ACT Government

WETLANDS 16C

MUNICIPAL INFRASTRUCTURE TECHNICAL SPECIFICATION

16 - STORMWATER

Transport Canberra and City Services

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1 WETLANDS

1.1 General

General: This Specification comprises the supply and construction of Water Sensitive Urban Design (WSUD) Wetlands.

Requirement: Provide a Wetland in general consisting of the following sections:

- Gross Pollutant Retention (Forebay) Zone (Typically a proprietary Gross Pollutant Trap);
- Sedimentation Zone (Typically a proprietary Gross Pollutant Trap);
- Vegetated Wetland (or Macrophytes) Zone;

Exclusions: This Specification does not include WSUD measures such as bioretention systems, ponds, gross pollutant traps etc. Preliminaries, Traffic Management, Earthworks, Drainage Structures, Incidental Works, Landscaping, Concrete Works and Signage required to construct wetlands shall be included under the respective *MITS 00 Preliminaries*, *MITS 01 Traffic Management*, *MITS 02 Earthworks*, *MITS 03 Underground services*, *MITS 08 Incidental works*, *MITS 09 Landscape*, *MITS 10 Concrete works* and *MITS 14 Road signs*.

1.1.1 Responsibilities

1.1.1.1 Objectives

Requirement: Provide wetland systems, as documented and as follows:

- Free of pollutants
- Stormwater diverted off line until construction works upstream are complete, stormwater quality improvement devices are constructed and/or or as agreed with TCCS.
- Constructed in accordance with the detailed design plans.
- In accordance with the construction tolerances specified.

1.1.2 Cross references

General: The following documents are related to this specification:

1.1.2.1 Legislation

Environmental Protection Act

Lakes Act

Public Roads Act

Road Transport (General) Act

Road Transport (Safety and Traffic Management) Act

Road Transport (Mass, Dimensions and Loading) Act

Road Transport (Safety and Traffic Management) Regulation

Scaffolding and Lifts Act

Scaffolding and Lifts Regulation

Territory Plan and related Codes

Water Resources Act

Waste Minimisation Act

Work Health and Safety Act

1.1.2.2 Specifications

Requirement: Conform to the following:

MITS 00	Preliminaries
MITS 01	Traffic Management
MITS 02	Earthworks
MITS 03	Underground services
MITS 06	Concrete kerbs, footpaths and minor works
MITS 09C	Planting
MITS 10	Concrete works
MITS 14	Road Signage
MITS 16A	Bioretention Systems
MITS 16B	Ponds
MITS 16D	Gross Pollutant Traps

1.1.2.3 Design Standards

General: The following Design Standards are related to this Specification:

MIS 18 Wetlands

Attachment B Design acceptance requirements

Canberra Central Design Manual

1.1.2.4 TCCS Reference Documents

General: The following TCCS reference documents are related to this specification:

Reference document 4	Protection of public landscape assets
Reference document 7	Operational acceptance submissions
Reference document 8	Works as executed quality records
Reference document 9	Final acceptance submissions
Reference document 10	Landscape consolidation
Reference document 11	Drafting Standard for Civil and Landscape works

1.1.3 Referenced documents

1.1.3.1 Standards

General: The following documents are incorporated into this Specification by reference:

Australian standards

AS 1141	Methods for sampling and testing aggregates
AS 1141.11.1	Particle size distribution - Sieving method
AS 1141.22	Wet/dry strength variation
AS 1289	Methods of testing soils for engineering purposes.
AS 1289 2.1.1	Moisture Content Tests

AS 1289 3.1.1	Plastic Limit Tests
AS 1289 3.1.2	Atterberg Limit Tests
AS 1289 3.2.1	Liquid Limit Tests
AS 1289 3.3.1	Plasticity Index Tests
AS 1289 3.6.1	Particle Size Distribution Tests
AS 1289 3.8.1	Emerson Class Number
AS 1289.5.2.1	Maximum Modified Dry Density Test
AS 1289.5.4.1	Optimum Moisture Content
AS 1289.5.5.1	Soil compaction and density tests - Determination of the minimum and maximum dry density of a cohesionless material - Standard method.
AS 1289 5.7.1	Optimum Moisture Content
AS 1289 6.7.3	Permeability (remoulded) on undisturbed tube samples collected from the completed pad liner
AS 2758.5	Filter Material Test
AS 3706.2	Geotextile Grab Tensile Strength
AS 3706.3	Geotextile Trapezoidal Tear Strength
AS 3706.7	Geotextile EOS – Pore Size
AS 3706.9	Geotextile Flow Rate
AS 4133.4.1	Rock Point Load Strength
AS/NZS 5667.1 and 6	Sampling of Water

1.1.3.2 Other publications

IPWEA (NSW)	Specification for the supply of recycled materials for pavements, earthworks and drainage (Greenspec)
USEPA	Calcium Carbonate content

Proprietary products: To *TCCS Products previously considered for use list*

Austroads

Austroads 90	Geotextile G Rating
AGPT	Austroads Guide to Pavement Technology
AGPT04J	Part 04J: Aggregate and source rock
ASTM F1632-03	Filter Material Testing

1.1.4 Interpretation

1.1.4.1 Abbreviations

General: For the purposes of this Specification the following abbreviations apply:

D: External diameter of the pipe.

DN: Nominal Diameter of pipe.

PAP: Principal Authorised Person (For use with GC-21 contracts).

WSUD: Water Sensitive Urban Design.

ITP: Inspection and Test Plan.

NATA: National Association of Testing Authorities.

RMS: NSW Roads and Maritime Services.

TCCS: Transport Canberra and City Services, ACT Government and its successors.

1.1.4.2 Definitions

General: For the purposes of this Specification the definitions given below apply:

Authorised person: PAP/Superintendent/Client of the works.

Inadequate foundation material: Material beneath or adjacent to the proposed drainage structures with insufficient strength to support the structure and loads on the structure, or material with characteristics that would adversely affect the performance or construction of the drainage structure.

Select fill: Backfill material with known properties and grading placed and compacted in layers.

Water Sensitive Urban Design (WSUD): The approach to urban planning and design that aims to integrate the management of the urban water cycle into the urban development process.

Inflow: Delivers stormwater into sedimentation zone

High Flow Bypass: Allows high flows to bypass parts of the wetland system to avoid damage to vegetated areas and scour of trapped sediments

Sedimentation Zone: Treats sediments of greater than >125 µm in the stormwater prior to discharge to the vegetation wetland zone

Inlet Pool - Vegetated Wetland Zone: The inlet pond of the vegetated wetland zone is and open water section to enable even flow distribution through the vegetated areas of the wetland.

Intermediate Pools- Vegetated Wetland Zone: An area of open water between dense vegetated plantings. These area assist in mitigating any short circuits that may develop and provide additional treatment through sedimentation

Outlet Pool - Vegetated Wetland Zone: An area of deep open water at the end of the vegetated wetland zone. This area provides for the construction of a suitable outlet and limits the risk of blockages.

Balance Pipes: These pipes provide for the open water zones of the wetland to have a consistent water level and enable the wetland to be drawn down for maintenance purposes.

Wetland Outlet: This is the hydraulic control that ensures the wetland operate as per the design hydrological regime. The outlet is most often a specially designed pit or weir.

1.1.5 Submissions

1.1.5.1 General

Conform to **Hold points and witness points**

Drawings: Prepare drawings or other documentation to record extent and constitution of final works in accordance with Requirements for Works as Executed quality records, TCCS.

1.1.5.2 Certification

Supply of Materials: All materials proposed for supply to the site shall be delivered with certification from the manufacturer confirming the material is compliant with this specification.

1.1.5.3 Execution details

Survey: Submit set-out survey for temporary and permanent drainage system.

Set-out of stormwater drainage system (Temporary and Permanent): Submit details of any proposed changes to the location, length, design levels, strength, conditions of installation or cover to suit construction procedures.

Temporary drainage during construction: Submit details of procedures/devices to maintain effective drainage of the works area and/or upstream diversions.

Soil type: Give notice if the soil type on site is not consistent with the soil type used for design.

1.1.5.4 Reports

Maintenance Report: A maintenance report shall be provided to the Authorised Person in accordance with this specification to achieve maintenance period completion.

1.1.5.5 Samples

General: Submit the following:

> Components:

- Wetland Materials
- Water

> Samples:

- Wetland Materials: Submit a minimum 5kg sample of each different type and/or source of material with conforming test results for approval by the Authorised Person prior to ordering. Samples are to be indicative of the material to be supplied for each different use.

1.1.5.6 Tests

Requirement: A NATA registered laboratory and a geotechnical engineer or an agronomist experienced and qualified in sandy loam soil testing must be used to carry out all testing for and verification of the wetland materials.

Sample all stockpiles in accordance with *AS1141.* Sample and test from supplier stockpiles at the minimum rate of 1 test/100m^3 of materials and a minimum of 1 test shall be provided per project and material. Test results up to 3 months old on the same stockpile will be accepted.

Provide the Authorised Person with copies of all test results, together with certification by the Testing Authority that all the stockpiled materials are in accordance with the Project Samples and the tolerances nominated in this Specification.

Carry out sampling and testing of the wetland materials to confirm compliance with the material requirements tabulated within this specification.

The amount of organic material to be added to the filter material shall be that required to achieve the required water holding capacity.

Hydraulic conductivity and water holding capacity tests are to simulate the material in the installed condition, i.e. with the amendments incorporated and the materials compacted to the densities determined to meet Specification requirements.

Testing frequencies are also tabulated within *MITS00B Quality Construction*.

1.1.6 Hold points and witness points

1.1.6.1 Notice

General: Give notice so that the documented inspection and submissions may be made to the **Hold point table** and the **Witness point table**.

All hold/witness points related to supply and construction of the various components related to provisions of Bioretention assets are included within the following sections:

- MITS 00 Preliminaries
- MITS 01 Traffic Management.
- MITS 02 Earthworks.
- MITS 03 Underground Services: All pipes and standard manholes.
- MITS 06 Minor Concrete Works, Kerbs and Footpaths.
- MITS 08 Incidental Works: All stone, wire mattress and retaining wall infrastructure.
- MITS 09 Landscaping Works.
- MITS 10 Concrete Works: All concrete and steel infrastructure.
- MITS 14 Road Signs: Floodway and other signage.

Table 16C-1 Hold point table

Item	Clause title	Requirement	Notice for inspection	Release by
Materials				
16C.1	Lining, Rock and Filtration Materials - General	Provide documentation of conformity of liner material including proposed installation process and documentation of conformity for rock and filter materials.	14 days before supplying materials	Authorised Person
Execution				
16C.2	Protection of Wetland from Pollutant Ingress and Upstream Drainage Established	The Contractor shall notify the Authorised Person that protection measures to prevent pollutants entering wetland works (including upstream diversions) are constructed in accordance with the specification and ready for inspection and approval.	3 days prior to commencement of excavation for wetlands	Authorised Person
16C.3	Excavated Levels	Approval and inspection/proof roll of completed earthworks, submission of survey conformance and notification of any groundwater presence	3 working days prior to construction of liner materials.	Authorised Person
16C.4	Installation of Liner Materials	Approval of completed liner layer and drainage infrastructure.	1 working day prior to construction of filter layer	Authorised Person
Maintenance				
16C.5	Maintenance of wetland – Commencement	Submit request to commence maintenance period with proposed maintenance schedule in accordance with **Commencement**	5 working days prior to proposed commencement of maintenance period upon operational acceptance by TCCS or as detailed in the contract	Authorised Person

Item	Clause title	Requirement	Notice for inspection	Release by
16C.6	Maintenance of wetland – Decreased life/Damage to system functionality from upstream catchment outside contractor scope	The contractor shall provide a summary of the extent of damage occurred to WSUD and include a report on specific sources of pollution for further investigation by the Authorised Person. The Authorised person shall then determine and provide the contractor with a summary of activities required (if any) to rectify the damage to WSUD.	5 working days after damage has been identified to newly constructed WSUD measures.	Authorised Person
16C.7	Maintenance of wetland systems – Undertaking of maintenance works	The contractor shall provide all relevant approved TTM/Environmental documentation and proposed materials/methodologies for use in the rectification of WSUD infrastructure.	5 working days prior to commencing maintenance works on WSUD system.	Authorised Person
16C.8	Maintenance of wetland - Completion	Submit request to complete maintenance period with submission of maintenance records completed in accordance with **Completion** Notify that the WSUD system is ready for final inspection.	5 working days prior to proposed completion of maintenance period	Authorised Person

Table 16C-2 Witness point table

Item	Clause title	Requirement	Notice for inspection
Execution			
16C.1	Temporary drainage during construction	Locate materials and equipment clear of water courses and provide temporary drainage to protect area of works.	2 days prior to commencement of excavation for wetlands.
16C.2	Establishment - Set out	Notify proposed set-out ready for inspection by the Authorised Person.	7 days before planned excavation.
16C.3	Backfilling with Filter Material	Witness completed filtration layer.	3 working days prior to undertaking planting works
16C.4	Placing of embankment survey markers	Witness survey markers have been placed and locations recorded by survey.	Within 5 days of embankment construction completion.

1.2 Preconstruction Planning

1.2.1 Protection to wetland system

Wetland systems: Do not allow unnecessary construction traffic access to areas of wetland systems. Provide fences if required to protect wetland systems. Refer *MITS 01 Traffic Management* for protection of wetlands (Sensitive Areas) from traffic.

Temporary Protection: Install silt fences, filter rolls or other approved sediment and erosion protection measures to protect the wetland system during all construction works in accordance with *MITS 00C Control of erosion and sedimentation*.

1.3 Materials

1.3.1 General

1.3.1.1 Materials and components

Earthworks materials: To *MITS 02 Earthworks*

Stormwater Pipes and culvert materials: To *MITS 03B Pipe drainage*

Precast Stormwater Structures materials: To *MITS 03C Precast box culverts*

Other Drainage Structures: To *MITS 03D Drainage structures*

Recycled Material: To *MITS 03H Road openings and restorations*

1.3.2 Liner materials

1.3.2.1 Impermeable Liner Materials

Usage: Impermeable liners must be used where the groundwater table is likely to interact with the wetland or where there are saline in-situ soils.

Clay Liner Properties: Clay Liner material properties must comply with the **Clay liner properties table**

Organic Materials Prohibited: The clay lining material shall be free of topsoil, tree roots and organic matter.

Manufactured Products: Geosynthetic Clay and HDPE liners shall not be utilised without prior written approval from TCCS.

Variance: If proposed clay liner material falls outside the specification in the **Clay liner properties table**, a geotechnical engineer may review the test results and provide a report recommending the material as suitable for use for review and approval by the Authorised Person and Design Engineer.

Table 16C-3 Clay liner properties table

Property	Specification to be met	Test Method
Particle Size Distribution (PSD)	As below	*AS 1289 3.6.1*
Particles passing 53-mm sieve	>100%	*AS 1289 3.6.1*
Particles passing 19-mm sieve	>90%	*AS 1289 3.6.1*
Particles passing 2.36-mm sieve	>70%	*AS 1289 3.6.1*
Particles passing 0.075-mm sieve	>30%	*AS 1289 3.6.1*
Maximum particle size	40 mm	*AS 1289 3.6.1*
Atterberg Limits	As below	*AS 1289 3.1.2, 3.2.1, 3.3.1, 3.4.1*
Plasticity Index	≥15% and above Casagrande A line	*AS 1289 3.3.1*
Liquid Limit	35 - 60%	*AS 1289 3.1.2*
Permeability (remoulded)	≤ 1 x 10-9 m/sec (300-mm thick clay pad liner)	*AS 1289 6.7.3*
Permeability on undisturbed tube samples collected from the completed pad liner	≤ 1 x 10-9 m/sec (300-mm thick clay pad liner)	*AS 1289 6.7.3*
Emerson Class Number	> 4	*AS 1289 3.8.1*
Calcium Carbonate content	< 15%	*USEPA*

1.3.2.2 Geotextile Liner Materials

The geotextile liner properties shall be a UV stabilised non-woven geotextile provided in accordance with the **Permeable liner properties table**

Table 16C-4 Permeable liner properties table

Property	Specification to be met	Test Method
Grab Tensile Strength	> 900 N	*AS 3706.2*
Trapezoidal Tear Strength	> 350 N	*AS 3706.3*
G Rating	> 2000	*Austroads 90*
EOS – Pore Size	≤ 120 µm	*AS 3706.7*
Flow Rate	> 50 l/m2/s	*AS3706.9*

1.3.3 Filter materials

1.3.3.1 General

Standards applicable: *AS 2758.5, AS 1141* and *AGPT04J.*

1.3.3.2 Filter Layer

Requirement: Filtration media properties shall be provided in accordance with the **Filter media properties table.**

Table 16C-5 Filter media properties table

Property	Specification to be met
Material	A loam/sand, a washed well-graded sand or a sand/gravel mix
Hydraulic conductivity	100 – 300 mm/hr. Determine using *ASTM F1815-11* method (Refer *Section 2.1.5.8*)
Clay & silt content	< 3% (w/w)
Grading of particles	Smooth grading – all particle size classes should be represented across sieve sizes from the 0.05mm to the 3.4mm sieve (as per *ASTM F1632-03)*
Nutrient content	Total Nitrogen (TN) < 1000 mg/kg Available phosphate (Colwell) < 80 mg/kg
Organic matter content	≤ 5% to support vegetation
pH	5.5 – 7.5 – as specified for 'natural soils and soil blends' in *AS4419* (pH 1:5 in water)
Electrical conductivity	< 1.2 dS/m – as specified for 'natural soils and soil blends' in *AS4419*
Horticultural suitability	Assessment by horticulturalist – media must be capable of supporting healthy vegetation. Note that additional nutrients are delivered with incoming stormwater
Particle size distribution	Note that it is most critical for plant survival to ensure that the fine fractions are included

	(% w/w)	Retained
Clay & silt	< 3%	(< 0.05 mm)
Very fine sand	5-30%	(0.05-0.15mm)
Fine sand	10-30%	(0.15-0.25 mm)
Medium sand	40-60%	(0.25-0.5 mm)
Coarse sand	< 25%	(0.5-1.0 mm)
Very coarse sand	0-10%	(1.0-2.0mm)
Fine gravel	< 3%	(2.0-3.4 mm)

1.4 Execution

1.4.1 General

1.4.1.1 General

General: All works shall be constructed in accordance with the construction drawings.

Survey control: Provide for the following:

- Mapping and pegging the drainage system.
- Locating components.

Survey data: Provide data for the set-out of gradients, culverts and drains and construction to tolerances.

Earthworks: To *MITS 02 Earthworks*

Stormwater Pipes and culverts: To *MITS 03B Pipe drainage*

Precast Stormwater Structures: To *MITS 03C Precast box culverts*

Other Drainage Structures: To *MITS 03D Drainage structures*

Recycled Material: To *MITS 03H Road openings and restorations*

1.4.1.2 Earthworks for Construction of Batters

Earthworks Specification: All earthworks required to construct batters to finish surface levels shall be undertaken in accordance with *MITS 02B Bulk Earthworks.*

1.4.1.3 Subgrade Preparation

Requirement: To provide a sound and stable base for liner construction.

Stripping: Topsoil and organic material should be removed.

Subgrade Compaction: The subgrade should be ripped and compacted to achieve 90% of the Maximum Modified Dry Density (*AS 1289.5.2.1*) to a minimum depth of 150 mm.

Subgrade finish: The subgrade must be smooth, unyielding and free of stones prior to liner placement.

Proof Rolling/Inspection: The prepared subgrade must be proof-rolled to *AS3798* in the presence of the Authorised Person or Principal's geotechnical engineer to determine the presence of zones (such as uncontrolled fill, voids and weak or compressible materials that are susceptible to collapse).

1.4.1.4 Clay Liner Placement

Layer Thickness: The compacted clay liner must be constructed in maximum 100mm thick layers.

Layer Bonding: An effective bond shall be created between successive layers. Prior to placement of each layer the surface of the previous layer shall be scarified to 25mm depth at maximum 300mm spacing and moisture conditioned as necessary to achieve a moisture content % (*AS1289.2.1.1 method 2.1.1*) between the plastic limit % (*AS1289.3.2.1*) and the liquid limit % (*AS1289.3.1.1*), to bond the layers and prevent laminations at the layer interface. The final surface should be smooth and evenly graded.

Tolerance: A constriction tolerance of +50mm and -0mm applies to the clay liner thickness.

Verification: The finished liner thickness must be surveyed to confirm it meets the design specifications and be tested in-situ to ensure that it meets the specified permeability criteria (*AS1289 6.7.3*).

Maintenance: Clay lining should be maintained and watered regularly to avoid desiccation during and following construction. Also if water is encountered while preparing earthworks, the site should be dewatered and dried to an appropriate level before being lined with clay.

Compaction: Minimum compaction of Clay liners shall be in accordance with the **Minimum thickness of wetland layers table.**

1.4.1.5 Minimum Thickness of Wetland Layers

The **Minimum thickness of wetland layers table** describes the minimum thickness required and associated construction tolerance for each layer of the wetland system.

Table 16C-6 Minimum thickness of wetland layers table

Material	Minimum Thickness	Construction Tolerance
Surrounding Topsoil	100mm	+ 50mm, - 0mm
Filter Topsoil Material (Macrophyte Zone)	200mm	+ 50mm, - 0mm
Clay Liner	200mm	+ 50mm, - 0mm

1.4.1.6 Compaction of Wetland Layers

Compaction of wetland layers shall be undertaken in maximum 100mm thick layers in accordance with the **Minimum compaction of wetland layers table**

Table 16C-7 Minimum compaction of wetland layers table

Material	Minimum Compaction	Australian Standard
Surrounding Topsoil	Lightly compacted using construction equipment during spreading process.	N/A
Filter Material (Macrophyte Zone)	Two (2) passes only of a compactor plate of approximately 80kg.	N/A
Clay Liner	Minimum dry density ratio of 95% relative to standard or a minimum Hilf density ratio of 95% standard.	AS 1289 5.1.1 or 1289 5.7.1
	0% to +3% of the Standard Optimum Moisture Content (SOMC) or within a Hilf moisture variation of 0% to +3%	AS 1289 5.1.1 or AS 1289 5.7.1
	Coefficient of permeability of less than $1x10^{-9}$ $m.s^{-1}$	AS1289.6.7.3 Tested in-situ

1.4.2 Vegetated wetland

Scope: This section covers the execution of the Submerged, Deep and Shallow Marsh Zones of the wetland.

1.4.2.1 Minimum Grades

The minimum grades of wetland batters are specified in the **Tolerance and minimum grades table**.

Finish surface levels of wetlands shall be constructed to provide an even ponding depth over the submerged area with a maximum depth variation of ± 50mm.

Table 16C-8 Tolerance and minimum grades table

Vegetated Wetland Area	Grade Tolerance (%)	Minimum Grade
Submerged Marsh Zone	± 1%	1(V) : 150(H)
Deep Marsh Zone	± 1%	1(V) : 150(H)
Shallow Marsh Zone	± 1%	1(V) : 150(H)

1.4.3 Edge batters

1.4.3.1 Batter Slopes

Requirements: The maximum grade for wetland batter slopes is detailed within the **Tolerance and maximum slopes of wetland embankments table**. All shoreline slopes are to be constructed to allow free drainage surfaces surrounding the wetland.

Table 16C-9 Tolerance and maximum slopes of wetland embankments table

Location of Slope	Grade Tolerance (%)	Maximum Slope
Surrounding Topsoil and general embankments	± 2%	1(V) : 6(H)[1]
Macrophyte Zone	± 1%	1(V) : 15(H)
Dam/Spillway Embankments	± 2%	1(V) : 6(H)[1]
Access Ramps	± 1%	1(V) : 6(H)[2]

1. 1(H) in 4(V) slopes will not be accepted without specific prior approval from TCCS.
2. up to 1m below the normal operating level.

1.4.4 Embankment survey markers

All survey markers shall be established in accordance with the design documentation within 5 days of completion of the embankment construction. The locations of each mark shall be recorded prior to and following filling of the wetland to the final water level.

2 MAINTENANCE

2.1 Commencement

In order to achieve maintenance period commencement, the following documentation shall be submitted to the Authorised Person:

> Maintenance Schedule: In tabular format detailing proposed dates for maintenance, description of maintenance to be undertaken in alignment with the Design Operation and Maintenance Plan. The schedule is to include room for signoff by the contractor that the maintenance was undertaken.

2.2 Works during maintenance period

Maintenance of the wetlands shall be undertaken in accordance with the following:

> Inspection: Inspect wetlands every fortnight between October to March and once a month between April to September. Items that are to be checked include but are not limited to the following:

- Litter/dead plant material;
- Water turbidity;
- Drainage effectiveness of embankments/shallows;
- Apparent algae blooms;
- Scouring and/or cracking/shifting of embankments;
- Sediment within SQID system;
- Oils or other contaminants apparent on water surface.

> Litter: Remove litter and dead plant material from wetlands.

> Herbicide: Do not use herbicides within 3m of wetland systems.

> After rainfall of over 10mm, within 2 days:

- Remove surplus silt build up.
- Replace scoured materials to embankments and reinstate plants/grass.
- Remove litter.

A description of works including a photo of each wetland area before and after each scheduled maintenance must be provided to the Authorised Person within 3 days of the works occurring.

2.3 Completion

2.3.1.1 Submissions

Work as Executed Records: To *MITS 00B Quality Requirements*.

2.3.1.2 Cleaning and Inspection

Flushing: On completion of the system, flush all transfer pipes clean from end to end and leave in working order.

Inspection: The contractor shall arrange a witness point inspection by the Authorised Person to confirm that water induced drains to the downstream structure with clean water at an adequate flow rate.

2.3.1.3 Report

A complete report shall be provided to the Authorised Person upon completion of the maintenance period. The maintenance report shall include the following documentation.

- All photos of before and after maintenance works undertaken. Including description of location and works undertaken.
- Signoff against the maintenance schedule by the contractor for each set of works undertaken,

3 MEASUREMENT AND PAYMENT

3.1 Measurement

3.1.1.1 General

Payments made to the Bill of Quantities: To *MITS 00A General requirements*, this Specification, the drawings and P**ay items.**

3.1.1.2 Methodology

The following methodology will be applied for measurement and payment:

- Allow for all work, materials, testing and quality assurance requirements in each Pay Item.
- Earthworks associated with the construction of swales, batters, bulk cutting or filling: To *MITS 02 Earthworks*
- Inlet/Overflow pits and drainage structures: To *MITS 03C Precast box culverts* and *MITS 03D Drainage structures.*
- Spillway construction: To *MITS 02B Bulk Earthworks*, *MITS 08 Incidental Works* and *MITS 10 Concrete Works*.
- Planting of Macrophytes, shrubs, grassing and mulch: To *MITS 09 Landscape.*
- Floodway and Warning signage: To *MITS 14 Road Signs.*
- Formalised Edge protection such as retaining walls, boulders, fences: To *MITS 08 Incidental Works.*
- Subsoil drains: To *MITS 03J Subsoil and foundation drainage.*
- Excavation and replacement of Unsuitable Material: *MITS 02B Bulk Earthworks*.
- Barrier fences for drainage structures: To *MITS 08A Fences and Barriers.*
- Removal of existing drainage structures: To *MITS 03A Trenching for underground services.*
- Hardstand pavement, driveways, kerbing: To *MITS 06A Concrete kerbs and open drains* and *MITS 06B Concrete paths, driveways medians.*
- No Additional payment will be made for excavation in rock, overbreak of trench due to ground conditions or over excavation of trenches.

3.2 Pay items

Table 16C-10 Pay items table

Item No	Pay items	Unit of measurement	Schedule of rates scope
16C.1	Clay Liner Material for Wetlands	m^3 The volume is determined by the area of work as measured by survey and specified on the drawings or as directed by the Authorised Person multiplied by the relevant design thickness shown on the drawings.	All activities associated with the construction of clay liner including detailed excavation in all types of material encountered including rock, supply, placement and compaction of the clay liner material in accordance with this specification inclusive of dewatering and watering as required.
16C.2	Filtration Layer for Wetlands	m^3 The volume is determined by the area of work as measured by survey and specified on the drawings or as directed by the Authorised Person multiplied by the relevant design thickness shown on the drawings.	All activities associated with the construction of filtration layer including detailed excavation in all types of material encountered including rock, supply, placement and compaction of the filtration Layer materials in accordance with this specification.
16C.3	Maintenance Period	Weeks of maintenance undertaken following maintenance commencement as directed by the Authorised Person.	This pay item shall include all works associated with maintenance of wetland systems in accordance with the specification.

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Transport Canberra and City Services

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