to be 500 mm below NWL (refer to Figure 1).
- Ensure that velocity through the sediment pond during the peak 100 year ARI event is ≤ 0.5 m/s. (The flow area must be assumed to be the EDD multiplied by the narrowest width of the sediment pond, at NWL, between the inlet and overflow outlet)

Sediment ponds must be ≤ 120% of the size needed to meet the limiting of the above three criteria. Compliance with the above criteria must be demonstrated using the methods described in WSUD Engineering Procedures: Stormwater (Melbourne Water, 2005). Alternatively, the velocity criteria can be checked using a hydraulic model such as HEC-RAS. Refer to Part D of this Manual for guidance on undertaking velocity checks.

SP4

The sediment pond EDD must be ≤ 350 mm.

Concept

Functional

Detailed

**Figure 1 Sediment pond storage.**
Macrophyte zone

| MZ1 | At least 80% of the area of the macrophyte zone at NWL must be ≤ 350 mm deep to support shallow and deep marsh vegetation. The wetland bathymetry should provide approximately equal amounts of shallow marsh (100mm - 150 mm deep) and deep marsh (150 mm to 350 mm deep). |
| MZ2 | The macrophyte zone EDD must be ≤ 350 mm. |
| MZ3 | Macrophyte zones must be located offline from all waterways and drains (i.e. there must be a bypass route around the macrophyte zone). |
| MZ4 | The length of the macrophyte zone must be ≥ four times the average width of the macrophyte zone. |
| MZ5 | The macrophyte zone outlet must be located at the opposite end of the macrophyte zone to the inlet(s). |
| MZ6 | The macrophyte zone must have a sequence and mix of submerged, shallow and deep marsh zones arranged in a banded manner perpendicular to the direction of flow. Refer Figure 2). |
| MZ7 | Inlet and outlet pools must be ≤ 1.5 m depth. |
| MZ8 | Intermediate pools (between the inlet and outlet pool) must be ≤ 1.2 m deep. |
| MZ9 | Velocities in the macrophyte zone must be:
  - less than 0.5 m/s for the peak 100 year ARI flow
  - less than 0.05 m/s for the peak three month ARI
Compliance with the above criteria must be demonstrated using the methods described in WSUD Engineering Procedures: Stormwater (Melbourne Water, 2005) or using a hydraulic model such as HEC-RAS or TUFLOW. Refer to Part D of this Manual for guidance on undertaking velocity checks. |
| MZ10 | The macrophyte zone must provide a 90th percentile residence time of a maximum of 72 hours (assuming plug flow between inlet and outlet through the EDD and 50% of the permanent pool volume). The macrophyte zone normal water level must not be exceeded for more than 72 consecutive hours. Refer to the Melbourne Water online tool and Part D of this Manual for guidance on determining residence time and wet spells analysis. |
### MZ11

A grade of between 1:150 and 1:400 must be provided between marsh zones (longitudinally through the macrophyte zone) to enable the wetland to freely drain. Intermediate pools will generally be needed to transition between marsh zones.

### MZ12

A marker must be used to show wetland water level relative to NWL and EDD. The marker must be able to be read from the bank and attached to the wall of the submerged outlet pit. Refer to Standard Drawings 7251/12/008 & 7251/12/009.

### MZ13

Melbourne Water will not accept islands within wetlands as are difficult to maintain (need a canoe or boat) and can become easily overgrown with weeds.

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**Figure 2 Macrophyte zone planting bands.**

**Bypass**

**BY1**

The bypass route must be sized to convey the maximum overflow from the sediment pond that will occur during the peak 100 year ARI event. Where a sediment pond is located within a retarding basin, the bypass must convey at least the peak one year ARI flow.
# Inlets and outlets

**IO1** All pits, grilles and structures must conform to Melbourne Water’s standards as shown in the Land Development Manual and Standard Drawings.  

**IO2** Outlet structures must be easily identifiable and maintainable. They must be accessible from the bank. The edge of the outlet structure closest to the bank (maintenance access point) must be located in < 350 mm water depth.  
Refer Standard Drawing 7251/12/403

**IO3** The Twin Chamber Outfall pit (containing the side winding penstock and gate valves) must have a grilled or grated lid to allow visual inspection and valve operation from the surface (e.g. through the grate/grille).  
Refer Standard Drawing 7251/12/011

**Note:** Melbourne Water will be installing a hydraulic level sensor and data logger on all Development Services Scheme wetlands to ensure the wetland is meeting the required hydraulic performance targets (refer Figure 3).

**IO4** The connection between the sediment pond and macrophyte zone inlet pool (sediment pond transfer pit) must be sized such that:
- All flows ≤ the peak three month ARI event are transferred into the macrophyte zone (refer Figure 4), AND
- 60% of the peak 1 year ARI flow overflows from the sediment pond into the bypass channel/pipe when the water level in the macrophyte zone is at TEDD (and not enter the macrophyte zone) (refer Figure 5), AND
- The velocity through the macrophyte zone is ≤ 0.5 m/s during the peak 100 year ARI event:
  i. Assuming the macrophyte zone is at TEDD if the wetland is not within a retarding basin or flood plain
  ii. Assuming the water level is at the peak 10 year ARI water level if the wetland is within a retarding basin or flood plain

**IO5** The submerged offtake pit connecting into the twin chamber outfall pit must be submerged to minimise blocking from floating debris. Refer to Standard Drawings 7251/12/008 & 7251/12/010.

**IO6** The twin chamber outfall pit must contain both a side winding penstock valve & a gate valve so that:
- When the penstock is fully open the wetland draws down to NWL quickly assisting with plant growth during the first 12 months of plant establishment.
- The penstock can be fully opened or closed to assist with maintenance of the wetland.
- The stage/discharge rate can be adjusted if required to achieve suitable residence times and/or inundation patterns.
  Refer [Standard Drawing 7251/12/011](#).
- The gate valve allows full or partial draw down of the wetland to assist with maintenance.
  Refer Standard Drawings 7251/12/010 & 7251/12/014

**IO7**

Balance pipes must be placed between all open water zones (inlet, intermediate and outlet pools) to enable water levels to be drawn down for maintenance or water level management purposes. Refer Standard Drawings [7251/12/011](#), [7251/12/012](#) & [7251/12/013](#) for various configurations. Balance pipes must be 300mm dia RCP with the RL of the submerged offtake pit (notch cut out) no more than 300 mm above the base of the deepest point of the pool to maximise draw down and minimise blockage potential. Refer Standard Drawings 7251/12/007 & 7251/12/008 for details.

**Figure 3: Hydraulic level sensor & data logger**
Figure 4 Connection between sediment pond and macrophyte zone – three month ARI flow check (refer to Melbourne Water Standard Drawings 7251/12/001 and 7251/12/002 for more details on the connection between sediment pond and macrophyte zone).

Figure 5 Connection between sediment pond and macrophyte zone – one year ARI flow check (Refer to Melbourne Water Standard Drawings 7251/12/001 and 7251/12/002 for more details on the connection between sediment pond and macrophyte zone).
### Vegetation & Landscape

<table>
<thead>
<tr>
<th>VG1</th>
<th>The macrophyte zone must contain a minimum of 80% cover of emergent macrophytes comprising of shallow and deep marsh zones. Open water areas (maximum 20% of the wetland area) must include submerged marsh vegetation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VG2</td>
<td>Any open water areas in excess of 20% of the macrophyte zone area (at NWL) must be located as a separate water body. These separate water bodies are not considered by Melbourne Water to be wetlands for the purpose of treating stormwater, and are therefore beyond the scope of this document. For further information, refer to Part A3 for open water, landscape design and amenity design considerations and the Planning and Building website for ownership and maintenance responsibilities. Conceptual models of wetlands and other parts of the treatment train (e.g. MUSIC) must assume there is no reduction in pollutant loads within these separate waterbodies.</td>
</tr>
<tr>
<td>VG3</td>
<td>Ephemeral batters (NWL to 350 mm above NWL) of the wetland macrophyte zone and sediment pond must be densely planted with plants at 6 plants per sqm suited to intermittent wetting. 80% of the plants used in the ephemeral batters must be in accordance with the species and densities shown in Table 1.</td>
</tr>
<tr>
<td>VG4</td>
<td>The ephemeral batters must be planted at an average density of 6 plants per sqm with individual plants grown in individual pots or tray cells that are a minimum of 90 cm³ in volume (V93 hiko cell equivalent), however 200cm³ (forestry tubes) are preferred.</td>
</tr>
<tr>
<td>VG5</td>
<td>The shallow marsh (100 to 150 mm below NWL) of the macrophyte zone and sediment pond must be densely planted with 2 plants per sqm in &gt;600cm³ containers. 90% of the plants used in the shallow marsh must be in accordance with the species and densities shown in Table 2. A minimum of three species must be specified for the shallow marsh zone.</td>
</tr>
<tr>
<td>VG6</td>
<td>The deep marsh (150 to 350 mm below NWL) of the macrophyte zone must be densely planted with 2 plants per sqm in &gt;600cm³ containers. 90% of the plants used in the deep marsh must be in accordance with the species and densities shown in Table 3. A minimum of three species must be specified for the deep marsh zone.</td>
</tr>
<tr>
<td>VG7</td>
<td>The submerged marsh (350 to 700 mm below NWL) of the macrophyte zone must be planted with 1 plant per sqm in</td>
</tr>
</tbody>
</table>
| VG8 | Emergent and submerged macrophyte seedlings must be grown in individual container/pots with a minimum volume of:  
• 600 cm³ (200 cm³ forestry tubes are not acceptable)  
**Note:** Seedlings sourced from bare-root divisions from tub/tray grown stock or stock harvested from existing wetlands will not be accepted. | Detailed |
| VG9 | Seedlings grown in >600 cm³ pots must have:  
• minimum stem height of 500 mm (except *Triglochin procerum* and *Eleocharis acuta* – minimum stem height of 400 mm)  
• total stem area must cover at least 50% of the pot surface area  
• well developed, healthy root system that occupies the full pot volume (i.e. the growing media must remain intact when the plant is removed from the pot)  
• Not have a pot depth exceeding 150mm.  
**Note:** The minimum stem height criteria specified for 600 cm³ pots does not apply to submerged macrophyte species. | Detailed |
| VG10 | The effective water depth (permanent pool depth plus TEDD) must not exceed half of the average plant height for more than 20% of the time. This must be demonstrated using inundation frequency analysis assuming the plants heights are in accordance with those shown in Table 2 to Table 4.  
Refer to [online tool](#) and **Part D** of this Manual for guidance on the inundation frequency analysis. | Functional |
| VG11 | For stormwater harvesting requirements please refer to the below guidelines. **Note:** the harvested water can only be extracted from the downstream chamber of the twin chamber outfall pit.  
[Stormwater harvesting guidelines](#)  
[Stormwater harvesting technical guidelines](#)  
[Stormwater harvesting technical guidelines – Drawings Appendix 2](#)  
**Note:** a diversion licence is required to harvest water from Melbourne Water assets. | Concept |
| VG12 | The wetland must have an appropriately sized outfall to ensure the planting wont drown and for Melbourne Water to accept ownership of the asset at completion of the defects period.  
**Note:** The developer and or their consultant is to negotiate with any downstream property owners with regard to outfall | Functional |
design and construction (temporary or permanent), not Melbourne Water. The developer must own and maintain any temporary outfalls until the permanent asset is constructed, not Melbourne Water.

**VG13**

Any grassed areas that Melbourne Water must maintain are to meet one of the below options. Councils batter grade requirements should be sought for areas they are to maintain as each council has a different requirement:

1) 1 in 5 or flatter with a 3m run out area at the bottom of the slope is to be provided so MW can mow up and down if necessary. Run out area is to be a maximum grade of 1:12 and be clear of rocks, trees, fences etc.

2) Maximum grade of 1:12 to allow for safe grass cutting (horizontal and vertical cutting method). No run out area is required, area must be clear of rocks, trees, fences, drops etc.

**Note:** For mowing around vegetation MW requires a 3m gap between vegetation to allow mower access. Overhanging vegetation can be an access issue. Slopes steeper than 1 in 5 to be densely vegetated.

**VG14**

No mulch to be placed below Q100 or frequently inundated areas. Jute mat to be installed in planted areas above TEDD for wetlands. Jute mat must be installed to the manufacturer's specifications, including fasteners.

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**Table 1 Ephemeral batter plant list (NWL to 350mm above NWL)**

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Minimum density (&gt;90cm² container/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baumea rubiginosa</td>
<td>Soft Twig-rush</td>
<td>6</td>
</tr>
<tr>
<td>Carex appressa</td>
<td>Tall Sedge</td>
<td>6</td>
</tr>
<tr>
<td>Carex tereticaulis</td>
<td>Basket Sedge</td>
<td>6</td>
</tr>
<tr>
<td>Cyperus lucidus</td>
<td>Leafy Flat-sedge</td>
<td>6</td>
</tr>
<tr>
<td>Juncus amabilis</td>
<td>Hollow Rush</td>
<td>6</td>
</tr>
<tr>
<td>Juncus flavidus</td>
<td>Yellow Rush</td>
<td>6</td>
</tr>
<tr>
<td>Juncus krausii</td>
<td>Sea Rush</td>
<td>6</td>
</tr>
<tr>
<td>Juncus pallidus</td>
<td>Pale Rush</td>
<td>6</td>
</tr>
<tr>
<td>Poa labillardieri</td>
<td>Common Tussock</td>
<td>6</td>
</tr>
<tr>
<td>Lomandra longifolia</td>
<td>Spiny-headed Matt-rush</td>
<td>6</td>
</tr>
</tbody>
</table>

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**Functional Detailed**
### Table 2 Shallow marsh plant list (100 to 150mm below NWL)

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Minimum density (plants/m²)</th>
<th>Average plant height (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baumea articulata</td>
<td>Jointed Club-rush</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Bolboschoenus caldwellii</td>
<td>Sea Club-rush</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>Bolboschoenus fluviatilis</td>
<td>Tall Club-rush</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Bolboschoenus medianus</td>
<td>Marsh Club-rush</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Cladium procerum</td>
<td>Leafy Twig-rush</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>Eleocharis acuta</td>
<td>Common Spike-rush</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Schoenoplectus tabernaemontani</td>
<td>River Club-rush</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Cycnogeton procerum</td>
<td>Water Ribbons</td>
<td>2</td>
<td>1.0</td>
</tr>
</tbody>
</table>

### Table 3 Deep marsh plant list (150 to 350mm below NWL)

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Minimum density (plants/m²)</th>
<th>Average plant height (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baumea articulata</td>
<td>Jointed Club-rush</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Bolboschoenus caldwellii</td>
<td>Sea Club-rush</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>Bolboschoenus fluviatilis</td>
<td>Tall Club-rush</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Bolboschoenus medianus</td>
<td>Marsh Club-rush</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Cladium procerum</td>
<td>Leafy Twig-rush</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>Eleocharis sphacelata</td>
<td>Tall Spike Rush</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Schoenoplectus tabernaemontani</td>
<td>River Club-rush</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Cycnogeton procerum</td>
<td>Water Ribbons</td>
<td>2</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Table 4 Submerged marsh plant list (350 to 700mm below NWL)

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Minimum density (plants/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>600cm³ tube</td>
</tr>
<tr>
<td>Myriophyllum crispatum</td>
<td>Upright Water-milfoil</td>
<td>1</td>
</tr>
<tr>
<td>Potamogeton ochreatus</td>
<td>Blunt Pondweed</td>
<td>1</td>
</tr>
<tr>
<td>Vallisneria australis</td>
<td>Eel-grass</td>
<td>1</td>
</tr>
</tbody>
</table>

Liner and topsoil

**LN1** The exfiltration rate from the base and the sides of the wetland must be accurately represented in the conceptual modelling software analysis (e.g. MUSIC). Wetlands with a permanent NWL must have a compacted clay liner made from site soils and/or imported material where site soils are unsuitable based on the recommendations from the site geotechnical report.

**LN2** Impermeable liners (based on the recommendations from the site geotechnical report) must be used where the groundwater table is likely to interact with the wetland or where there are saline in-situ soils.

**LN3** At least 200mm of topsoil must be provided in all areas of the macrophyte zone; and in sediment ponds to 500mm below NWL in accordance with Melbourne Waters Topsoil Specification.

**LN4** Topsoils used within the wetland (in situ or imported) must comply with Melbourne Waters Topsoil Specification which is sub set of AS 4419 Soils for landscaping and garden use. Testing must be carried out by a NATA accredited laboratory. If required, amelioration to the topsoil must be undertaken to achieve compliance with Melbourne Waters Topsoil Specification.

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2 The AS 4419 requirement for % organic matter content does not apply. Topsoils used in wetlands must have a minimum of 5% organic matter content.
Landscape design structures

| LDS1  | All boardwalks, piers, bridges and/or structurally treated edges installed and maintained by others are to meet Melbourne Waters below guideline requirements and also have heights and/or railings in accordance with relevant design codes and satisfy inundation and safety criteria.  
|       | - Constructing waterway crossings guideline  
|       | - Shared pathways guideline  
|       | - Maintenance Agreements  
|       | Refer to Part A3 of this Manual for design consideration and guidance on landscape design features. |

| LDS2  | Boardwalks and/or viewing platforms are not permitted over sediment ponds, pipes & pits, weirs, rock chutes and EDD control structures for maintenance access reasons. |

| LDS3  | Vehicle exclusion bollards are required around entire wetland reserve to prevent unauthorised access and illegal rubbish dumping.  
|       | Refer Standard Drawing 7251/12/005 |

Edge treatment

| ET1  | The edge of any deep open water should not be hidden or obscured by embankments or terrestrial planting unless measures are taken to preclude access. Public access to structures, the top of weirs, orifice pits and outlet structures must be restricted by appropriate safety fences and other barriers. Permanent fencing is required adjacent to potentially unsafe structures (i.e. deep water zones, steep drops, top of weirs, outlet structures etc). |

| ET2  | All wetland edges must have:  
|       | • Vegetated approach batters no steeper than 1:5, a 2.8 metre wide vegetated safety bench at 1:8 between NWL and 350 mm below NWL and a maximum 1:3 slope beyond 350 mm below NWL (refer Figure 6). OR  
|       | • The batter from TEDD to 350mm below NWL must contain dense impenetrable planting that is a minimum of 2.8 metres wide and 1.2 metres high (refer Figure 7 and Figure 8 ). |

| ET3  | A minimum offset of 15 metres must be provided from the wetland’s NWL to any allotment or road reserve (not including Concept Functional Detailed |
shared pathways). A safety design audit may be required for any proposal that does not achieve this condition. Refer to Part A3 of this Manual for design consideration and guidance on safety in design.

**Figure 6** Indicative cross-section of vegetated wetland edge with safety bench (Refer to Melbourne Water Standard Drawing 7251/12/006 for more details).
Figure 7 Indicative cross-section of vegetated wetland edge with impenetrable planting.

Figure 8 Photos showing examples of wetland edges with dense impenetrable planting
Landscape contractor selection, plant supply, installation & maintenance

The landscape consultant must be engaged by the developer to supervise and approve the entire landscape construction process from the pre-commencement meeting through to achieving the end of defects period (a minimum of 27 months), ensuring the fellow requirements are met:

<table>
<thead>
<tr>
<th>LC1</th>
<th>The landscape contractor awarded the wetland project is suitably qualified and experienced and has completed work on Melbourne Water wetlands historically and the work is of a high quality.</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC2</td>
<td>The landscape contractor awarded the wetland project must be the contractor undertaking the plant installation. Melbourne Water will not accept sub-contracting to another contractor without written approval to ensure the sub-contractor is suitably qualified, experienced and has completed work of this nature previously.</td>
<td>Construction</td>
</tr>
<tr>
<td>LC3</td>
<td>The landscape contractor awarded the wetland project must be the contractor maintaining the planting once installed. Subcontracting of the maintenance activity must be approved by Melbourne Water in writing to ensure the sub-contractor is suitably qualified and experienced and has completed work of this nature previously.</td>
<td>Construction</td>
</tr>
<tr>
<td>LC4</td>
<td>The landscape contractor awarded the wetland project must order stock from an accredited nursery that grows plants to the specifications outlined within this manual (no wild stock or cutting up of planting clumps is to be installed).</td>
<td>Construction</td>
</tr>
<tr>
<td>LC5</td>
<td>Check the planting contractor’s delivery dockets to ensure the number of plants and format of plants ordered and delivered matches the landscape plan and requirements of this manual.</td>
<td>Construction</td>
</tr>
<tr>
<td>LC6</td>
<td>Audit the quality of stock delivered to site prior to the installation occurring accepting and/or rejecting any unacceptable stock that doesn’t meet the requirements of this manual.</td>
<td>Construction</td>
</tr>
<tr>
<td>LC7</td>
<td>Ensure the contractor is undertaking regular weed runs (aquatic, ephemeral and terrestrial) of the site to ensure a weed seed bank doesn’t develop.</td>
<td>Construction</td>
</tr>
<tr>
<td>LC8</td>
<td>Undertake random audits of the accredited nursery’s they regularly source stock from to ensure the stock they are growing and supplying is of a high quality and meets the requirements of this manual.</td>
<td>Construction</td>
</tr>
</tbody>
</table>
Make Melbourne Water aware of any accredited nursery’s growing and supplying poor quality stock that doesn’t meet the requirements of this manual.  

Make Melbourne Water aware of any landscape contractor not sourcing, installing and maintain planting to the requirements of this manual.  

Make Melbourne Water aware of any topsoil installation that doesn’t meet the requirements of Melbourne Waters topsoil specification weather installed by the civil or planting contractor.  

Make Melbourne Water aware of wetland bathymetry that doesn’t meet the requirements of this manual resulting in reduced planting banding and wetland treatment.  

**Note:** Should Melbourne Water feel the quality of sourced plants delivered to and installed on site don’t meet the requirements of this manual, we reserve the right to engage an independent auditor to assess and make a recommendation as to the quality of the landscape planting. Any required rectification works resulting from this audit would be at the expense of the developer, not Melbourne Water.
Appendix 1: Concept Design Example Drawings

<table>
<thead>
<tr>
<th>PLANT ZONES</th>
<th>10%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow Marsh</td>
<td>37%</td>
<td>40%</td>
</tr>
<tr>
<td>Deep Marsh</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Submerged Marsh</td>
<td>12%</td>
<td>13%</td>
</tr>
<tr>
<td>Open Water</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Total</td>
<td>98%</td>
<td>98%</td>
</tr>
</tbody>
</table>

**Example Concept Design Plan View (Not to Scale)**

- **Receiving Drain (Existing)**
  - NL 16.95

- **Inlet Pool**

- **Outlet Pool**

- **High Flow Bypass**
  - 7251/12/013
  - 7291/12/013

- **High Flow Bypass Weir A**
  - 7251/12/002
  - 7251/12/002

- **High Flow Bypass Weir B**
  - 7251/12/004

- **Sediment Pond**
  - 7251/12/004

- **Existing Vegetation to be Retained**

- **Maintenance Access Ramp**
  - 7251/12/005

- **4m Wide Maintenance Access Track**
  - 7251/12/005

- **Share 4m Wide Maintenance and Pedestrian Access Track**
  - 7251/12/005

- **Proposed Playground**

- **Legend**
  - NL
  - 1:1000
  - 0:100
  - Extent of Works

**Note:**
- High Flow Bypass A is designed to convey flows at outlet,
- High Flow Bypass B is designed to convey flows at inlet.

Ownership of the land including the wetland area is generally controlled on behalf of the developer. In favour of the wetland area, it is required for any development activities to be undertaken in accordance with the requirements of this Manual.

Any Council / Melbourne Water Reserve with a decisional role should ensure that developments are consistent with Melbourne Water's requirements.

Additional comments, requirements, and specifications are detailed in the technical report.
Appendix 1: Concept Design Example Drawings

NOTE 1:
THE EXAMPLE IS FOR DEEMED TO COMPLY WETLANDS WHERE THE FLOWS GREATER THAN THREE MONTHS ARE DIVERTED AT THE SEDIMENT POND.

NOTE 2:
THE NWL OF THE SEDIMENT POND IS DICATED BY THE SL OF THE TRANSFER PIT CREST, WHICH SHALL BE 100MM (MINIMUM) HIGHER THAN THE DESIGN NWL OF THE INLET POOL. THIS ALLOWS FOR THE TRANSFER PIT TO FUNCTION AS A "PUMP OUT PIT" WHEN Dewatering OF THE SEDIMENT POND IS REQUIRED FOR SEDIMENT POND RESETTING.
Appendix 2: Functional Design Example Drawings

NOTE:
- This example is for design to comply with wetlands where the flows greater than three months are diverted at the sediment pond.
- Ownership of the land including the wetland area is generally councils. An annual water metering system is required for areas of land affected by inundation, which is a requirement of common provision AA 1162 (creation and maintenance of wetland floodways and drainage).
- Any council’s utilisation of water reserve with a substation area running adjacent to it should be fitted with bolts and non-ramps to prevent unauthorised vehicle access. This minimises damage of embankment etc in the reserve.
- For functional design assessment, fire break, pit structures, and other balance fire configuration and rockworks, are to be included in the functional design submission.
Appendix 2: Functional Design Example Drawings
Appendix 3: Detailed Design Example Drawings

DETAILED DESIGN NAME

XXXX-XX MWC DRAWING NUMBER

GENERAL NOTES:
1. These drawings are to be read in conjunction with Council and Melbourne Water Standard Contract Specifications. Any discrepancy between drawings, existing conditions or specifications is to be referred to the Superintendent for confirmation prior to the commencement of works.
2. All site management, construction works and quality control is to be in accordance with the current Melbourne Water Standards including all amendments and the other statutory authority regulations.
3. Do not scale off drawings.
4. All dimensions and levels to be site checked and any discrepancy reported to the Superintendent.
5. Any variation to the details shown on the drawings must be authorised by the Superintendent prior to fabrication and/or construction.
6. Construction works shall be carried out strictly in accordance with manufacturer’s recommendations.
7. All dimensions are in mm unless noted otherwise.
8. All R.L.s and F.S.L.s are in m to AHD.
9. The contractor shall verify the location of all existing services with relevant authorities before commencing construction.
10. All assets modified or damaged by the proposed works shall be reinstated to the satisfaction of the Superintendent.
11. The contractor shall remove all structures, debris and fences from the site to the satisfaction of the Superintendent. The contractor shall notify the Superintendent prior to commencement of demolishing any existing structures within the site areas.
12. Survey used in preparation in preparation of these plans have been supplied by.
13. A CAD file will be supplied to the contractor for set out purposes. This will include the wetland ponds and bathymetry.
14. All tests and control points are to be maintained and protected at all times during construction. Should any works be disturbed the contractor will immediately notify the Superintendent to arrange reinstatement at the constructors expense.
15. The contractor is to employ the services of a qualified and experienced surveyor for setting out all works in accordance with the drawings.
16. The contractors responsibility to check and prove all design drawings and levels on site to ensure no discrepancies are found prior to commencement of construction works.

Refer to specification for additional contract requirements.
Appendix 3: Detailed Design Example Drawings

NOTE:

- This example is for deemed to comply wetlands where the flows greater than three months are diverted at the emergent pond.
- Ownership of the land including the wetland area is generally council's. An easement in favour of Melbourne Water is required for areas of land affected by impoundment. Refer Memorandum of Common Provision AM 110 (creation and maintenance of wetland footpaths and drainage).
- Any council / Melbourne Water reserve with a sub regional road running adjacent to it should be fitted with a bunding wall (non-permeable) to prevent unauthorised vehicle access thus minimising dumping of rubbish etc in the reserve.

Legend:
- Existing Contour (BBRE Grade)
- Extent of Works (Existing Boundaries)
- Wet. (75%)
- Total 75% P/C
- Exposed Line
- Existing Contour Line
- Non-Permeable Wall

Construction Wetlands Design Manual

Example Detailed Design - Plan View

Builder
Preliminary
Not For Construction

Prepared By: [Name]
Prepared For: [Name]
Prepared Date: [Date]
Appendix 3: Detailed Design Example Drawings
Appendix 3: Detailed Design Example Drawings

NOTE:
- REFER TO SHEET T325120-1002 FOR SPLIT BALANCE PIPE SYSTEM
- THIS EXAMPLE IS FOR DESIGNED TO CARRY FLOWING WATER WHERE THE FLOWS GREATER THAN THREE SOURCES ARE DIVERGED AT THE SEDIMENT BOND.

PROFILE 1

SECTION A - A

SECTION A - A

PROFILE 1

SECTION B - B

CONSTRUCTED WETLANDS DESIGN MANUAIL
EXAMPLE DETAILED DESIGN - LONG SECTION

NOT FOR CONSTRUCTION
Appendix 3: Detailed Design Example Drawings