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Government

DRAINAGE STRUCTURES 03D

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INFRASTRUCTURE
TECHNICAL
SPECIFICATION
03 - UNDERGROUND SERVICES

Transport Canberra and
City Services

July 2019



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1 DRAINAGE STRUCTURES

1.1 General

1.1.1 Responsibilities

1.1.1.1 General

Requirement: Provide drainage structures as documented including the following: Headwalls, wingwalls, pits, gully pits, inspection pits, sealed sumps, drop structures, inlet and outlet structures, energy dissipators, batter drains and other supplementary structures as shown on the drawings.

1.1.2 Cross references

General: The following documents are related to this Specification.

1.1.2.1 ACT Legislation

Road Transport (General) Act

Public Roads Act

Scaffolding and Lifts Act

Scaffolding and Lifts Regulation

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 04 | Flexible pavement construction |
| MITS 06A | Concrete kerbs & open drains |
| MITS 08 | Incidental works |
| MITS 09 | Landscape |
| MITS 10 | Concrete works |
| MITS 16D | Gross Pollutant Traps |

1.1.3 Referenced documents

1.1.3.1 Standards

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

Australian standards

| | |
|---------|---|
| AS 1012 | Methods of testing concrete |
| AS 1214 | Hot-dip galvanized coatings on threaded fasteners |
| AS 1379 | Specification and supply of concrete |

| | |
|---------------|--|
| AS 1478 | Chemical admixtures for concrete, mortar and grout |
| AS 1478.1 | Admixtures for concrete |
| AS/NZS 1554 | Structural steel welding |
| AS/NZS 1554.3 | Welding of reinforcing steel |
| AS 1657 | Fixed platforms, walkways, stairways and ladders – Design, construction and installation |
| AS 1726 | Geotechnical site investigations |
| AS 2758 | Aggregates and rock for engineering purposes |
| AS 2758.1 | Concrete aggregates |
| AS 3600 | Concrete structures |
| AS 3610 | Formwork for concrete |
| AS 3610.1 | Documentation and surface finish |
| AS 3735 | Concrete structures retaining liquids |
| AS 3972 | General purpose and blended cements |
| AS 3996 | Access covers and grates |
| AS/NZS 4671 | Steel reinforcing materials |
| AS 4680 | Hot-dip galvanized (zinc) coatings on fabricated ferrous articles |
| AS 5100 | Bridge design |

Austrroads

| | |
|---------|---|
| AGPT | Austrroads Guide to Pavement Technology |
| AGPT04G | Part 4G: Geotextiles and geogrids |

1.1.3.2 Other publications

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

1.1.4 Interpretation

1.1.4.1 Abbreviations

GPT: Gross Pollutant Trap

MH: Maintenance hole

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

1.1.4.2 Definitions

General: For the purpose of this Specification, the definitions of terms used to define the components of the road reserve are in conformance with *AS 1348, Glossary of Austrroads Terms* and *AGRD03*, the definitions given below also apply:

Drainage structures: Devices to control stormwater flowing into and through a stormwater drainage system including culverts, inlet and outlet structures, sumps, manholes, drop structures, headwalls, wingwalls, energy dissipaters and ancillary hardware such as grates, frames and step irons as well as subsurface drainage pipes at pits, headwalls and wingwalls.

1.1.5 Hold points and witness points

1.1.5.1 Notice

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

Table 3D-1 Hold point table

| Item | Clause title | Requirement | Notice for inspection | Release by |
|------------------|---|---|---------------------------------------|-------------------|
| Materials | | | | |
| 3D.1 | Precast units - General | Submit details of precast or proprietary items for approval, including drawings, method of manufacture, testing and installation. | 3 working days before ordering | Authorised Person |
| 3D.2 | Precast units - Substitutions | Submit details for substituting precast units for cast insitu units. | 3 working days before ordering | Authorised Person |
| Execution | | | | |
| 3D.3 | Installation – Cast insitu reinforced concrete structures | Submit certification that installation of reinforcement and compliance of formwork conforms with <i>MITS 10 Concrete works</i> and the Drawings and give notice for inspection. | 1 working day before pouring concrete | Authorised Person |

Table 3D-2 Witness point table

| Item | Clause title | Requirement | Notice for inspection |
|------------------|------------------------------------|--|-----------------------|
| Execution | | | |
| 3D.1 | Sumps and manholes - Precast units | Give notice of installation of precast sumps | 1 week |

1.2 Materials

1.2.1 Constituent materials

1.2.1.1 Concrete

Concrete, reinforcement and formwork: To *MITIS 10 Concrete works*.

Minimum grade: Unless noted otherwise, adopt the following:

- > Manholes including covers: N32.
- > Scour stops, concrete bedding and encasement: N20.

Formwork: Both internal and external surfaces shall be formed. The Contractor may elect to omit external forms where surfaces are increased by 50mm thickness and cast against undisturbed ground. External formwork shall be used for the top 300mm of manholes and sumps in all cases.

1.2.1.2 Steel fixtures

Mild steel fixtures: All mild steel fixtures including grates, frames, step irons, ladders etc., shall be hot dip galvanised to *AS 1214* or *AS 4680*, as appropriate.

1.2.2 Precast units

1.2.2.1 General

Product drawings: For any precast item, including proprietary items submit the following:

- > Product (“shop”) drawings.
- > Method of manufacture, testing and installation including clearance to pit shaft ends, pipe to pipe jointing and step iron positioning

This is a **HOLD POINT**.

1.2.2.2 Substitutions

Substituting precast units for cast insitu units: Submit details including proposed methodology for approval.

This is a **HOLD POINT**.

1.2.2.3 Marking

Identification marking: At the time of manufacture, clearly mark each precast unit with the following information:

- > Date of manufacture.
- > Manufacturer’s name or registered mark and the location of manufacture.
- > Maximum mass of unit in kg.
- > Batch number.
- > Inspection status.

Height of letters: 75mm.

Location of marking: Easily visible but hidden once the unit is installed.

1.3 Execution

1.3.1 Provision for traffic

1.3.1.1 General

Requirement: Conform to *MITS 01 Traffic Management*.

1.3.2 Site establishment

1.3.2.1 Survey

Requirement: Conform to *MITS 00 Preliminaries*.

1.3.2.2 Handling, delivery and storage

Handling and installation: Handle and install precast units, including kerb inlet lintels, to conform to the manufacturer's instructions.

1.3.3 Excavation

1.3.3.1 General

Excavation: Conform to *MITS 03A Trenching for underground services* and *MITS 02B Bulk Earthworks*.

Bedding, support and backfill material: Unless otherwise documented, to *MITS 03A Trenching for underground services*.

1.3.4 Installation

1.3.4.1 General

Members subject to traffic and earth loads: To *AS 5100 Series*.

Water retaining structures with a capacity > 25,000 L: To *AS 3735*.

Water retaining structures with a capacity ≤ 25,000 L: To *AS 3600*.

Other concrete components: Conform to *AS 3600*.

Horizontal tolerance: ± 25mm.

Inlet and outlet invert levels: As shown on the drawings ± 10mm.

Benching: Bench bases as detailed and finish smoothly to minimise turbulent flow.

Render: Rendering of concrete structures shall not be permitted.

1.3.4.2 Foundation

Preparation: Dewater and wash clean of contaminants in preparation for concreting.

1.3.4.3 Joints and seals

Location: Provide isolation joints adjacent to drainage structure where they abut another structure or concrete pavement.

Isolation joint: 10mm wide approved preformed jointing filler.

Sealing: Effectively seal joints and connection points against the ingress of water and other kinds of material with cement mortar 1: 3 general purpose cement: sand ratio.

1.3.4.4 Cast insitu reinforced concrete structures

Headwalls and wingwalls, special chambered manholes and special structures: Certify that the installation of reinforcement and compliance of formwork conforms with *MITTS 10 Concrete works* and the Drawings. The placed reinforcement shall be inspected by the Authorised Person prior to the concrete being poured.

This is a **HOLD POINT**.

1.3.5 Headwalls and wingwalls

1.3.5.1 Alignment

Arrangement: Unless otherwise shown on the drawings, construct headwalls and pits parallel to the road centreline and wingwalls at 135° to the headwall.

Skewness: If the culvert is laid skew to the road, splay the wingwalls and headwalls so that the front edge of the wing bisects the angle between the centreline of the culvert and the headwall.

1.3.5.2 Weepholes

Detail: Provide weepholes as shown on the drawings.

Requirement: Place broken stone or river gravel to *MITTS 03A Trenching for underground services* as follows:

- > Height: > 450mm above the bottom of the weephole.
- > Plan area: > 600mm along the wall and 300mm out from the wall located centrally about the weephole.

Geotextile: Enclose the broken stone or river gravel with geotextile filter fabric in conformance with *AGPT04G*.

Alternative to geotextile: Cover the facial area of the structure with an equivalent area of geocomposite.

1.3.6 Sumps and manholes

1.3.6.1 Construction

Details: Construct all new manholes to accept access covers, gully grates and frames to *AS 3996* and the Standard drawings.

Types:

- > R sump
- > Grated sump Type 1
- > Grated sump Type 2
- > Single sided plantation sump
- > Double sided plantation sump
- > Double R sump
- > QS sump
- > On grade KI sump
- > Sag point KI sump

Standard Drawings: *ACTSD-0820-0826*.

Sealed sumps: Construct as for standard sumps without a kerb opening. The sump shall be setback behind the kerb.

Existing pits: Modify existing pits only if shown on the drawings. Where existing structures are to be raised or lowered, break out walls to expose reinforcement and allow a minimum of 150mm of new concrete below the new cover or frame. Splice new reinforcement to old, form and place concrete as specified for new structures.

1.3.6.2 Precast units

Knockouts: Do not provide standard precast pit base units with thinned wall sections on all 4 sides. Provide base units and other riser units to suit the design configuration of the particular pit with preformed knockouts only where required.

Notice: Give notice before installation of precast sumps.

This is a **WITNESS POINT**.

Precast concrete manholes: Construct insitu concrete bases to match precast components. The minimum concrete thickness between the invert of the seating ring and the crown of the highest pipe shall be 25mm. This ring shall be filled with a 3:1 sand cement mortar prior to the placement of precast components and trowelled off after installation.

1.3.6.3 Access covers and frames

Access cover: Locate so that removal of the cover is not obstructed by a wall, kerb or other fixed item.

Fit and seals may be compromised: Covers and frames are matched items. Do not switch. Ensure there is no excavated or other material between cover and frame to compromise seals and service life.

Proprietary access covers: Conform to the manufacturer's recommendations, including any infill requirements for the covers.

Marking: All stormwater manholes shall be marked with the letters "SW".

Grade: Provide Heavy Duty Class D covers and frames to AS 3996 with 600mm clear opening in paved or trafficable areas.

Levels: Cover levels are provided for guidance only. The Contractor is responsible for ensuring finished levels to the following:

- > Paved areas: Finish flush with pavement.
- > Landscaped areas including verges: Finish 25mm above finished surface.
- > Other areas: Finished 75mm above finished surface.

1.3.6.4 Rung ladders and step irons

Standard drawing: *ACTSD-0830*.

Structures > 900mm deep: Install an individual rung ladder or step iron on one internal wall for the full depth of the structure to conform to AS 1657.

Tolerance: Conform to the following:

- > The top of the uppermost rung: $\leq 600\text{mm}$ below the top of the pit.
- > The top of the bottom rung: $\geq 300\text{mm}$ and $\leq 500\text{mm}$ above the invert of the pit.
- > Rung spacing: $300\text{mm} \pm 50\text{mm}$.
- > Fixing: Conform to the following:
- > Fix step irons firmly within the formwork before placing the concrete for the pit walls.
- > Provide blockout formers to make recesses in the concrete to receive the arms of the step irons.
- > Install at a later date by drilling the pit wall.
- > Drill holes using a rotary masonry bit or similar. Do not use percussion tools to form the hole for the step iron.
- > Use epoxy resin in conformance with the step iron and epoxy resin manufacturer's recommendations.
- > Make sure that no movement of the step irons occurs until the epoxy resin has reached the specified strength.

1.3.7 Other structures

1.3.7.1 Pipe drainage structures

Thrust blocks: To *MITSD 03B Pipe drainage*.

Dead ends: To *MITSD 03B Pipe drainage*.

1.3.7.2 Gross Pollutant Traps

Specification: to *MITSD 16D Gross Pollutant Traps*.

Access: Provide a heavy duty access driveway to all GPT's.

Trash racks: To *ACTSD-0874*.

Davit units: To *ACTSD-XXX*

1.3.8 Backfill

1.3.8.1 General

Commencement: Do not backfill against cast insitu concrete drainage structures within 14 days of placing the concrete or until compressive strength $> 15\text{MPa}$ unless otherwise approved.

Backfill: Place backfill against the full height of the vertical faces of structures for a horizontal distance equal to one-third the height of the structure. Unless noted otherwise, backfill around drainage structures as specified for the adjacent pipe trench. Backfilling to structured abutting kerbs or pavement edges shall be as specified for trenches in paved areas.

Weepholes: Where there is no other subsurface drainage, provide a layer of Type A or B filter material minimum 150mm in all directions behind weepholes to *MITSD 03I Subsurface drainage*.

Loading: Prevent excessive surcharge loading against vertical surfaces during the backfilling. Balance backfill on both sides of the structure alternately in layers to avoid unbalanced forces on the structure.

Compaction: To *MITSD 03A Trenching for underground services*. Commence backfilling and compaction at the wall.

1.4 Completion

1.4.1.1 Submissions

Work as Executed Records: To *MITS OOB Quality Requirements*.

1.4.1.2 CCTV for Stormwater

Closed circuit television (CCTV) inspections: Submit a report to the Authorised Person for approval in accordance with *TCCS Reference Document 8 Requirements for Work-As-Executed Quality Records* requirements, including video evidence for all drainage structures as follows:

- > On completion of all drainage structures and prior to commencement of pavement construction above the drainage structure to verify the works are within the specified tolerances and without visual signs of structural failure.
- > No more than 14 days prior to Practical Completion to verify tolerances and ensure there is no obstruction to the flow of water.

Defects: Any defects identified by the CCTV inspection shall be rectified together with a new CCTV inspection report prior to requesting final inspection.

Repair: Repair of damaged pipes by patching is not acceptable.

2 MEASUREMENT AND PAYMENT

2.1 Measurement

2.1.1.1 General

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

2.1.1.2 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.
- > Excavation, bedding, support and backfill material for drainage structures: Conform to *MITS 03A Trenching for underground services*, paid under this Specification.
- > Miscellaneous minor concrete work not included in the pay items in this Specification: To *MITS 06 Concrete kerbs, footpaths and minor works*.
- > Subsoil drains: To *MITS 03J Subsoil and foundation drainage*.
- > Thrust blocks and dead ends: To *MITS 03B Pipe drainage*.
- > Backfill under roads, paths and driveways: Extra over to *MITS 03H Road openings and restorations*.
- > Barrier fences for drainage structures: To *MITS 08A Fences and Barriers*.
- > Sealed sumps: Paid as standard sumps.
- > Removal of existing drainage structures: To *MITS 03A Trenching for underground services*.
- > Hardstand pavement, driveways, kerbing for GPT's: To *MITS 06A Concrete kerbs and open drains* and *MITS 06B Concrete paths, driveways medians*.
- > Drop structures: To *MITS 06A Concrete kerbs and open drains*.
- > Excavation and replacement of Unsuitable Material in Trenches: *MITS 02B Bulk Earthworks*.
- > All costs associated with removal of water from excavations shall be included within respective excavation rates for drainage structures.
- > No Additional payment will be made for excavation in rock, overbreak of trench due to ground conditions or over excavation of trenches.

2.1.1.3 Deductions

In situ concrete strength: Deductions made as follows:

- > Scheduled rate of payment is reduced by 2% for each 1%, or fraction thereof, by which the strength of the specimen fails to reach the specified strength, up to a maximum deficiency of 10%.
- > If the deficiency in strength exceeds 10%, the concrete represented by the specimens may be rejected, in which case no payment will be made.

2.2 Pay items

Table 3D-3 Pay items table

| Item No | Pay items | Unit of measurement | Schedule of rates scope |
|---------|-----------------------|---|---|
| 3D.1 | Stormwater MH | Number | <p>All activities associated with construction of 1050mm diameter stormwater maintenance holes including excavation in all types of material encountered including rock, over excavation for bedding, shoring, supply and placement of bedding, concrete, reinforcement, formwork, precast units, step irons, precast cone and Class B access cover.</p> <p>This pay item shall include benching, sealing, marking, backfilling and compaction around the structure.</p> |
| 3D.2 | Stormwater MH >1.45m | Total depth in metres Measured as additional depth per MH to nearest 100mm | <p>All activities extra over Stormwater MH associated with construction of 1050mm diameter maintenance holes deeper than 1.45m measured from the top of the cover to the underside of the base.</p> |
| 3D.3 | Class D access covers | Number | <p>All activities extra over Stormwater MH associated with supply and installation of Class D access covers for 1050mm diameter maintenance holes.</p> |
| 3D.4 | Special chambered MH | Number | <p>All activities associated with construction of special chambered stormwater maintenance holes including excavation in all types of material encountered including rock, over excavation for bedding, shoring, supply and placement of bedding, concrete, reinforcement, formwork, step irons, access shaft, precast cone and Class D access cover.</p> <p>This pay item shall include benching, sealing, marking, backfilling and compaction around the structure.</p> <p>A separate pay item shall be included in the Contract for each special chambered manhole. For example;</p> <p>3D.4.1 Special chambered MH 1/1 3D.4.2 Special chambered MH 1/2 Etc...</p> |

| Item No | Pay items | Unit of measurement | Schedule of rates scope |
|---------|------------------------|---|--|
| 3D.5 | Stormwater sumps | Number | <p>All activities associated with construction of stormwater sumps including excavation in all types of material encountered including rock, over excavation for bedding, shoring, supply and placement of bedding, concrete, reinforcement, formwork, precast units, step irons, Class D grate and surround, precast lid and Class B access cover, as detailed.</p> <p>This pay item shall include benching, sealing, concrete aprons, matching to kerb line, backfilling and compaction around the structure.</p> <p>A separate pay item shall be included in the Contract for each type of stormwater sump.</p> <p>3D.5.1 R sump</p> <p>3D.5.2 Grated sump Type 1</p> <p>3D.5.3 Grated sump Type 2</p> <p>3D.5.4 Single sided plantation sump</p> <p>3D.5.5 Double sided plantation sump</p> <p>3D.5.6 Double R sump</p> <p>3D.5.7 QS sump</p> <p>3D.5.8 On grade KI sump</p> <p>3D.5.9 Sag point KI sump</p> |
| 3D.6 | Stormwater sumps >1.8m | Total depth in metres Measured as additional depth per sump to nearest 100mm | <p>All activities extra over Stormwater sumps associated with construction of sumps deeper than 1.8m measured from the top of the cover to the underside of the base.</p> <p>A separate pay item shall be included in the Contract for each type of stormwater sump.</p> <p>3D.6.1 R sump</p> <p>3D.6.2 Grated sump Type 1</p> <p>3D.6.3 Grated sump Type 2</p> <p>3D.6.4 Single sided plantation sump</p> <p>3D.6.5 Double sided plantation sump</p> <p>3D.6.6 Double R sump</p> |

| Item No | Pay items | Unit of measurement | Schedule of rates scope |
|---------|----------------------|---------------------|--|
| 3D.7 | Surcharge structures | Number | <p>All activities associated with construction of surcharge structures including excavation in all types of material encountered including rock, over excavation for bedding, shoring, supply and placement of bedding, concrete, reinforcement, formwork, precast units, step irons, Class D grate and surround, as detailed.</p> <p>This pay item shall include benching, sealing, concrete aprons, backfilling and compaction around the structure.</p> <p>A separate pay item shall be included in the Contract for each surcharge structure. For example;</p> <p>3D.7.1 Surcharge structure 1/1 3D.7.2 Surcharge structure 1/2 Etc...</p> |
| 3D.8 | Headwalls | Number | <p>All activities associated with the construction of headwalls and associated footings including excavation for the units in all types of material encountered including rock, shoring, supply and placement of bedding, concrete, reinforcement, formwork, weepholes, filter material and precast walls.</p> <p>This pay item shall include jointing, sealing, backfilling and compaction around the structure.</p> <p>A separate pay item shall be included in the Contract for each headwall type including a description of the overall culvert dimensions. For example;</p> <p>3D.8.1 Culvert 1: 900Wx450H headwall 3D.8.2 Pipe Culvert 1/1-1/2: DN450 headwall Etc...</p> |



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