AUS-SPEC

Infrastructure Specifications

1351 Stormwater drainage (Construction)

1351 STORMWATER DRAINAGE (CONSTRUCTION)

IMPORTANT: This document has been adapted from the NATSPEC suite of specification templates for use in the Cessnock City Council area by both Council and industry. NATSPEC regularly updates the base templates (currently in April and October each year), and Council may incorporate changes into its version of AUS-SPEC from time to time. To assist in highlighting any changes made by Council to the NATSPEC templates, the following conventions are used.

- See ANNEXURE M at the end of this document which contains (where practical) Cessnock City Council customisations (also known as 'office master' text). References to the Annexure are to also be inserted at relevant clauses in the main body of the document.
- Where content is added to the main body of the document, it is to be shown in brown text like this.
- Where content is deleted or excluded from the main body of the document, it is to be shown ~~struck through like this~~. Such clauses are to have no effect.

Where there is a conflict between main body text and Cessnock City Council specific clauses, Council's specific clauses shall prevail.

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide drainage works as a complete system for collecting and carrying stormwater from roadways, open spaces and built-up areas, as documented. Include Water Sensitive Urban Design (WSUD) principles

1.2 CROSS REFERENCES

General

Requirement: This worksection is not a self-contained specification. In addition to the requirements of this worksection, conform to the following:

- *0136 General requirements (Construction)*.
- *0152 Schedule of rates (Construction)*.
- *0161 Quality management (Construction)*.
- *0257 Landscape - road reserve and street trees*.
- *0319 Auxiliary concrete works*.
- *1101 Traffic management*.
- *1102 Control of erosion and sedimentation (Construction).*
- *1112 Earthworks (Road reserve).*
- *1121 Open drains .*
- *1151 Road openings and restoration.*
- *1196 Boundary fencing for road reserves.*
- *1352 Pipe drainage.*
- *1353 Precast box culverts.*
- *1354 Drainage structures.*
- ~~*1859 CCTV inspection of drainage conduits.*~~

1.3 INTERPRETATION

Abbreviations

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

- CCTV: Closed circuit television.
- WSUD: Water Sensitive Urban Design.

Definitions

General: For the purposes of this worksection the following definitions apply:

- 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.

1.4 SUBMISSIONS

Authority approvals

Environmental and planning approval: Construct works in accordance with DA consent conditions or REF recommendations.

Road opening permit: Submit an application to the relevant Council for approval for works to road or footpath, including the following:

- Retired existing services: Provide written confirmation from the Authority that retired services are inactive.
- Location of services: Location and marking of existing services before excavation to AS 5488.1 (2022) and AS 5488.2 (2022). Contact BEFORE YOU DIG AUSTRALIA to identify the locations of underground utility services pipes and cables.
- Opening and compaction specifications: To *1151 Road openings and restoration*.

Certification

Construction traffic: If proposing to move heavy construction plant or vehicles over pipes or box culverts, submit certification by a professional engineer of the protection measures.

Traffic Management Plan: Submit to the appropriate Road Authority for approval.

Execution details

Survey: Submit set-out survey for drainage system

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

Temporary drainage during construction: Submit details of procedures/devices to maintain effective drainage of the work areas.

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

Subgrade before bedding: Check suitability of support material below culverts and compaction of subgrade.

Depth of bedding: Check level of base of trench to meet minimum bedding requirements before placing bedding material.

Operation and maintenance manuals

Requirement: Submit manual to **COMPLETION**, **Operation and maintenance**.

Products and materials

General: Submit product information for components of the stormwater system.

Product conformity: Submit current assessment of conformity as follows:

- Certificates for all pipes, culverts, precast concrete units, access covers, road grates or frames and all materials and components. Identify the item and record the inspection and test records that verify conformance to the specification.

Records

Survey: Submit set-out survey for the drainage system.

Work-as-executed drawings: Submit drawings including stormwater system information sheets and works, in electronic formats to *0136 General requirements (Construction)*.

CCTV reports

CCTV inspection results: If CCTV reports are required, submit inspection results to ~~*1859 CCTV inspection of drainage conduits*~~ *WSA 05-2013 Conduit Inspection Reporting Code of Australia* within 5 working days of the field CCTV inspection completion.

Samples

General: Submit the following for conformity testing to relevant standards:

- Pipes and fittings.
- Recycled materials.

Tests
Results: Submit test results to **ANNEXURE – MAXIMUM LOT SIZE AND MINIMUM TEST FREQUENCIES**.

1.5 INSPECTIONS

Notice
General: Give notice so that inspection may be made of the following:

- Set-out of culverts and the stormwater drainage system.
- Clear width of excavations for drainage structures other than pipes.
- Subgrade before bedding to check the suitability and compaction of support material for culverts.
- Areas (including trench sides) containing unsuitable foundation material.
- Rock foundation: Remove excavated rock to spoil, measure rock in loose heap, to pay.
- Trench base levels before placement of bedding material.
- Backfilling:
  ~~. Dimensions of corrugated metal structures after backfilling.~~
  . Against in situ concrete structures.
- Rectification of damage due to compaction adjacent culverts or drainage structures.
- Compaction of cementitious stabilisation in the concrete pipe bedding and haunch zones.
- Protection to WSUD including vegetated swales, buffer strips, and bioretention systems from construction traffic (environmental protection).

2 MATERIALS

2.1 GENERAL

Materials and components
Pipe and culvert material: To Austroads AGRD05 (2023) Table B1.

Pipes: To *1352 Pipe drainage*.

Precast: To AS 3850.3 (2021) and *1353 Precast box culverts*.

Structures: To *1354 Drainage structures*.

2.2 BEDDING AND SUPPORT MATERIAL

General
Recycled material: To Austroads AGPT04E (2022), ~~LGNSW (2020) *Guide to recycled materials in roads and pavements* ~~and the ARRB Best Practice Guide 1 (2020) *Road materials*.

Concrete pipes
Fill material for bed and haunch zones: Select fill conforming to the following:

- Particle size distribution: To AS/NZS 3725 (2007) Table 6.
- Plasticity index: To AS 1289.3.3.1 (2009): Maximum 6.

Fill material for side and overlay zones of pipes, box culverts and adjacent to other drainage structures: Select fill conforming to the following:

- Maximum dimension: 75 mm.
- Plasticity index to AS 1289.3.3.1 (2009): 2 to 12.

Corrugated metal structures
Not used in Cessnock LGA.

~~Grading and plasticity: To AS/NZS 2041.2 (2011) Table 2.4.1(B).~~

Flexible pipes
Embedment material: If using flexible pipes and the embedment method, provide embankment material to AS/NZS 2566.1 (1998) clause 3.3 or AS/NZS 2566.2 (2002) Appendix G.

Backfill material adjacent to weepholes
Requirement: Clean, graded, hard and durable stone or river gravel conforming to the following:

- Maximum particle dimension: 50 mm.
- Minimum particle dimension: 5% by mass passing the 9.5 mm AS sieve.

2.3 TESTING

Quality

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

Quality verification: If material/product quality verification can be obtained from the supplier, documented tests need not be repeated.

3 EXECUTION

3.1 ESTABLISHMENT

General

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.

Existing services

Existing underground services: Conform to **EXISTING UTILITY SERVICES** in *0136 General requirements (Construction)* and *Work near underground assets - Guide (2007)* from SafeWork NSW.

Locate by exploratory excavation or by ground penetrating radar (GPR) before principal trench excavation.

Disused, retired or abandoned services: Before removal, provide written confirmation from the appropriate Authority that services are inactive.

Set-out of stormwater drainage systems

Requirement: Identify and set out the location and levels of the following:

- Outlets and inlets of pipes and box culvert structures. Include the lengths in the set out.
- Gully pits, junction boxes, energy dissipators, and inlet and outlet structures.
- Ends of wingwalls and headwalls.
- Open drains.

Site conditions: If required by site conditions, amend the inlet and outlet locations, designed levels or the culvert length, in consultation with designer.

Temporary drainage during construction

Dams and diversions: Do not temporarily or permanently dam or divert existing watercourses.

Material and equipment: Locate clear of watercourses or secure to prevent danger or damage due to large runoff flows.

Swales and buffer strips: Protect during construction or make use of the swale as a temporary measure. Provide geotextile with 50 mm topsoil and instant turf laid perpendicular to the flow path.

Stabilisation of topsoil areas: If required, stabilise the topsoil with hydroseed immediately after earthworks to *0257 Landscape - road reserve and street trees*.

Construction traffic

Requirement: If proposing to move heavy construction plant or vehicles over pipes or box culverts, provide certified protection measures.

Existing structures

Requirement: Demolish and remove existing redundant pipe culverts, head walls and pits as documented.

3.2 OPEN DRAINS

General

Requirement: Provide open drains, associated embankments and protective linings to *1121 Open drains*.

3.3 EXCAVATION FOR DRAINAGE SYSTEMS

General

Topsoil removal: To *1112 Earthworks (Road reserve)* and before excavation.

Trench support stabilisation: Provide shoring, sheet piling or other stabilisation to the sides of trench excavations.

Excavation level: Excavate to the design level for bedding or foundation. Remove all loose material.

Swales, batter slopes and bioretention trenches: Level beds as documented.

Soil type

Requirement: Confirm surrounding soil type conforms to the soil type used for the stormwater drainage system design.

Trenches and embankments

Concrete and flexible pipes: Minimum trench width as follows:

- Concrete pipes: To AS/NZS 3725 (2007) clause 9.
- Flexible pipes: To AS/NZS 2566.2 (2002) clause 4.4.

Embankment installation condition: Before placing bedding and laying pipes, place and compact embankment fill to *1112 Earthworks (Road reserve)*, and to manufacturer's specifications for different conditions.

Trench installation condition: Complete the embankment to the underside of the selected material zone before trenching.

Drainage structures other than pipes

Excavation: Provide a clear width between the structure wall and face of the excavation, equal to one third of the excavation face height or a minimum of 300 mm.

Inadequate foundation material

Requirement: Remove and dispose inadequate foundation material to *1112 Earthworks (Road reserve)* and replace with material to **BEDDING AND SUPPORT MATERIAL**.

Rock foundation

Requirement: If rock is encountered at the foundation level, excavate to a depth required for the pipe type and backfill with compacted select fill.

3.4 BEDDING AND BACKFILLING

Pipe bedding

Concrete and flexible pipes: Bedding depth as follows:

- Concrete pipes: To AS/NZS 3725 (2007) Table 5.
- Flexible pipes: To AS/NZS 2566.2 (2002) Table 4.2.

Corrugated metal structures: Not to be used. ~~Provide minimum 75 mm thick uncompacted bedding material between the foundation and the outer surface of corrugations to AS/NZS 2041.2 (2011) clause 2.6.~~

Backfilling

Recycled materials for backfilling: To Austroads AGPT04E (2022).

Concrete pipes minimum height of fill: To AS/NZS 3725 (2007) Table B1.

Flexible pipes minimum cover: To AS/NZS 2566.2 (2002) Table 4.1.

~~Corrugated metal structures: Place backfill as follows:~~

- ~~Equally balanced on both sides, with minimum dimensions to AS/NZS 2041.2 (2011) Table 2.4.3 and Table 2.5.~~
- ~~Monitor the shape during placement in conformance with AS/NZS 2041.2 (2011) clause 2.14.~~

In situ concrete structures: Do not backfill against in situ concrete drainage structures less than 14 days after placing concrete.

Trench backfill material: Backfill the remainder of the trench to the underside of the subgrade, or selected material zone in conformance with *1112 Earthworks (Road reserve)*.

Sequence: Start backfilling and compaction at the pipe or structure to confine future backfill material.

3.5 COMPACTION

Compaction of foundations, bedding and backfilling

Foundations, bedding (other than for pipe drainage) and backfilling: To the **Compaction table**, tested in conformance with AS 1289.5.4.1 (2007) for standard compactive effort.

Compaction table

Zone	Relative compaction
Foundations or trench base:	
- To a depth of 150 mm below foundation levels	95%
- Material replacing unsuitable material	95%
Bedding material	95%
Selected backfill and ordinary backfill material:	
- Below 1.5 m of finished surface	95%
- Within 1.5 m of finished surface	100%
Backfill material within the selected material zone	100%

Compaction layers thickness: Compact all material in layers not exceeding 150 mm compacted thickness and to the documented relative compaction before the next layer is commenced.

Moisture content range: At the time of compaction, adjust the moisture content (within the range 60% to 95% of the optimum moisture content) of the material to achieve the documented compaction as determined by AS 1289.5.7.1 (2006) (standard compaction).

Compaction adjacent to culverts or drainage structures

Method: If compacting adjacent to culverts or drainage structures, adopt compaction methods which do not cause damage or misalignment. Rectify any damage.

Compaction of pipe drainage bedding

Protection of the pipe from construction damage: If required, adjust the layer thickness to avoid damaging the pipe.

Concrete pipes bed and haunch zones:

- Compaction: To AS/NZS 3725 (2007) clause 8 and Table 5.
- Place and shape the top 0.1 times the external diameter of the pipe of the bedding and haunch material directly under the pipe to house the pipe after compaction achieved in the bed and haunch zone external to area of direct support.
- If the impermeability of the natural ground and the slope of the drainage line may cause erosion of bedding material, provide cementitious stabilisation.

Flexible pipe embedment: To AS/NZS 2566.2 (2002) clause 5.6 and Table 5.5.

3.6 CONCRETE WORK

General

Requirement: Supply and place normal class concrete, sprayed concrete, steel reinforcement and formwork, and provide tolerances, construction joints, curing and protection to *0319 Auxiliary concrete works* and as documented.

3.7 WATER SENSITIVE URBAN DESIGN

Protection to WSUD

Vegetated swales, buffer strips and bioretention systems: Do not allow construction traffic access to areas of WSUD or infiltration systems. Provide fences if required, to *1196 Boundary fencing for road reserves*. So far as is practicable, construct final filter layer and vegetation media in WSUD basins after the main construction sequence is completed and site soil revegetation has established, to minimise sediment loads. Remediate any sedimentation prior to Practical Completion.

Permanent protection: Install bollards, signposting or other street furniture, to protect the constructed vegetated areas from damage.

Vegetated swales and buffer strips

Details: As documented and to the requirements of this subclause, if appropriate.

Ponding prevention: Provide a perforated pipe beneath the swale drain.

Geometry and slope: As documented. Where mowing maintenance by a public authority is required, no steeper than 4H:1V.

Longitudinal slope: If longitudinal slope is not within 1% to 4%, conform to the following:

- Slopes greater than 4%: Install check dams.
- Slopes less than 1%: Install under drains. Maximum swale width: 2.5 m.

Bioretention systems/rainwater gardens

Base or drainage layer:

- Depth: 150 to 200 mm.
- Material: Coarse and poorly graded sand (1 mm) or fine gravel (2 to 5 mm).
- Impermeable liner: If the surrounding soil is free draining, use an impermeable liner on the base and sides.
- Liner type: As documented.

Transition layer:

- Minimum 100 to 150 mm thick layer of sand.

Filtration layer:

- Depth of filter media: 300 and 700 mm, as documented.
- Saturated hydraulic conductivity: 200 to 500 mm/hr.
- Perforated pipe capacity: Make sure the perforated pipe capacity is more than the infiltration capacity of the filter media.

Gross pollution treatment (GPTs) as part of a treatment system

General: Provide GPTs as documented.

Treatment objectives: To capture at least 90% of gross pollutant litter and vegetation larger than 5 mm and sediment particles larger than 0.125 mm.

Landscape and vegetation

Plant species selection: To *0257 Landscape - road reserve and street trees*.

Minimum depths of topsoil: Conform to the following:

- Turf areas: 150 mm.
- Ground covers and small shrubs: 300 mm.
- Large shrubs: 450 mm.
- Trees: 600 mm.

Stormwater re-use

Requirement: Provide stormwater re-use collection, storage, treatment and distribution.

Application rate for irrigation: As documented.

3.8 TESTING

Quality

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

3.9 COMPLETION

Inspection

CCTV inspections: Inspect drainage structures to ~~*1859 CCTV inspection of drainage conduits*~~ *WSA 05-2013 Conduit Inspection Reporting Code of Australia* and as follows:

- If the conformance of completed drainage structures is not visible from externally: On completion of all drainage structures and before 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 before completion to verify tolerances and to make sure there is no obstruction to the flow of water.

Cleaning

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

Operation and maintenance

During Defects Liability Period.

General: Prepare a manual including recommendations for operation and maintenance of the stormwater infrastructure.

Bioretention systems/rainwater gardens:

- Inspection: Inspect bioretention systems every fortnight between October to March and once a month between April to September.
- Litter: Remove litter and dead plant material from gardens.
- Density: Maintain the planting density of the garden.
- Herbicide: Do not use herbicides in bioretention systems/rainwater gardens.
- After rainfall of over 10 mm, within 2 days:
  - Remove surplus silt build up.
  - Replace washed away soil.
  - Replace gravel or mulch.
  - Remove litter.

Buffer strips: Remove deposited sediment. Inspect vegetation regularly for reasonable condition.

GPTs: To Stormwater NSW (2021) *Guidelines for maintenance of stormwater treatment measures.*

Swales: Maintain vegetation height so that it is not submerged.

4 ANNEXURE A

For private developments, certain Hold and Witness Points where specifically noted below require representatives of both the Superintendent and the Principal Certifier (e.g. Council) to authorise release.

4.1 ANNEXURE – SUMMARY OF HOLD AND WITNESS POINTS

Clause and description	Type	Submission/ Inspection details	Submission/Notice times	Process held
SUBMISSIONS, Authority approvals	H	Confirmation retired services are inactive.	10 days before excavation	Excavation
SUBMISSIONS, Authority approvals	H – Superintendent and Principal Certifier	BEFORE YOU DIG AUSTRALIA investigation. Gain Service Authority Approval where conflicts exist.	10 days before excavation	Excavation
SUBMISSIONS, Authority approvals Road opening permit	H – Superintendent and Principal Certifier	Approval from Road Authority with appropriate approval certificate.	5 days before site commencement	Work in public roads or footpaths
SUBMISSIONS, Certification Construction traffic	H	Certification of protection measures	5 days before installation of protection measures	Installation of protection measures
SUBMISSIONS, Certification Traffic Management Plan	H – Superintendent and Principal Certifier	Traffic Management Plan submitted to Road Authority for approval	10 days before site commencement	Site Commencement
SUBMISSIONS, Execution details Set-out of stormwater drainage system	H	Details of any proposed changes to the designed system	5 days before site commencement	Construction set-out
SUBMISSIONS,	H –	Details of	10 days before site	Excavation and

Clause and description	Type	Submission/ Inspection details	Submission/Notice times	Process held
Execution details Temporary drainage during construction	Superintendent and Principal Certifier	procedures/devices	commencement	temporary drainage installation
SUBMISSIONS, Execution details Soil type	H	Soil type confirmation	3 days before starting excavation	Excavation
SUBMISSIONS, Products and materials Products conformity	H	Certification that all products and materials used conform to the documented requirements	3 days for pipes and fittings, 5 days for other drainage structures	Delivery to the site
SUBMISSIONS, Tests Durability	H	Soil test results for materials around steel and concrete structures	5 days before proceeding	Site commencement
INSPECTIONS, Notice Set-out of stormwater drainage system	W	Set-out of location design levels and design cover	3 days	Set-out of stormwater drainage
INSPECTIONS, Notice Drainage structures other than pipes	W	Clear width of excavations	3 days	Temporary drainage during construction
INSPECTIONS, Notice Unsuitable foundation material	W	Areas containing unsuitable foundation Identify unsuitable material and remove to spoil heap and pay loose heap measure	Proceeding	Trench grade suitability
INSPECTIONS, Notice Rock foundation	W	Compaction of fill for excavated rock Removal of excavated rock to spoil to measure loose heap	Proceeding	Bedding
INSPECTIONS, Notice Culvert subgrade	W – Superintendent and Principal Certifier	Compaction and suitability of subgrade for culverts	1 day before installing culvert bedding material	Installation of bedding material
INSPECTIONS, Notice Trench base	W	Levels	1 day before installing bedding material	Installation of bedding material
~~INSPECTIONS, Notice - Backfilling~~	~~W~~	~~Dimensions of corrugated metal structures after backfilling~~	~~1 day~~	~~Rectification or finishing works~~
INSPECTIONS, Notice Backfilling	W	Backfilling to in situ concrete structures	2 days	Rectification or finishing works
INSPECTIONS, Notice	W –	Observation of	Proceeding	Compaction of

Clause and description	Type	Submission/ Inspection details	Submission/Notice times	Process held
Compaction adjacent to culverts or drainage structures	Superintendent and Principal Certifier	compaction around culverts to check compliance		backfilling
INSPECTIONS, Notice Compaction of pipe drainage bedding	W	Cementitious stabilisation in the concrete pipe bedding and haunch zones as specified	Proceeding	Compaction and stabilisation of backfilling and bedding
INSPECTIONS, Notice Protection to WSUD	W	Vegetated swales, buffer strips, and bioretention systems from construction traffic	Proceeding	Restoration of any damaged WSUD
Note: H = Hold Point, W = Witness Point				

4.2 ANNEXURE – MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
Siting and excavation	Geometry	1 drainage line/structure	1 per drainage line/structure	Survey
Foundation	Compaction	1 drainage line/structure	1 per 20 lin m	AS 1289.5.4.1 (2007)
Material surrounding steel structures	Material quality: pH/Electrical resistivity	1 drainage line/structure	1 per material	AS 1289.4.3.1 (2021) AS 1289.4.4.1 (2017)
Material surrounding concrete structures	Material quality: Chloride, sulfate and CO_2 concentration	1 drainage line/structure	1 per material	AS 1289.4.2.1 (2020)
Bedding	Material quality: Particle size distribution Compaction/moisture content	1 contract 1 drainage line/structure	1 per 200 m^3 1 per layer, per 20 lin m	AS 1141.11.1 (2020) AS 1289.5.4.1 (2007) AS 1289.5.7.1 (2006)
Concrete bedding or lining	Geometry		1 Cross section per 25 m	Survey and 3 m straightedge
Selected backfill	Material quality: Maximum particle size Plasticity index Compaction/moisture content	 1 contract 1 contract 1 drainage line/structure	 1 per 100 m^3 * 1 per 100 m^3 * 1 per 2 layers per 50 m^2	AS 1141.11.1 (2020) AS 1289.3.3.1 (2009) AS 1289.5.4.1 (2007) AS 1289.5.7.1 (2006)
a. or part thereof, per lot				

4.3 ANNEXURE – PAY ITEMS

This Annexure applies to Council projects. For private development works use of this schedule is optional, at the Superintendent's discretion.

Pay items	Unit of measurement	Schedule rate scope
1351.1 Excavation and backfilling for stormwater drainage	m^3 measured as volume excavated: **Box culverts:** - Plan area calculated from base slab dimensions plus 300 mm and wingwalls, as documented.	The Schedule rate for this **Pay Item** to be an average rate to cover all types of material excavated including both earth and rock.

Pay items	Unit of measurement	Schedule rate scope
culverts and structures	- Depth is average actual site measurement from the bottom of the specified bedding to the ground surface after stripping topsoil. **Other drainage structures:** - Plan area from outside dimensions as documented. - Depth is average actual site measurement from the bottom of the specified bedding to the ground surface after stripping topsoil. **Unsuitable material under culverts and drainage structures:** - Volume m^3 loose. - Actual plan area and average depth below bedding of material removed. - Provisional item for rock excavation per m^3 of rock.	All costs associated with all activities for the excavation of material and backfilling as specified including setting out and associated survey, replacement of unsuitable material, replacement of over-excavation, control of stormwater runoff, temporary drainage, erosion and sediment control, and disposal of excess or unsuitable material.
1351.2 Excavation for pipe drainage, pipes, structures.	m^3 measured as volume of excavated material calculated for each component to **Excavation dimensions for PAY ITEM 1351.2 schedule**.	The Schedule rate for this **Pay Item** to be an average rate to cover all types of material excavated including both earth and rock. All costs associated with all activities for the excavation of material, traffic control, and erosion control.
1351.3 Inadequate foundation material under drainage structures and open drains.	m^3 measured as volume of excavated material (loose in truck) or as measured in bank.	The Schedule rate for this **Pay Item** to be an average rate to cover all types of material excavated including both earth and rock. All costs associated with all activities for the excavation, removal, replacement and disposal of inadequate foundation material, traffic control, and erosion control.
Traffic management	Lump sum.	To *1101 Traffic management*
Erosion and sedimentation control		To *1102 Control of erosion and sedimentation (Construction)*
Topsoil removal and backfilling		To *1112 Earthworks (Road reserve)*
Open drain linings		To *1121 Open drains*
Concrete works		To *0319 Auxiliary concrete works*

Excavation dimensions for PAY ITEM 1351.2 schedule

Reinforced concrete and fibre reinforced cement pipes – Positive projection (if excavation required)		
Width	Single cell	External pipe diameter +1 m.
	Multi cell	Sum of external diameters + sum of spacings between pipes measured square to the line of the culvert +1 m.
Depth	In natural ground	Average actual depth from topsoil stripped ground surface to

		underside of specified bedding.
	In embankment	Average actual depth or 500 mm above top of pipe to underside of specified bedding, whichever is less.
Length		Actual excavation length, centre to centre of pits or centre of pit to face of headwall.
Reinforced concrete and fibre reinforced cement pipes – Wide trench		
Width	Single cell:	External pipe diameter +1 m.
	Multi cell:	Sum of external diameters + sum of spacings between pipes measured square to the line of the culvert +1 m.
Depth	In natural ground	Average actual depth form topsoil stripped ground surface to underside of specified bedding.
	In embankment	Maximum 500 mm above top of pipe to underside of specified bedding.
Length		Actual excavation length, centre to centre of pits or centre of pit to face of headwall.
Reinforced concrete and fibre reinforced cement pipes – Normal trench		
Width		1.4 x external pipe diameter or +300 mm on each side, whichever is the greater.
Depth	In natural ground	Average actual depth form topsoil stripped ground surface to underside of specified bedding.
	In embankment	Maximum 500 mm above top of pipe to underside of specified bedding.
Length		Actual excavation length, centre to centre of pits or centre of pit to face of headwall.
Steel pipes and pipe arches		
Width	Wide trench	External pipe diameter or span +2 x external pipe diameter or span.
	Normal trench	External pipe diameter or span +600 mm on each side.
Depth		As for RC and FRC pipes.
Flexible pipes		
	Pipe size (mm)	
Width	External diameter at collar ≥ 75 and ≤ 150	External diameter of pipe +200 mm
	External diameter at collar ≥ 150 and ≤ 300	External diameter of pipe +300 mm
	External diameter at collar ≥ 300 and ≤ 450	External diameter of pipe +400 mm
Depth		Average actual depth excavated.
Length		Actual excavation length, centre to centre of pits or centre of pit to face of headwall.

4.4 REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS 1141		Methods for sampling and testing aggregates
AS 1141.11.1	2020	Particle size distribution - Sieving method
AS 1289		Methods of testing soils for engineering purposes
AS 1289.3.3.1	2009	Soil classification tests - Calculation of the plasticity index of a soil
AS 1289.4.2.1	2020	Soil chemical tests - Determination of the sulfate content of a natural soil and the sulfate content of the groundwater - Normal method
AS 1289.4.3.1	2021	Soil chemical tests - Determination of the pH value of a soil - Electrometric method
AS 1289.4.4.1	2017	Soil chemical tests - Determination of the electrical resistivity of a soil - Method for fine granular materials
AS 1289.5.4.1	2007	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	2006	Soil compaction and density tests - Compaction control test - Hilf density ratio and Hilf moisture variation (rapid method)
AS/NZS 2041		Buried corrugated metal structures
AS/NZS 2041.2	2011	Installation
AS/NZS 2566		Buried flexible pipelines
AS/NZS 2566.1	1998	Structural design
AS/NZS 2566.2	2002	Installation
AS/NZS 3725	2007	Design for installation of buried concrete pipes
AS 3850		Prefabricated concrete elements
AS 3850.3	2021	Civil construction
AS 5488		Classification of subsurface utility information (SUI)
AS 5488.1	2022	Subsurface utility information
AS 5488.2	2022	Subsurface utility engineering (SUE)
ARRB BPG1	2020	Road materials
Austroads AGPT		Guide to pavement technology
Austroads AGPT04E	2022	Recycled materials
Austroads AGRD		Guide to road design
Austroads AGRD05	2023	Drainage – General and hydrology considerations
LGNSW Guide	2020	Recycled materials in roads and pavements - A Guide for local councils
Stormwater NSW Guide	2021	Guidelines for maintenance of stormwater treatment measures
SWN Underground assets	2007	Work near underground assets - Guide
EN 15804	2012	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
ISO 14025	2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 21930	2017	Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services
WSA 05	2013	Conduit Inspection Reporting Code of Australia Version 3.1

5 ANNEXURE M – CESSNOCK CITY COUNCIL SPECIFIC CLAUSES

M1.	Variations to or non-conformances with Council's AUS-SPEC are to be evaluated with reference to the procedure in Council's *Development Engineering Handbook*. Acceptance is to be obtained in writing from: an authorised representative of Council's Director of Infrastructure and Engineering Services.	**Variation procedure**
M2.	This specification applies in addition to any development consent (DA) conditions. If there is any inconsistency, the conditions of consent shall prevail.	**DA Conditions**
M3.	Refer to the Cessnock City Council *Development Engineering Handbook* for final inspection, works-as-executed and handover requirements.	**Completion**

6 AMENDMENT HISTORY

0	15/01/2024	First Published