CITY OF SYDNEY

Sydney Streets

Technical Specifications

Revision 6 (Aug 2023)

Contents

Preamble

The Sydney Streets Technical Specifications detail the design and construction standards for physical assets in our city, including roads, footpaths, kerbs, gutters, public domain lighting, survey and stormwater infrastructure.

These Technical Specifications ensure these assets continue to provide services in a reliable and cost- effective manner for the benefit of the people who live, work in and visit our city.

They are for use by staff, developers, consultants and service providers of the City of Sydney (the City).

Since the previous issue of Technical Specifications, significant new design details, materials and construction methods have become available. Updates in this revision are based on research, analysis of industry standards, specifications, best practice and feedback from key stakeholders.

The Sydney Streets Technical Specification also aligns with other City of Sydney design codes and specifications including:

- Sydney Streets Code
- Street Tree Master Plan
- Sydney Lights Code
- Principles of Sustainability established by Sustainable Sydney 2030 – 2050 and subsequent strategic planning and project initiatives such as the Liveable Green Network.

CITO Technical Services Manager

Introduction

General

The primary purpose of the Technical Specifications is to outline the City's approach to consistent infrastructure asset management, which is underpinned by design, construction and asset handover for the purpose of City's ongoing inspections and maintenance.

The City of Sydney Local Government Area (LGA) covers approximately 26 square kilometres and includes the following areas:

City Centre (CBD), The Rocks, Walsh Bay, Barangaroo, Millers Point, Ultimo, Pyrmont, Surry Hills, Woolloomooloo, Kings Cross, Elizabeth Bay, Rushcutters Bay, Darlinghurst, Chippendale, Darlington, Camperdown, Forest Lodge, Glebe, Alexandria, Beaconsfield, Centennial Park, Erskineville, Newtown, Redfern, Rosebery, Waterloo and Zetland.

NSW Government agencies have environmental responsibilities in the LGA and the Australian Government Department of Defence has administrative control over Garden Island. The NSW Government Transport for NSW has jurisdiction over State Roads and Port facilities. Placemaking NSW formed in June 2020 owns and manages Darling Harbour, The Rocks and Barangaroo including parks and waterfront boardwalks in Pyrmont.

The city is densely urbanised and is intensively used for a variety of purposes including residential, commercial, tourism and cultural activities.

The City's vision for 2050 is to create an even more liveable, diverse and sustainable city. We revised our targets and directions of Sustainable Sydney 2030. We asked architects, creatives and other experts for 10 ambitious project ideas that bring these directions and targets to life for 2050.

One of the 10 targets the City has set as part of its Sustainable Sydney 2030 – 2050 Strategy Plan is by 2030 there will be 90% recycling and recovery of residential waste, commercial and industrial waste, and construction and demolition waste, which will be maintained at that level to 2050.

Wherever possible, the City proposes sustainable options for materials and construction techniques in these Technical Specifications. This includes the use of reclaimed asphalt pavement (RAP) in asphalt mixtures which reduces energy consumption, lowers transportation costs required to obtain quality virgin aggregate, decreases the material going into landfills and preserve non-renewable natural resources.

Scope

These Technical Specifications set the guidelines for asset design, construction and handover for asset operation and maintenance. For reference, standard technical drawings are included.

The Technical Specifications apply to the design, construction and asset handover of infrastructure within the City of Sydney LGA that is under the City's control.

The Technical Specifications also provide direction for design, construction and asset handover for private development that has implications on the public domain.

The City also encourages the use of the Technical Specifications in areas within its boundaries to achieve a coordinated and consistent approach to support long-term maintenance benefits and consistent design and construction standards for the public domain.

The Technical Specifications do not replace Australian Standards or any project-specific NATSPEC documentation (Other Standards), but rather complement them, as they may not cover the same content. All these guidelines are to be followed. For this reason, there may be instances where both the Technical Specifications and the Other Standards are used on a given project. Where there is an inconsistency between the Other Standards and the Technical Specifications, the Technical Specifications will take precedence unless the City directs otherwise.

The City expects that any project design consultant engaged by the City will consider the content of the Sydney Streets Technical Specifications and ensure that they are adequately included within relevant project documentation. Any departures from the Technical Specifications and the Other Standards must be agreed to by the City in relevant project documentation before a project design consultant proceeds with any of them.

Reading the Specifications

The Specifications is composed of the following sections:

Introduction

This section provides an overview of how the Technical Specifications are set out, their use and relation to the City's public domain framework.

A: Design
This section outlines the key design considerations for City infrastructure.

B: Construction
This section provides information and standard requirements for construction.

C: Standard Drawings
This section provides standard design drawings, which are also referred to in these Technical Specifications.

User

The Technical Specifications provide technical information including standard drawings for the public infrastructure within the City's Local Government Area, enabling the City, its community, designers, consultants and contractors to understand and deliver assets to the City's requirements. The Technical Specifications should be used by all stakeholders involved with planning, design, approval and construction of infrastructure works for the City.

Application of the Technical Specifications

The Technical Specifications outline the overall asset design, construction and handover strategy, which encompasses the functional asset management approach to the City's infrastructure.

Refer to the City maps prior to applying the Technical Specifications and also confirm which Australian Standards are applicable.

Refer to the Streets Design Code for infrastructure installation details.

Engagement of an independent, professional and qualified infrastructure designer is essential.

Glossary of Terms	
Authorities	Authorities such as NSW Department of Planning and Environment, NSW Heritage, Transport for NSW, Ausgrid, Sydney Water Corporation , Jemena, Optus, and Telstra
BYDA	Before You Dig Australia (formerly known as Dial Before You Dig or DBYD)
The City	The Council of the City of Sydney
City's Representative	The person nominated by the Council of the City of Sydney to act on the City's behalf in the discharge of its contractual responsibilities
Community Liaison Officer	A person employed by the City or Service Provider to directly communicate with the community
Consultants	Specialist consultants appointed or novated to the Service Provider
Excavation	Excavation in all classes of material, matter or substance
Handover documents	All documents provided by the Service Provider to the City on Practical Completion as specified, including as-built drawings
MGA Coordinate System	Map Grid of Australia 2020 (MGA2020). This is a standard Universal Transverse Mercator (UTM) projection and is used by all states and territories across Australia
PMP	Project Management Plan
PSM	Permanent Survey Mark
Practical completion	Practical completion is the stage of the project when the Works are generally considered to be practically complete and when there are no outstanding defects (except for minor items) and the project can be put to its intended use
Proprietary items	Manufactured proprietary items selected or approved by the City for inclusion/installation in the project by the Service Provider
Road classification	Medium to heavy traffic • 15,000 to 25,000 vpd (vehicles per day) • 500 to 1,500 hvpd (heavy vehicles per day) • 60 km/h to 80 km/h speed limit • Roads with design traffic equal to or exceeding 1 x 10^7 Equivalent Standard Axles (ESA) Light to medium traffic • < 15,000 vpd (vehicles per day) • < 500 hvpd (heavy vehicles per day) • ≤60 km/h speed limit • Roads with design traffic less than 1 x 10^7 Equivalent Standard Axles (ESA).
Service Provider	Any parties such as contractors, suppliers, consultants, developers, authorities or staff who are planning, designing and conducting the Works.
Site	Land and structures within the extent of the Work's area/site boundary, including storage areas. The site area includes privately owned property that is to be dedicated to the City as a public asset.

Glossary of Terms	
Specifications	This detailed statement of materials, dimensions and quality for all work that is to be built, installed or manufactured for the City or for work that is to be dedicated to the City as a public asset.
SSM	State Survey Mark
Stakeholders	Persons, groups or organisations with interests in the project, who require special consideration or consultation prior to or during Works being undertaken
Sub-service provider	Party conducting Works for the Service Provider
Supervisor	Supervisor appointed by the Service Provider to supervise site works
Suppliers	Suppliers of goods for use
SWMS	Safe Work Method Statement
Tenant	Tenants or Lessees of Private Property on non-government and non- Crown land. Generally, tenants neighbouring the site boundary
TMP	Traffic Management Plan
Works	All Works required to complete the project as specified and approved

Standards, Policies and Codes of Practice Applicable

All Works shall be carried out in a sound, efficient and well-executed manner and in accordance with sound engineering practice and principles.

Unless otherwise specified, materials and works must be in accordance with the engineering purpose and intent of the drawings and these specifications, and the relevant standards of Standards Australia, the City of Sydney, utility authorities and Transport for NSW (formerly NSW Roads & Maritime Services).

Compliance

The Service Provider shall complete all Works in accordance with the relevant statutory requirements, standards, codes and guidelines including but not limited to:

Publisher	Title
City of Sydney	City's Contractors Safety Handbook supplied at the induction process.
City of Sydney	Sydney Streets Design Code
City of Sydney	The Central Sydney Heritage LEP
City of Sydney	The Central Sydney LEP
City of Sydney	Street Tree Master Plan
City of Sydney	Code of practice for construction hours/noise within the central business district.

Publisher	Title
NSW Department of Planning and Environment	Managing Urban Stormwater: Soils and Construction Volume 1 & 2; the Clean Air Act; and the Protection of the Environment Act.
RMS/Transport for NSW	Various specifications
NSW Government legislation	Work Health and Safety Act 2011.
SafeWork NSW	Various work health and safety regulations and requirements.
NSW Streets Opening	Guide to Codes and Practices for Streets Openings.
NSW Spatial Services	Protecting survey marks and Surveyor General's Directions
SAI Global	Australian Standards
SafeWork Australia	Codes of practice, guidance materials, information sheets and fact sheets; SafeWork Australia: Asbestos – Code of Practice and Guidance Notes.

Revision Register

Revision	Clause	Description of Revision	Authorised By	Date
Rev. 6	Glossary	References to "Roads and Maritime Services" or "RMS" changed to "Transport for NSW" or "TfNSW" respectively.	SA	Aug-23
		References to "Dial Before you Dig" or "DBYD" changed to "Before you Dig Australia" or "BYDA" respectively.		
		Reference to MGA Coordinate System changed to "MGA 2020"		
	Compliance	Reference to LPI updated to NSW Spatial Services; link added to Surveyor General's Directions		

A1 & A2 General Design Requirements

The purpose and intent of the Technical Specifications is to provide guidelines for design and construction of civil infrastructure on Sydney streets on behalf of the City of Sydney (the City), including written specifications and standard drawings to obtain high-quality design and construction.

The Technical Specifications are primarily to be used by developers, construction companies and designers on civil infrastructure projects with specific focus on:

- Footways
- Kerb and Gutter
- Roadways
- Street Furniture
- Public Domain Lighting
- Road Signage and Pavement Markings
- Stormwater Drainage
- Survey Marks
- Pavement Restorations

Notably excluded from this document are guidelines for the design and construction of public buildings, landscaping and parks, which are also owned and managed by the City.

The Sydney street design is directly related to traffic needs and specifically:

- Streets, intersections, driveways and pedestrian facilities shall be designed to provide for the greatest safety for motorists, pedestrians and cyclists
- Accessibility shall be provided in accordance with the requirements of the Disabilities Act.

The design details and criteria are intended to aid in preparation of plans and specifications and are considered minimum standards; a complete design will usually require more than what is presented in this document.

As with any design criteria, occasions may arise where the minimum standards are inappropriate. In these cases, a variance shall be considered. Written request for each variance should be directed tothe City.

Prior to the Service Provider beginning work, an approved set of plans and specifications must be onfile with the City. All contracts, bonds, insurance, permits and licences must be fully executed by the Service Provider before beginning work.

The City's review and approval:

- will only be to determine if the plans, specifications and construction conform to the City's requirements
- will not relieve the Design Professional and Service Provider/Owner from responsibility for any variation from the City's requirements or adequate design standards
- shall not constitute any assumption of responsibility or liability for the design or construction.

No permits for construction will be issued until the design documents have been certified by a registered professional.

All design and construction within public domain works shall be by or under the direct supervision of a registered professional. All drawings and support data submitted to the City for approval must bear their seal and signature.

A3 Roads and Structures Design

Contents

A3 ROADS AND STRUCTURES DESIGN

3.1 INTRODUCTION

The City of Sydney Streets Technical Specifications have been developed to ensure the provision of high-quality civil infrastructure compatible with the City's maintenance, asset management and serviceability requirements.

These technical specifications are output-based and specify the criteria that must be satisfied for roads and street civil assets owned by the City. Roads and streets infrastructure shall be designed by suitably qualified and experienced professionals and in compliance with these specifications and all relevant legislation, standards and current practice.

This document shall be read in conjunction with Technical Specifications B: Construction and C: Standard Drawings.

3.2 EXCEPTIONS

Departures to the requirements stipulated in the City's Sydney Streets Technical Specifications A: Roads and Street Design, B: Construction and C: Standard Drawings are only permitted with the written approval of the City.

Departures shall be requested in writing. Failure to gain approval prior to construction may result in an order to remove, redesign or reconstruct non-compliant elements.

Written approval shall be required for each instance of non-compliance and shall include a comprehensive explanation of the following:

- description of the proposed departure
- clauses for which departure is sought
- justification when compliance is not possible.

Where the departure is sought during construction, justification as to why the departure was not reasonably foreseeable during the Construction Certificate or detailed design stages is also required.

3.3 CERTIFICATION

Roads and Streets shall be designed by suitably qualified and experienced professionals and certification shall be required stating that the proposed design complies with:

- City's Sydney Streets Technical Specification A3: Roads and Streets Design
- City's Sydney Streets Technical Specification B: Construction
- City's Sydney Streets Technical Specification C: Standard Drawings
- All relevant Standards/Specification/Guide/Standard Drawings that include Austroads Guide to Pavement Technology, TfNSW Specifications and Standards Drawings.

Certification is required for the design of all elements even where the City's standard drawings are used. The City's standard drawings are to be used for guidance only and the consultant has to verify each of their drawings and details for the project specific requirements (e.g. geometry, loading, subgrade capacity, exposure classification) and amend them as required. At the end, the consultant needs to certify all the details and drawings that will be used in the project.

For flexible pavement design, CIRCLY software is to be used to justify the accuracy of the flexible pavement design. All pavement design considerations and CIRCLY design output are to be certified and submitted to the City.

Similarly for rigid pavement design all design considerations and design calculations are to be certified and submitted to the City. It will need to be justified how all these comply with the requirements of Austroads Guide to Pavement Technology, TfNSW Specifications and Standards Drawings.

3.4 RELEVANT STANDARDS

Roads and streets shall be designed and constructed in accordance with all relevant standards. This includesthe standards listed below; however, it should be noted that the list is not exhaustive. The requirements of these Technical Specifications will prevail where the following standards are in conflict with it:

- Transport for NSW (TfNSW) Technical Directions and guidelines
- Austroads Guide to Pavement Technology

Transport for NSW Specifications and Standards Drawings.

3.5 SOFTWARE

CIRCLY software is to be used to justify the accuracy of the flexible pavement design.

For rigid pavement design, relevant software used by the TfNSW and other NSW organisations (where available) is to be used to justify the accuracy of the design.

3.6 DATA REQUIREMENTS

The following information shall be required with every detailed design or Construction Certificate that includes roads and streets:

- General Plan
- Utilities Investigation Plan
- Relevant City standard drawings
- Certification of Design
- Construction Certification.

3.6.1 GENERAL PLAN

A general plan of the proposed works shall be provided at a suitable scale such as 1:200 on A3 and include the following:

- Title block, legend, north point, scale and scale bar
- Property boundaries
- Roads and road names
- Proposed development
- Existing and proposed levels, e.g. road, footpath, other topographical features, etc.
- Relevant topographical features
- Dimensions and/or coordinates accurately identifying the position of all assets without the need to scale positions off plans.

3.7 GENERAL DESIGN PRINCIPLES FOR ROAD DESIGN

Roads should be designed to:

- provide safe, short and fast thoroughfare and access to all road users (motor vehicles, cyclists and pedestrians)
- clearly convey the primary function to road users and encourage appropriate driver behaviour
- deliver traffic volumes at speeds compatible with function
- provide convenient location for services
- provide an opportunity for landscaping

- allow for parking, where appropriate
- have due regard to topography, geology, climate, environment and heritage of the site
- provide low cost of ownership
- comply with these Technical Specifications and relevant Austroads and TfNSW Guidelinesand/or Standards.

The appropriate design criteria for a specific road largely depend on a set of economic indicators: the costs of construction and operation on one side and financial benefits to the community on the other. These are strategic parameters that influence a decision to build a road. Economic analysis, in conjunction with traffic analysis, determine the functional class of the road and the design speed. This section must be read in conjunction with the relevant Austroads and TfNSW Guidelines and/or Standards.

3.8 GENERAL DESIGN PRINCIPLES FOR STREET DESIGN

A well-designed street requires street design coordination through planning, design detailing and implementation. Composing and considering all elements within the street is a significant contributor to the character and appearance of a place as well as providing a safe and comfortable pedestrian domain.

Good design and layout of elements:

- create a safe street
- reinforce the street hierarchy
- provide required paths of travel and pedestrian priority
- provide a clear and direct composition that reinforces the major design elements
- integrate seamlessly into the paved ground plane
- are located consistently throughout the public domain to reflect the overall special character. This section must be read in conjunction with the Sydney Street Code.

3.9 BRIDGES AND STRUCTURES DESIGN REQUIREMENTS

Any major structure (e.g. bridge, retaining wall, public stairs/steps/ramps) and inaccessible structures (e.g. box culvert) shall have a 100 year design life and Australian Standard AS5100 is to be used in the design. Further to that appropriate concrete mix (e.g. concrete mix complying with TfNSW Specification B80) is to be used to ensure a 100 year design life. Australian Standard AS5100.5 is to be used for concrete exposure classification, concrete cover, etc.

- AS5100 – Bridge Design
- TfNSW QA Spec B80 – Concrete Work for Bridges.

Any new bridge and culvert under the road shall be designed for unrestricted vehicular load capacity and shall be capable of supporting all vehicular load of Australian Standard AS5100.2 that include SM1600 and HLP400.

Minor structures are to be designed as per relevant Australian Standards (e.g. AS3600, AS4100). A minimum design life of 50 years shall be achieved in the design unless specified higher by the Council. The Standards to be used include the following:

- AS3600 – Concrete Structures
- AS3735 – Concrete Structures for Retaining Liquids
- AS2870 – Residential Slabs and Footings
- AS2159 – Piling – Design and Installation
- AS4100 – Steel Structures.

Steel structures and their surface coatings are to be designed to ensure a minimum of 50 year design life unless specified higher by the Council.

Design standards include the following:

- AS4100 – Steel Structures

Shotcrete is to comply with relevant TfNSW QA Specification (e.g. B82, R68):

- TfNSW QA Spec B82 – Shotcrete Work
  (For shotcrete work with 100 year design life, e.g. tunnels and retaining walls)
- TfNSW QA Spec R68 – Shotcrete Work without Steel Fibres
  (For works such as stabilising slopes in conjunction with soil nailing or rock dowelling)

Where stainless steel element is used in council works, the Grade 316 with a minimum of 100 year design life is to be used. Stainless steel items are to be appropriately isolated from carbon steel items where both types of steel are used in the same structure.

Rock bolts to be used in any cliff remediation work shall have a minimum 100 year design life.

For timber works, relevant Australian Standard and TfNSW Specifications are to be used in the design, construction and surface and preservative treatments. Only certified timber under a reputable forest certification scheme (i.e PEFC / FSA) shall be used for timber works. Design report and drawings shall clearly list all these documents to demonstrate how the most appropriate timber grade and timber treatments are used in the design and construction.

3.10 REVISION REGISTER

Revision	Clause	Description of Revision	Authorised By	Date
Rev. 6	3.4	"Technical Directions" added to TfNSW guidelines	SA	Aug-23
	3.9	New para added "Only certified timber under a reputable forest certification scheme (i.e PEFC / FSA) shall be used for timber works"		
	Overall	References to "Roads and Maritime Services" or "RMS" changed to "Transport for NSW" or "TfNSW" respectively.		

A4 Stormwater Drainage Design

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A4 STORMWATER DRAINAGE DESIGN

List of Tables

4.1 INTRODUCTION

The City of Sydney Stormwater Drainage Design Technical Specifications have been developed to ensure the provision of high-quality stormwater infrastructure compatible with the City's maintenance, asset management and serviceability requirements.

These Technical Specifications are output-based and define the criteria that must be satisfied by stormwater networks that are to be owned by the City or located on public land within the City's local government area. Stormwater infrastructure shall be designed by suitably qualified and experienced professionals and in compliance with these Technical Specifications and all relevant legislation, standards and current practice.

This document shall be read in conjunction with B10: Stormwater Drainage Construction, all other parts of the City's Sydney Streets Technical Specifications, and Part C: Standard Drawings.

4.2 EXCEPTIONS

Departures to the requirements stipulated in the City's Sydney Streets Technical Specifications, A4: Stormwater Drainage Design, B10: Stormwater Drainage Construction and Part C: Standard Drawings are only permitted with the written approval of the City's Principal Engineer Environment & Water.

Variations shall be requested in writing using the Drainage Standards Variation Form and a Drainage Standards Variation Approval Summary Sheet signed by the Principal Engineer Environment & Water and shall be obtained prior to construction. They are both available in Annexure B and can be downloaded from the City's website. Failure to gain approval prior to construction may result in an order to remove, redesign or reconstruct non-compliant elements.

Written approval shall be required for each instance of non-compliance and shall include a comprehensive explanation of the following:

- Description of the proposed variation
- Clauses for which variation is sought
- Justification as to why compliance is not possible.

Where the variation is sought during construction, justification as to why the variation was not reasonably foreseeable during the Construction Certificate or detailed design stages is also required.

4.3 CERTIFICATION

Stormwater infrastructure shall be designed by suitably qualified and experienced professionals and certification shall be required stating that the proposed design complies with:

- City's Sydney Streets Technical Specification A4: Stormwater Drainage Design
- City's Sydney Streets Technical Specification B10: Stormwater Drainage Construction
- City's Sydney Streets Part C: Standard Drawings
- All other relevant standards.

Certification is also required for the hydraulic and structural design of all elements. Structural certification is not required for items constructed as per City of Sydney standard drawings.

4.4 RELEVANT STANDARDS

Stormwater drainage shall be designed and constructed in accordance with all relevant standards. This includes the following standards; however, it should be noted that the following list is not exhaustive. The requirements of these technical specifications will prevail where the following standards are in conflict with it:

- Sydney Streets Technical Specifications
- Sydney Streets Technical Specification B10: Stormwater Drainage Construction
- Sydney Streets Standard Drawings
- The relevant Australian Rainfall and Runoff Projects, numbers 1 to 21 inclusive
- Australian Runoff Quality, A Guide to Water-Sensitive Urban Design, Engineers Australia, 2006
- The Constructed Wetlands Manual, Volume 1 and 2, NSW Department of Land and Water Conservation, 1998
- Condition Assessment & Asset Performance Guidelines, Practice Note 5: Stormwater Drainage, Institute of Public Works Engineering Australia
- AS 1210 Pressure vessels
- AS 1214 Hot dip galvanised coatings on threaded fasteners (ISO Metric Coarse Thread Series)
- AS 1254 Unplasticised PVC (UPVC) pipes and fittings for storm or surface water applications
- AS 1260 PVC pipes and fittings for drain, waste and vent applications
- AS 1289 Methods of testing soils for engineering purposes
- AS 1302 Steel reinforcing bars for concrete
- AS 1303 Hard drawn steel reinforcing wire for concrete
- AS 1304 Welded wire reinforcing fabric for concrete
- AS 1463 Polyethylene pipe extrusion compounds
- AS 1579 Arc-welded steel pipes and fittings for water and waste-water
- AS 1597 Precast reinforced concrete box culverts
- AS 1646 Rubber joint rings for water supply, sewerage and drainage purposes
- AS 1741 Vitrified clay pipes and fittings with flexible joints – sewer quality
- AS 1831 Ductile cast iron
- AS 2032 Code of practice for installation of UPVC pipe systems
- AS 2566.1 Buried flexible pipelines – structural design
- AS 2865 Safe working in confined space
- AS 3500 National plumbing and drainage code – compendium
- AS 3500.3 Stormwater drainage – plumbing and drainage – stormwater drainage
- AS 3600 Concrete structures
- AS 3725 Loads on buried concrete pipes
- AS 3735 Concrete structured for retaining liquid
- AS 3972 Portland and blended cements
- AS 3996 Metal access covers, road grates and frames
- AS 4058 Precast concrete pipes (pressure and non-pressure)
- AS 4139 Fibre reinforced concrete pipes and fittings
- AS 3571-1989 Glass filament reinforced thermosetting plastics (GRP) pipes – Polyester based – Water supply, sewerage and drainage applications
- AS/NZS 5065 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
- Polyethylene pipe code 2004 3rd Edition Version 3.1– Water Services Association of Australia
- ISO 10467:2004 Plastic piping systems for pressure and non-pressure drainage and sewage – Glass

reinforced thermosetting plastics (GRP) systems based on unsaturated polyester resin.

- ISTT Trenchless Technology Guideline – Cured in place lining systems, new version August 2005
- ISTT Trenchless Technology Guideline – Close fit thermoplastic lining, new version August 2005
- ISTT Trenchless Technology Guideline – Pipe bursting and splitting, new version June 2005.

4.5 DATA REQUIREMENTS

The following information shall be provided where relevant with every detailed design or Construction Certificate that includes stormwater infrastructure:

- General Plan (services and drainage plan)
- Utilities investigation plan
- Longitudinal sections
- Drainage Details
- Relevant City of Sydney standard drawings
- Certification of Design
- Drainage Design Variation Form
- Catchment Plan
- Hydrologic and Hydraulic Design Data
- Water Quality Design Data
- Environmental Impact Assessment
- Structural Certification.

The following information shall be required for any project that requires stormwater relining works:

- A plan showing the extent of the proposed relining works including the size of the host conduit
- Details of any proposed additional structures or modification of existing structures in order to gain access to undertake the Works, including all relevant City of Sydney standard drawings
- Structural requirements for the liner, the method of relining to be undertaken and design calculations with certification of the structural capacity of the liner
- CCTV of the host conduit depicting current conditions
- Information regarding kerb outlet connections is only required on the General Plan.

The following sections provide additional detail on the requirements for each item listed above. Annexure A provides design checklists to ensure all relevant information is included with drainage designs.

4.5.1 GENERAL PLAN

A general plan of the proposed Works shall be provided at a suitable scale such as 1:200 at A3 and include the following:

- Title block, legend, north point, scale and scale bar
- Property boundaries
- Roads and road names
- Proposed development
- Existing and proposed levels, e.g. stormwater, road, footpath, other topographical features, etc.
- Relevant topographical features
- Existing stormwater network
- Proposed stormwater network
- Dimensions and/or coordinates accurately identifying the position of all stormwater assets without the need to scale positions off plans

- Stormwater pits and structures labelled from upstream to downstream using "line number/pit number" format
- Labels or schedule identifying the requisite pit or structure types, properties and relevant standard drawing or detail
- Existing and proposed pipe or conduit size
- Appropriate labels describing the proposed Works.

4.5.2 UTILITIES INVESTIGATION PLAN

A Utilities Investigation Plan shall be prepared documenting the position of all services in the vicinity of the proposed stormwater works. The plan shall be provided at a suitable scale such as 1:200, 1:250 or 1:500 at A3 and include the following:

- Title block, north point, scale and scale bar
- Property boundaries
- Road and road names
- Existing and proposed stormwater
- Location of all utilities services
- Location of potholing and surveyed service levels
- Photographs of potholed services.

Where the services investigation is large and complex, the above plan can be supplemented with a detailed service investigation report.

4.5.3 LONGITUDINAL SECTIONS

Longitudinal sections of all stormwater conduits are required for all projects where the total length of new conduit exceeds 4.8 metres.

Notwithstanding the above, longitudinal sections are not required in the following circumstances:

- Relining of existing stormwater conduits
- Replacing existing conduits like for like and there are no service intrusions in the existing conduits.

4.5.3.1 SCALE AND DATUM

Scales: 1:200 (H) 1:20 (V) at A3

1:250 (H) and 1:25 (V) at A3

Datum: AHD

4.5.3.2 TITLE BLOCK

Title block, legend, scale and scale bar shall be provided.

4.5.3.3 DIAGRAMS

The following shall be drawn on the upper portion of the longitudinal sections:

- Invert
- Obvert
- Surface
- Pits and structures
- Pit/structure labels in the form of 'Line Number/Pit Number'
- 5% AEP HGL
- 1% AEP HGL

- Position of other services crossing pipeline from survey of potholed services
- Linetype of different colours labelling service utilities with type of service and type and number of conduits.

4.5.3.4 LABELS

The middle portion of the longitudinal sections shall indicate the length of each reach and include the following information:

- Dimension/type/strength class of steel reinforced concrete pipe
- Length and grade %
- 5% AEP peak flow rate.

4.5.3.5 DATA TABLE

The lower portion of the longitudinal section shall include a data table with the following information:

- Datum
- WAE invert (blank space to be completed post construction)
- 5% AEP HGL level
- Existing surface level
- Proposed surface level
- Design invert level
- Chainage.

4.5.4 DRAINAGE DETAILS

Details shall be provided for all stormwater structures not covered by the City of Sydney standard drawings. Details shall be provided at an appropriate scale such as 1:20 at A3 and include all relevant detail to document the physical and structural features. Detail includes but is not limited to the following:

- Title block, legend, scale and scale bar
- Plan of each structure
- Sections as appropriate
- All dimensions
- Prefabricated items such as covers
- Structural steel design
- Notes and specifications.

4.5.5 CITY OF SYDNEY STANDARD DRAWINGS

Where possible City of Sydney standard drawings shall be used. A copy of all referenced City of Sydney standard drawings shall be provided with the Construction Certificate and construction drawings.

4.5.6 DRAINAGE DESIGN VARIATION FORM

The Drainage Design Variation Form and Variation Approval Summary Sheet are only required where a variation to the Technical Specifications is requested. They are both available in Annexure B of this chapter and can be downloaded from the City's website.

The purpose of the Drainage Design Variation Form is to:

- Document the proposed scope and extent of non-compliance
- Identify the elements of the Stormwater Design and Construction Technical Specifications where variance is sought

- Provide a justification for the proposed variation.

The purpose of the Variation Approval Summary Sheet is to:

- Summarise the proposed variance
- Provide written approval or refusal of the variation request.

Where a variation to the design or construction specifications is sought during the construction phase of a project, justification is required as to why the variation could not have been reasonably foreseen during the detailed design or construction certificate stages.

The following are not considered to be valid justifications for a variation:

- Failure to undertake proper services locating and potholing during the Construction Certificate or detailed design phases
- In order to avoid modifications to development consent or proposed design
- In order to avoid redesigning, removing or reconstructing elements that have already been constructed as a cost saving measure.

4.5.7 CATCHMENT PLAN

A catchment plan shall be provided at a suitable scale such as 1:500 at A3 and include the following:

- Title block, north point, scale and scale bar
- Property boundaries
- Pit and pipe layout
- Pit labels
- Sub-catchment delineation
- Label indicating catchment area
- Flow direction arrow pointing to outlet.

4.5.8 HYDROLOGIC AND HYDRAULIC DESIGN DATA

The hydrologic and hydraulic capacity of the stormwater network shall be designed in accordance with Section 4.7 of this chapter. The hydrologic and hydraulic design shall be provided to the City as either a DRAINS File and supporting information in accordance with Section 4.5.8.1 or as a comprehensive design report and design summary sheets as outlined in section 4.5.8.2.

4.5.8.1 DRAINS FILE REQUIREMENT

Where the DRAINS hydrologic and hydraulic modelling software is used for the design of the stormwater network, a copy of the DRAINS modelling file shall be provided. The modelling file shall conform to the following:

- The Catchment Plan outlined in Section 4.5.7 shall be used as a background with the modelled drainage network elements schematised in their true positions on the plan
- The stormwater network shall be schematised in the model at full scale and in its actual position on the background plan
- All required storm events and durations
- The extended hydrological parameters shall be used
- Standard Drains pit inlet capacity curves shall be used wherever appropriate
- Where non-standard pit inlet capacities are used, a supplemental report shall be provided outlining the calculation and justification for the adopted inlet capacities.

4.5.8.2 HYDROLOGIC AND HYDRAULIC DESIGN REPORT

Where the DRAINS hydrologic and hydraulic modelling software is not used for the design of the stormwater network, a comprehensive stormwater design report as well as hydrologic and hydraulic

design summary tables shall be provided.

The Stormwater Design Report shall include the following:

- A description of the hydrologic and hydraulic modelling software package used including the suitability of the software for this purpose
- The methodologies employed in the calculation of rainfall, runoff and hydraulic capacity
- The adopted pit inlet capacities
- Where non-standard pit inlet capacities are used, the calculation and justification for the adopted inlet capacities
- The hydrologic and hydraulic parameters utilised and the appropriateness of the selected values
- Description and justification of boundary conditions
- Completed hydrologic and hydraulic design summary tables as specified in Annexure C shall be provided.

4.5.9 WATER QUALITY DESIGN DATA

Water quality improvement devices shall be designed in accordance with Section 4.12 of this chapter. The water quality improvement design shall be provided to the City as either a MUSIC File and supporting information in accordance with Section 4.5.9.1 or as a comprehensive design report and design summary sheets as outlined in Section 4.5.9.2.

4.5.9.1 MUSIC FILE REQUIREMENT

Where the MUSIC water quality improvement modelling software is used for the design of the water quality improvement devices network, a copy of the MUSIC modelling file shall be provided.

4.5.9.2 WATER QUALITY IMPROVEMENT DESIGN REPORT

Where the MUSIC modelling software is not used for the design of the stormwater quality improvement devices, a comprehensive design report shall be provided.

The design report shall include all relevant information including the following:

- A description of the water quality improvement device modelling software package used, including the suitability of the software for this purpose
- The methodologies employed in the calculation of pollutant reductions
- The device bypass design arrangements
- The parameters utilised and the appropriateness of the selected values.

4.5.10 ENVIRONMENTAL IMPACT ASSESSMENT

- Where the stormwater works are to be undertaken as part of a Development Consent, the environmental impacts were assessed as part of the Development Application and further assessment is not required.
- Where the Works are to be undertaken without a Development Application, the environmental impacts of the stormwater works shall be assessed as part of a Review of Environmental Factors.

4.5.11 STRUCTURAL CERTIFICATION

Certification of the structural design is required for all stormwater structures except for City of Sydney standard drawings. The structural certificate shall be accompanied with the detailed design calculation of the structure.

All structures shall be designed to achieve 100 years' life expectancy and shall be designed in accordance with relevant Australian Standards. All concrete structures shall be designed and constructed as if they are liquid- retaining structures to minimise cracks and maximise the life expectancy of structures.

4.6 DATA HANDOVER

The following is required to be provided to the Environment & Water Team upon completion of the project:

- Marked "Works as Executed" plans
- Asset location file
- Asset data sheet
- CCTV of newly constructed conduits.

Where water quality improvement devices are created, the above information shall be accompanied by the following:

- Product specifications for all prefabricated GPT devices installed
- Operation and maintenance manual for each GPT device.

Where stormwater-relining work has been undertaken, the following information shall be provided upon completion of the project:

- Lining product specification and material data sheets
- Structural design documentation
- CCTV of host pipe prior to commencement of Works
- CCTV of host pipe with all preparations completed and ready to accept the new liner
- CCTV upon completion of lining demonstrating proper installation of liner.

4.6.1 WORKS AS EXECUTED DRAWINGS

Plans of Works-As-Executed shall be provided electronically in PDF format consisting of the design plan with red line markings indicated as-built data. The as-built data shall include the following:

- The position of all stormwater assets
- Pipe sizes and invert levels at the upstream and downstream ends of each pipe reach
- A description of all pits and structures including the type, grate, cover and kerb inlet length
- Pit and structure invert and surface levels.

4.6.2 ASSET LOCATION FILE

A shape file shall be supplied indicating the position of pipes, pits, structures and other stormwater assets. Each asset type shall be represented as outlined in **Table *1***. The positions shall be provided in the GDA2020, MGA2020 Zone 56 coordinate system. Each asset shall be provided with a unique label.

Table 1- SHAPE FILE PROPERTIES

Asset type	Feature type	Notes
Conduit	Line	Centre line of conduit
Pit	Point	Centre of grate along the kerb line. Where there is no kerb line, the centre of the pit structure shall be used
Headwall	Point	Centreline of the outlet pipe on the wall
GPT	Point	Centre of the GPT structure. Where the unit consists of multiple structures then the

Asset type	Feature type	Notes
		centre point of each structure shall be provided
Raingarden	Polygon	Polygon representing the extent of planting for each raingarden.

4.6.3 CCTV FOOTAGE

CCTV footage shall be provided for all new pipes and for all existing pipes modified. The footage shall comply with the following:

- The files shall be in MPG4 format
- File resolution shall be minimum 640 by 480 pixels, 3Mbps and 25 frames per second
- Each pipe reach (i.e. between two pits) shall be provided as a separate file
- The CCTV inspection shall be undertaken in accordance with the IPWEA Condition Assessment & Asset Performance Guidelines, Practice Note 5, Stormwater Drainage
- The speed and panning of the footage shall be sufficient to demonstrate that there are no significant cracks in the pipe and that the joints have been properly constructed
- The files shall have a name corresponding with the unique label provided in the DXF file and asset data sheet
- A summary report (*.pdf) shall accompany the data.

4.6.4 PRODUCT SPECIFICATIONS

Product specifications and all available guarantees shall be provided for all prefabricated products used such as gross pollutant traps and relining products.

4.6.5 OPERATION AND MAINTENANCE MANUAL

Where gross pollutant traps or other water-quality devices or non-standard assets (excluding raingardens) are constructed, an operation and maintenance manual shall be provided, which shall cover the following:

- Description of the asset and its components
- The design life of the asset and the individual components
- The maintenance procedures, frequency and equipment needs
- Demonstrated appropriate vehicle and equipment access
- Cost for all required maintenance activities
- A copy of the design plans, Works as Executed plans, specifications, instruction manuals and warranties for the asset.

4.7 HYDROLOGIC AND HYDRAULIC DESIGN CRITERIA

4.7.1 GENERAL STANDARDS

General standards for hydraulic design are as follows:

- Relevant Australian Rainfall and Runoff Projects, numbers 1 to 21 inclusive
- Be consistent with current industry best practice.

The requirements of these technical specifications will prevail where the above standards are in conflict.

4.7.2 HYDROLOGIC DESIGN

The hydrologic and hydraulic design shall comply with the following:

- Appropriate hydrologic and hydraulic modelling software shall be used
- Hydrology shall be determined using the ILSAX type time-area method or an appropriate storage routing model
- The use of methods such as the Rational, Advanced Rational or Probabilistic Rational methods is not permitted
- The use of hand calculations or design charts is not permitted.

4.7.2.1 DESIGN STORMS

The stormwater network shall be designed in accordance with the Major/Minor design concepts outlined in Australian Rainfall and Runoff, A Guide to Flood Estimation. Design storms shall be as follows:

- Major: 1% AEP, also referred to as 100 year Average Recurrence Interval (ARI) .
- Minor: 5% AEP, also referred to as 20 year ARI.

Simulation of additional design storms may also be required in order to comply with Section 4.7.4 and Section 4.7.5.

4.7.2.2 STORM DURATIONS

All design storms shall be simulated for the following durations:

- 5 minutes
- 10 minutes
- 15 minutes
- 20 minutes
- 25 minutes
- 30 minutes
- 45 minutes
- 60 minutes
- 90 minutes
- 120 minutes.

The worst-case duration shall be used for determining the required capacity of each structure and conduit.

4.7.3 HYDRAULIC DESIGN

Hydraulic calculations shall comply with the following:

- Appropriate hydrologic and hydraulic modelling software shall be used
- The capacity of conduits shall be calculated using hydraulic grade line analysis
- All conduits shall meet the required Minor Storm capacity without pressurisation
- Surcharging of the network is not permitted, except for the downstream reach where connecting to an existing network with capacity less than the 5% AEP
- Open-channel capacity shall be determined using appropriate open-channel hydraulic methods such as solving the energy equation using the standard step method
- Open-channel capacity shall not be determined using simplistic methods such as a single application of the Manning equation
- The use of hand calculations, design charts or monograms is not permitted.

4.7.3.1 INLET CAPACITY

Inlet capacity shall be determined in accordance with published industry data where available.

Additional information regarding the inlet capacity of certain existing inlet types commonly found in the City has been provided in Annexure E. Where available, the City's inlet capacity data shall be used.

Where non-typical inlet types are utilised and no published data is available, an appropriate relationship shall be determined. Documentation of the method used in deriving the relationship as well as a justification for the selected method shall be provided.

4.7.3.2 INLET BLOCKAGE FACTORS

Blockage factors shall be applied to all stormwater inlets as outlined in **Table *2*** below.

Table 2 - *PIT DESIGN BLOCKAGE FACTORS*

Pit type	On grade blockage factor	Sag blockage factor
kerb inlet <= 1.0 m	50%	70%
kerb inlet > 1.0 m	20%	50%
V grate or grate only	90%	90%
Strip drain or other	95%	95%

Should the pit design specifications lie outside the table above, Australian Rainfall and Runoff (ARR) Project 11 – "Blockage of Hydraulic Structures" should also be consulted and a valued derived by the ARR method adopted, subject to the approval of the Principal Engineer Environment & Water, City of Sydney.

4.7.3.3 OVERLAND FLOW LIMITS

Gutter flows and overland flow paths shall comply with the requirements in the following tables. The carriageway width indicated in the tables below shall be calculated from kerb face to kerb face ignoring parking bays. AEP is Annual Exceedance Probability.

Table 3 - *1% AEP GUTTER FLOW LIMITS FOR CARRIAGEWAYS <= 7 METRES WIDE*

Criteria	Limit
Maximum depth	100 mm
Maximum flow width	3.0 m
Maximum depth x velocity	0.6 m^2/s

Table 4 - *1% AEP GUTTER FLOW LIMITS FOR CARRIAGEWAYS > 7 METRES WIDE*

Criteria	Limit
Maximum depth	150 mm
Maximum flow width	3.5 m
Maximum depth x velocity	0.6 m^2/s

Table 5 - 1% AEP OVERLAND FLOW LIMITS FOR PEDESTRIAN AND SHARED ZONES

Criteria	Limit
Maximum depth	50 mm
Maximum flow width	1.5 m
Maximum depth x velocity	0.4 m^2/s

4.7.3.4 PIT LOSSES

Pit losses shall be determined in accordance with published 'Missouri Chart' references.

4.7.3.5 DOWNSTREAM BOUNDARY CONDITIONS

Where a network is being sized in accordance with the Minor Storm requirements, the downstream starting level for the hydraulic grade line shall be the higher of the following for the Minor Storm:

- The obvert of the pipe
- Ocean Boundary Conditions consistent with the relevant City of Sydney flood study, available on City's website.
- Hydraulic Grade Line of the downstream connection conduit
- 150mm below the surface, where the downstream conduit capacity is less than the 5% AEP.

Where the impacts of a proposed network are being analysed, the downstream starting level for the hydraulic grade line shall be the higher of the following:

- The obvert of the pipe
- The hydraulic grade line of the downstream network for the same storm event
- For flood prone land, flood levels reported in the relevant City of Sydney flood study
- Ocean boundary conditions consistent with the relevant City of Sydney flood study.

4.7.4 ADVERSE IMPACTS

Stormwater networks shall also be analysed for the 20% AEP and 10% AEP when:

- Connecting to an existing stormwater network with capacity less than the 5% AEP
- Overland flow paths are obstructed by other road features such as raised thresholds or kerb extensions
- Entry points to adjacent existing buildings are below the 5% AEP.

Stormwater shall not result in adverse impacts on private property for the 20% AEP, 10% AEP, 5% AEP and 1% AEP.

4.7.5 CONSISTENCY WITH FLOODPLAIN MANAGEMENT REQUIREMENTS

Stormwater design shall be consistent with the City's floodplain management requirements including the following:

- Interim Floodplain Management Policy
- Recommendations in the relevant Floodplain Management Plan adopted by the City.

Variations to these technical specifications can be approved under Section 4.5.6 where requirements of a site- specific flood study approved by the Environment & Water Team conflict with the specifications.

4.8 NETWORK LAYOUT

4.8.1 GENERAL LAYOUT

The general layout of the network shall comply with the following:

- The network shall be laid out in a logical fashion consistent with the topography
- Conduit capacity shall progressively increase in the downstream direction except for the existing network at the downstream connection point
- The network shall be laid out in the most hydraulically efficient manner
- Stormwater conduits shall not cross above or below other stormwater conduits
- Conduits shall be constructed in straight lines and uniform grade.

4.8.2 CONDUIT LOCATION

Stormwater conduits shall generally be located as follows:

- Below the kerb with the outside diameter of the pipe flush with the back of the kerb; or
- Centrally located within the kerbside traffic lane.
- Notwithstanding the above, conduits can be aligned in other locations in the following instances:
- Utilities or other constraints prevent installation in the preferred location
- Drainage is required to cross the road or service areas that cannot drain to the road
- Connection to existing drainage requires deviation from the preferred location.

4.8.3 PARALLEL CONDUITS

Parallel conduits shall comply with the following:

- The conduits shall be laid side by side with the minimum spacing required to achieve proper compaction of the adjoining material to achieve the required support
- The stacking of conduits is not permitted
- Conduits shall be the same size and shape except where augmentation of an existing conduit necessitates variance
- Conduits shall have the same upstream and downstream invert level except where augmentation of an existing conduit necessitates variance.

4.8.4 PROXIMITY OF OTHER STRUCTURES

Structures in the vicinity of the stormwater network shall not impose a structural load on any stormwater asset.

Structures within the 'zone of influence' shall be piered or have foundations extending below the invert level of the pipeline. The 'zone of influence' is the area that extends horizontally from the edge of the conduit by the depth to invert and extends vertically from the surface to the invert depth.

4.8.5 DRAINAGE EASEMENTS

All conduits through private land that drain public land or drain adjoining private land shall be located within drainage easements.

All drainage easements shall comply with the following:

- Easement terms shall be in accordance with the standard terms for a Drainage Easement under the Conveyancing Act 1919 (NSW)
- Where the conduit drains public land, the easement shall be in favour of the City of Sydney
- Where the conduit does not drain any public land, the easement shall be in favour of the private land that drains through the conduit
- In all cases, authority to modify or extinguish the easement shall be vested in the City of Sydney
- Easement widths shall be in accordance with **Table *6***.

Table 6- EASEMENT WIDTHS

Criteria (Conduit diameter/width and depth to invert)	Width
375 mm <= Diameter/width < 750 mm	1.8 m
750 mm => Diameter/width < 1200 mm	2.2 m
1200 mm => Diameter/width < 1500 mm	3.0 m
Diameter/width => 1500 mm and depth <= 3 m	Diameter/width plus 2 m
Diameter/width => 1500 mm and depth > 3 m	Diameter/width plus 4 m

4.8.6 PROXIMITY OF OTHER UTILITY SERVICES

The minimum separation between the stormwater network and other utility services shall be the greater of the following:

- The requirements of the other service utility authority
- 100mm.

4.8.7 PIT LOCATIONS

General requirements for pit locations are as follows:

- Stormwater pits within the wheel tracks on vehicle traffic lanes shall be avoided where practical
- The maximum conduit length between two pits shall not exceed the length specified in **Table 7**
- All pipe connections shall be via accessible pit structures and the direct connection of one drainage line to another shall not be permitted.

Stormwater pits with surface inlets shall be required at the following locations:

- All low points within the kerb and gutter
- All other low points in the public domain
- At sufficient intervals along kerb and gutter and other overland flow paths to collect runoff meeting the requirements of Section 4.7.3.3.

Stormwater pits shall be required where there is a change in any of the following conduit properties:

- Cross-sectional shape
- Size or dimension
- Grade
- Direction
- Material type

- Joint type.

Table 7 - MAXIMUM PIPE LENGTH BETWEEN STORMWATER PITS

Criteria (conduit diameter/width)	Maximum distance between pits
375 mm <= Diameter/width < 750 mm	40 m
750 mm => Diameter/width < 1500 mm	60 m
Diameter/width => 1500 mm	100 m

4.9 STRENGTH CLASS

4.9.1 PROXIMITY OF PITS TO VEHICLE AND PEDESTRIAN CROSSINGS AND INTERSECTIONS

Stormwater inlet pits are not permitted on the kerb and gutter at the following locations:

- On the radius within intersections
- Within the bounds of a signalised pedestrian crossing
- Within kerb ramps at non-signalised pedestrian crossings
- Within vehicle crossings.

Where there are existing kerb inlet pits at proposed vehicle or pedestrian crossing sites, the following modifications shall be made:

On grade pits:

- An additional kerb inlet pit or pits shall be provided to ensure equivalent inlet capacity is retained
- New kerb inlet pits shall be provided on the upstream side
- Where site constraints prevent installation on the upstream side, it is permitted to install new kerb inlet pits on the downstream side
- Where possible, the existing pit shall be removed; however, if site constraints prevent removal, the pit shall be modified as follows:
  i. If the existing pit is in a driveway crossing and is to be retained, a grated cover shall be provided
  ii. If the existing pit is in a pedestrian crossing and is to be retained, a solid infill cover shall be provided.

On sag pits:

- An additional kerb inlet pit or pits shall be provided to ensure equivalent inlet capacity is retained
- Kerb inlet pits shall be provided on both sides of the crossing
- The pedestrian crossing shall be regraded towards the adjacent inlet pit and the existing pit shall be removed. Where site constraints prevent removal of the existing pit, a solid infill cover shall be provided on the pit.
- A sag without a kerb inlet pit or grate-only pit is not acceptable.

4.9.2 CONDUIT ANGLES AT PITS

The acute angle between each inflow pipe and the outlet shall be no less than 95 degrees. Conduits shall not connect at the corner of a pit (i.e. birdsmouthing).

4.9.3 PROXIMITY TO TREES

Where practical, stormwater infrastructure within the drip line of trees shall be avoided. Where trees are unavoidable, an arborist's report shall be required. Additional investigations of tree roots may be required.

4.9.4 INTEGRATION WITH PUBLIC DOMAIN

The overall integration of the stormwater network with the public domain shall be considered including the proximity to footing for poles, street furniture, and the like.

4.9.5 OUTLET STRUCTURES

The number of outlet structures discharging into the harbour, watercourses or water bodies shall be minimised. Land adjoining these areas shall be drained through existing outlet structures where permitted by topography.

Outlet structures shall comply with the following:

- Designed in accordance with relevant standards and best practice for the type of structure and the relevant water body
- Comply with all planning and legislation requirements
- Minimise the potential for scouring or erosion
- Ensure the long-term stability of the receiving area and adjoining structures.

4.9.6 OTHER STORMWATER AUTHORITIES

Portions of the stormwater network within the City are owned by other government authorities such as Sydney Water, Place Management NSW and Transport for New South Wales.

Connections to the stormwater assets of other government authorities shall be undertaken with the approval of and in accordance with the requirements of the relevant authority.

Variations to these technical specifications, in order to avoid connection to other public authorities' stormwater assets, shall not be permitted.

4.10 CONDUIT DESIGN

4.10.1 CONDUIT TYPE

Stormwater conduits shall comply with the following:

- Steel reinforced precast concrete stormwater pipes with standard rubber ringed belled socket joints shall be used for all pipes located in the public domain or owned by the City
- Steel reinforced precast concrete stormwater pipes with rubber ring flush joints can be used where cover or utility constraints prevent the use of belled socket joints
- Fibre reinforced precast concrete pipes with rubber ring flush joints can be used where a pipe is to be fully encased in concrete
- All concrete pipes shall be rated for a Class 4 load (minimum)
- Steel reinforced precast concrete box culverts may also be used for all box culverts located in the public domain or owned by the City
- Steel reinforced precast concrete box culverts shall be rated for direct traffic loadings with no cover
- Cast in situ conduits or other material types shall not be used in the public domain or for City-owned conduits
- Irrespective of the above requirements, the base of box culverts shall be cast in situ steel reinforced concrete.

- A minimum 20mm deep V drain shall be cast into the base slab of culverts.

4.10.2 MINIMUM CONDUIT SIZE

The minimum size of City-owned conduits shall be as follows:

- Pipelines – 375mm nominal diameter
- Box culverts – 450mm width by 300mm height nominal.

Where box culverts are used, the width shall not exceed four times the height.

4.10.3 PERMITTED GRADES

The grade of conduits shall comply with the following:

- The conduit grade shall be within the range specified in Table 4.10.3-1 below
- The grade of a conduit can be reduced to an absolute minimum of 0.5 per cent where topography, existing stormwater or utility services prevent installation of a conduit within the preferred range
- Drop pits shall be used to ensure the maximum grade specified in
- Table 8 is not exceeded
- Vertical pipelines shall not be permitted.

Table 8 - PERMITTED GRADE

Criteria (Conduit diameter/width)	Minimum grade	Maximum grade
375 mm <= diameter/width < 1200 mm	1%	10%
Diameter/width => 1200 mm	1%	5%

4.10.4 INVERT LEVELS

Invert levels of conduits shall comply with the following:

- Invert levels shall be no lower than mean high tide
- The fall within pipes shall be in the downstream direction
- Reverse grades are not permitted
- Charged conduits are not permitted
- Submerged outlets are not permitted.

4.10.5 STRUCTURAL DESIGN

Conduit structural design shall be in accordance with all relevant Australian Standards and shall consider the anticipated loadings over the entire life of the asset.

Conduits shall be designed for the SM1600 series vehicle loads (minimum).

Notwithstanding the above, all conduits in the public domain or owned by the City shall be a minimum Class 4.

4.10.6 CONDUIT COVER

Where possible, conduits shall have a minimum cover of 600mm. Where this cannot be achieved due to site constraints such as utility services or connections to existing drainage, the minimum cover permissible is as follows:

- Pipes – 150mm

- Box culverts – 100mm

Pipes shall be concrete encased where the cover is less than or equal to 300mm.

Pipes with cover less than 600mm and more than 300mm shall be assessed to ensure the structural integrity of the pipe is not compromised under expected loads specified in Section 4.10.5 and the pipe shall be concrete encased if necessary.

Concrete encasement shall comply with the following:

- Minimum encasement thickness shall be 150mm mass concrete surrounding the entire conduit
- Where the cover is less than 200mm, a 50mm asphalt surface shall be maintained and the balance of the cover shall be concrete encasement with steel reinforcement
- Subject to the calculated service loads, steel reinforcement within the encasement may be required to ensure structural strength
- Where the concrete encasement above the pipe is less than 150mm, steel reinforcement shall be required over the top of the pipe
- Where it is proposed that stone kerb be placed on top of the pipe, a minimum of 100mm concrete encasement with steel reinforcement is required between the pipe and the stone kerb
- Where it is proposed that concrete kerb and gutter are to be placed on top of the pipe, a construction joint shall be required to separate the concrete encasement from the kerb and gutter, and steel reinforcement shall be required in the gutter.
- Conduit cover shall not exceed 2 metres.

4.10.7 DECOMMISSIONING OF REDUNDANT CONDUITS

Conduits not in use shall be decommissioned. Decommissioned conduits shall be removed where possible. Where site constraints prevent the removal of a decommissioned conduit, the conduit may remain in the ground, provided the following:

- The conduit is disconnected from the live stormwater network at the point where the conduit connects to the live network
- Where the decommissioned conduit was connected to a live stormwater structure or box culvert at the downstream end, the live structure or culvert shall be properly repaired and sealed with a concrete wall
- Where the decommissioned conduit was directly connected to a live pipe at the downstream end, the live pipe shall be repaired by replacing the unsealed conduit length
- The downstream end and all upstream inlets to the decommissioned conduit are sealed with mass concrete plugs
- The conduit shall be backfilled with a sand slurry.

4.11 STORMWATER STRUCTURE DESIGN

4.11.1 STANDARD STRUCTURES

The City provides a suite of standard design cast in situ reinforced concrete structures. Stormwater structures shall comply with the following:

- All stormwater structures shall be cast in situ reinforced concrete
- All stormwater structures shall include suitable maintenance access from the surface
- Where possible, standard City of Sydney structures shall be utilised.

4.11.2 NON-STANDARD STRUCTURES

4.11.2.1 GENERAL REQUIREMENTS

Where City of Sydney standard structure designs cannot be used, a non-standard structure shall be specified subject to the following:

- The structure shall be cast in situ reinforced concrete
- The structure shall as far as possible comply with the features of the most similar City of Sydney standard drawing
- The structure shall comply with all requirements in these technical specifications and the City's construction specifications
- All stormwater structures shall be designed to an appropriate loading capacity to suit the loading capacity of the specified grate (Class 'D' for trafficable areas and Class 'C' for areas only subjected to pedestrian activity). The loading criteria shall comply with AS3996 and the ultimate-limit state design load shall be the same as the ultimate-limit state design load for the specified loading classification of the grate (240 KN for Class 'D' and 150 KN for Class 'C' Grates).
- If grates are supported by suspended slab, the thickness of the concrete slab shall not be less than 125mm at the thinnest location under the grate.

4.11.2.2 MAINTENANCE ACCESS

Maintenance access requirements for non-standard structures shall comply with the following:

- The access grate or cover shall be a minimum of 900mm rectangular or 600mm circular.
- The access shafts shall be a minimum of 900mm by 900mm square where the depth is less than 2m.
- The access shafts shall be a minimum of 1200mm by 1200mm square where the depth is greater than 2m, and the access cover shall be precast within a concrete surround.

4.11.3 EXTENDED KERB INLET LINTELS

4.11.3.1 GENERAL REQUIREMENTS

All extended kerb inlet lintels shall be precast concrete to the relevant Australian Standard with permitted nominal lengths as follows:

- 2.4 m
- 1.8 m
- 0.9 m

The longest permitted kerb inlet lintel length that can be accommodated by site constraints shall be used.

Extended kerb inlet lintel heights shall comply with the following:

- The top of the kerb inlet lintel shall be flush with the top of the kerb
- The minimum opening height is 125 mm
- The maximum opening height is 200 mm

Kerb-only and grate-only pits are not permitted on roads; however, due to the number of such existing pits in use, inlet capacity information has been provided in Annexure E for hydraulic analysis purposes.

The approved stone kerb inlets listed in Annexure E are also permitted.

4.11.3.2 EXISTING TRACHYTE KERB INLETS

Existing trachyte kerb inlets shall be retained or re-used where possible provided that a bicycle safe grate is also used.

Pit inlet capacity shall be analysed as per Annexure E for 100 mm kerb heights, the grate-only inlet capacities in Annexure E shall be used.

Should the existing trachyte kerb inlets provide insufficient inlet capacity, additional kerb inlet pits shall be provided in the vicinity in order to provide the requisite inlet capacity.

4.11.4 GRATES AND COVERS

The preferred covers are circular and shall comply with the following:

- The word "Stormwater" is embedded into the cover material and will remain visible for the life of the cover
- Sewer covers or covers with the word "Sewer" inscribed on the cover shall not be used
- Covers shall be bolted down with a minimum of three bolts
- Covers shall be a minimum strength Class D
- Alternatively, rectangular covers can be used subject to compliance with the following:Infill covers shall have a surface material matching the surrounding surface Covers shall be bolted down with a minimum of four bolts
- Where grates and covers are within a landscaped/grassed area, the main chamber of the pit shall be recessed (200 mm minimum depth) below ground and an access shaft provided to surface level with a concrete mowing strip (150mm minimum width) around the grate or cover
- Covers shall be a minimum strength Class D.

4.11.5 TRAPPED GULLIES

Trapped gullies are legacy assets from combined stormwater/sewer systems.

Trapped gullies shall be demolished, completely removed and replaced with standard stormwater pits in accordance with these technical specifications, except for networks where combined stormwater/sewer systems remain or on systems where there is no downstream gross pollutant trap.

Prior to the removal of trapped gullies, site investigations shall be undertaken to confirm that there are no sewer connections to the stormwater in the vicinity of the Works.

4.11.6 BRICK OR MASONRY STRUCTURES

Brick and masonry structures are legacy assets no longer supported and are not to be modified or refurbished. Where it is necessary to undertake work on brick or masonry structures, they are to be removed and replaced with modern reinforced cast in situ concrete structures complying with the requirements of these technical specifications.

Notwithstanding the above, a brick or masonry structure can be retained and modified or refurbished in these circumstances:

- The scope of modification is limited to replacing the lintel, grate or cover
- The structure is an integral part of an existing brick or masonry conduit
- The structure is within a heritage area and forms part of a heritage item.

4.11.7 DECOMMISSIONING OF REDUNDANT STRUCTURES

Where a stormwater structure is no longer required such as in Section 4.11.7 of these technical specifications, the structure shall be decommissioned.

All decommissioned stormwater structures shall be completely demolished and removed.

4.12 STORMWATER QUALITY IMPROVEMENT DEVICES

4.12.1 RAINGARDENS

4.12.1.1 GENERAL REQUIREMENTS

Raingardens shall be designed in accordance with the following general requirements:

- Prior to design of the raingardens, a full catchment analysis shall be undertaken to ensure the raingarden does not have any negative impact on floodplain or the impact is negligible
- When the raingardens are built in a floodway, the designer shall ensure that impact of the raingarden on the flood storage capacity is negligible
- The raingardens shall be modelled using MUSIC and the results shall be submitted to the City for approval
- The planting area of an individual raingarden shall be no less than 8 square metres
- The raingarden shall be designed in such way to have negligible negative impact on the floodway capacity

4.12.1.2 STORAGE CAPACITY

- Raingarden ponding capacity shall be equivalent to the volume of the rainfall created by a 25 minute 3 months storm. When this volume cannot be achieved, a minimum volume of three cubic meters shall be provided in the raingarden.
- Depth of the storage in the raingarden shall not be less than 150mm and not more than 280mm. The depth of the raingarden's storage capacity shall be measured from the lowest point that water can enter or exit the raingarden.
- Any pit chambers or other structures in the raingarden are not allowed. If any pits are in the raingarden, the area and volume of these structures and pit chambers shall not be included in the storage volume calculation.

4.12.1.3 IN-FLOW

- In no circumstances shall the raingarden be utilised as the surface run-off collection device
- Where possible raingardens shall be designed as off-line systems with an appropriate bypass at upstream. Where drainage network is in the proximity, the bypass shall consist of a surface run-off collection device which is connected to the stormwater network.
- Where connection to the stormwater network is not possible, an overland flow path can be designed as bypass. The overland flow path shall be designed to have minimum interference with traffic and pedestrian activities.
- The raingarden inlet shall be designed to allow all surface run-off caused by minor rainfall events to flow freely to the raingarden
- The raingarden inlet device shall be designed to allow the entrance of a maximum 50% AEP surface

run-off into the raingarden, calculated for the critical time of concentration of the catchment. Regardless of the catchment size, the flow entering the raingarden shall not exceed 30 litres per second.

- The level at the raingarden's entry shall be 50mm lower than the level of the bypass
- The bypass shall be designed in such way that it is activated when:
  - the flow exceeds maximum entry flow specified in the clauses above
  - the raingarden is full.
- Appropriate erosion control and energy dissipation shall be provided at the entry to the raingardens that ensures planting is not damaged by erosive forces
- A gross pollutant trap/device, as per the City's standard drawings, shall be incorporated within the raingarden's inlet device, immediately upstream of the raingarden to intercept gross pollutants and sediment.
  - The size of the mesh shall be 50 mm x 50 mm stainless steel mesh where installed within the inlet pit
  - An inlet restriction plate shall be installed at the entry point to the raingarden. The plate shall be installed flush with the top and face of the kerb. The maximum opening size in the plate shall be 50mm and the plate shall be installed at 50mm distance from the invert of the kerb.

4.12.1.4 DESIGN

- The raingardens' media layers shall be designed in accordance with the City's standard drawings
- Unlined raingardens shall be limited to the following suburbs:
  - Rosebery
  - Waterloo
  - St Peters
  - Beaconsfield
  - Zetland
  - Alexandria.
- Unlined raingardens shall only be used where ground conditions permit infiltration and there is sufficient distance from buildings and structures to ensure these structures will not be adversely impacted by the raingarden.
  - Ground infiltration rate shall be more than 100 mm/hour
  - The highest predicted underground water table shall be 1500 mm lower than the levels of theraingardens.
- Infiltration rates and the underground water table shall be determined prior to design by an accredited experience geotechnical engineer.
- Partly lined raingardens shall be used where ground conditions permit infiltration and protection is required for adjoining buildings or structures
- All other raingardens shall be lined.

4.12.1.5 MAINTENANCE

All raingardens and associated components shall be designed in accordance with Sections 4.6.4 and 4.11.2.2

All submissions for raingarden design shall include a maintenance schedule addressing maintenance activities, access, frequency, type, amount of resources and annual cost.

4.12.1.6 PLANTING

The raingarden shall be located in a position that provides a minimum of six (6) hours of sunlight daily. Planting of the raingarden shall be approved by the City's Greening & Leisure Team.

Some of the species which are allowed in the raingarden are listed below:

- *Callistemon sp*
- *Westringia sp*
- *Dianella sp*
- *Lomandra sp*
- *Carpobrotus glaucescens*
- *Hibbertia scandens*
- *Doryanthes excelsa*
- *Banksia robur.*

4.12.2 GROSS POLLUTANT TRAPS

4.12.2.1 DESIGN REQUIREMENTS

The design should also be in accordance with the other criteria outlined in the Technical Specifications and in particular those detailed below:

- Devices shall have a diversion chamber with a fixed weir and a high flow bypass
- The device shall have separate access shaft provision to the diversion chamber, treatment area and storage area for inspection, maintenance and cleaning
- The device shall treat the three-month ARI design flow rate with high flows bypassing the device
- The device storage shall be sized for a six-month cleaning interval
- The device shall have off-line storage
- Surcharging of devices onto roads as a bypass method shall not be permitted and devices shall not at any time cause surcharging
- The device shall be fitted with suitable lifting lugs to allow for installation (where appropriate).

4.12.2.2 DEVICE PERFORMANCE

The performance of the device shall comply with the following:

- The device shall be designed to achieve 100 years life expectancy
- The device shall remove no less than 70% of all particles between 0.125mm and 5mm in size and 90% of particles greater than 5mm in size
- The device shall remove 30% of Total Phosphorus
- The device shall treat the three-month ARI design flow rate with high flows bypassing the device
- The device shall be sized for a six-month cleaning interval
- Devices shall have non-blocking self-cleaning screens
- Total pollutant storage volume per device shall not exceed 3 cubic metres and shall not be less than 0.7 cubic metres
- Devices shall have a high flow bypass
- Surcharging of devices onto roads as a bypass method shall not be permitted and devices shall not at any time cause surcharging
- Devices shall be designed in a manner that minimises blockage of the device or remobilisation of pollutants.

4.12.2.3 CLEANING AND MAINTENANCE REQUIREMENTS

In order to facilitate cleaning operations, devices shall comply with the following:

- The device shall be designed to facilitate a suitable, easy and safe cleaning process. Access openings shall be provided directly over the inlet pipe, the outlet pipe and the pollutant collection area
- The device shall be designed to have screens that can be easily removed to enable cleaning behind the screens or sufficient room between the wall and screen to allow cleaning in a safe manner
- Devices shall be designed to avoid the need for cleaning personnel to enter confined spaces
- Devices shall be designed to minimise the contact of cleaning personnel with pollutants
- Devices shall be designed with consideration of the access necessary to replace internal components of the device
- Access and working platforms shall be provided to the device suitable to permit the required cleaning process as well as accommodate the required cleaning equipment
- Pollutant storage areas shall be enclosed with public access to pollutants limited by covers.

4.12.2.4 ACCESS AND WORKING PLATFORMS

Access and working platforms for cleaning activities shall comply with the following:

- Sealed working platforms shall be provided to accommodate eductor trucks for cleaning
- Driveways and working platforms shall be designed to permit cleaning vehicles to park adjacent to the device with the device located at the rear of the vehicle or on the left (passenger) side of the vehicle
- The road itself could be used as a working platform if it is a low traffic road and there is sufficient width to allow the safe passing of traffic around the cleaning truck, cleaning operations will not damage the road, and there are no other safety issues that necessitate off-road working platforms
- Suitable working platforms and areas shall be provided off road where access to a device is required via a high traffic road
- Access to devices shall be from either a public road or a sealed driveway accessible via a public road
- Driveway access from high traffic roads shall permit cleaning vehicles to enter and exit in the forward-facing direction
- Where driveway access is proposed on low traffic roads, it is preferred that the driveway be designed to permit vehicles to exit in the forward-facing direction
- Sufficient separation shall be provided from pedestrian walkways and cycleways to ensure maintenance operations do not conflict with pedestrian and cycle movements.

4.12.2.5 DEVICE AND MATERIAL TYPES

The design of custom devices or the selection of a proprietary product shall be undertaken in consultation and with the approval of the City's Environment & Water team. The device once installed shall be designed to take traffic loadings of maintenance vehicles such as eductor trucks.

The devices shall consist of the following material types:

- Reinforced concrete structure
- Stainless steel or heavy galvanised mild steel screening components
- Access covers can be mild steel, ductile iron or cast iron to a minimum strength Class D.

4.13 RELINING

General requirements for relining are as follows:

- Relining shall be undertaken for the entire length of a pipeline between its upstream and downstream pit
- Stormwater pits at the upstream and downstream end shall be modified to facilitate the relining if required
- Any buried pits, blind pits or significant bends along the length of Works shall be replaced with standard junction pits
- The liner shall be designed to withstand all loads anticipated over the life of the liner assuming the host pipe is fully deteriorated with no remaining strength
- The deteriorated host pipe and its surrounding embedment shall be considered to support the liner but no bonding or composite action shall be assumed between the liner and the host pipe
- Where a pipeline is located outside a road reserve, beneath a building or is subject to a point load, a structural analysis shall be provided calculating the likely loads that will be imposed on the liner.

4.14 FOOTPATH DRAINAGE

4.14.1 GENERAL REQUIREMENTS

Where possible footpaths shall be graded towards the kerb and gutter, raingardens or garden beds to as much as possible avoid the need for stormwater infrastructure.

Where stormwater drainage within the footpath cannot be avoided:

- Footpath drainage shall comply with the requirements of these technical specifications that are applicable to all other road drainage
- All surface inlets shall be grated sump drains
- Grates shall be heel proof in high pedestrian traffic areas and pedestrian proof in low or medium pedestrian areas
- Footpath drainage shall be connected to the underground stormwater network.

4.14.2 CENTRAL SYDNEY PRECINCT

Footpath drainage within the Central Sydney planning precinct shall comply with Section 4.14.1 and the following requirements:

- Notwithstanding Section 4.10.2, the minimum size of a pipe on the footpath can be reduced where utility services constraints do not permit the use of a 375 mm diameter pipe
- The pipe size shall be as large as can be accommodated by the site constraints but no less than 150mm diameter
- Notwithstanding Section 4.10.1, a uPVC pressure pipe, minimum Class 12 to AS1477, can be used for 150mm diameter pipes
- The minimum pit length and width shall be 300 mm by 300 mm
- The minimum cover for a 150mm diameter pipe shall be 100 mm with the pipe concrete encased.

4.14.3 TRENCH GRATES OR STRIP DRAINS

4.14.3.1 PERMITTED USE

The use of trench grates or strip drains is generally not permitted. However, it is accepted that in certain circumstances, it is not possible to drain a site using alternative methods.

Where no other alternative is possible, trench grates or strip drains can be used in the following locations:

- At the top of stairways or stairway landings
- Across accessible ramps
- Across an opening to a private property where it is not possible to drain away from the property boundary
- As a gutter bridge as per Section 4.14.4.

4.14.3.2 GENERAL REQUIREMENTS

Trench grates and strip drains shall comply with the following:

- The length shall be minimised
- Notwithstanding Section 4.10.2, the minimum dimensions shall be 300 mm wide by 300 mm deep
- Shall withstand a Class D loading
- Shall be embedded in a minimum of 150 mm thick mass concrete
- Grates shall be bolted down
- Heel-proof grates shall be used in high pedestrian traffic areas and pedestrian-proof grates in low or medium pedestrian areas.

4.14.4 GUTTER BRIDGES

4.14.4.1 PERMITTED USE

Where a low point within a gutter need to be drained, gutter bridges shall be used in the following circumstances:

- There is no existing piped drainage within a reasonable distance of the low point to permit the connection of a below ground stormwater network
- Utility constraints prevent the installation of a conduit to the minimum size specified in Section 4.10.1
- To connect adjoining raingardens across a pedestrian footpath.

4.14.4.2 GENERAL REQUIREMENTS

General requirements for gutter bridges are as follows:

- The design shall comply with the City's standard drawing for gutter bridges
- Notwithstanding Sections 4.10.2 and 4.14.3.2, the minimum internal dimensions of a gutter bridge are 100mm high by 450mm wide
- Access points shall be provided either along the entire length or at changes in direction
- The surface material of the gutter bridge shall be consistent with the surrounding surface material
- Suitably slip-resistant and heel-proof grates can be used
- Notwithstanding Sections 4.11.4 and 4.14.3.2, a Class C cover or grate can be used where surface constraints prevent vehicle traffic from mounting the kerb and traversing the gutter bridge
- A gutter bridge is permitted to discharge directly into a stormwater pit or back to a kerb
- Kerb inlets and outlets shall be designed to withstand vehicle loads and impacts.

4.15 PRIVATE CONNECTIONS

4.15.1 STORMWATER DRAINAGE CONNECTION APPROVAL APPLICATION

All private stormwater connections require approval prior to construction. Applications for private connections shall be undertaken using the Private Connection Application Form available from the City's website.

4.15.2 KERB OUTLETS

4.15.2.1 OUTLET CONFIGURATION

Kerb outlets shall comply with the following:

- Discharge to the kerb and gutter
- A single discharge point shall be provided for each property at the most appropriate location
- Where a property fronts multiple roads and/or it is not physically possible to utilise a single discharge point then an additional discharge point can be provided on alternative road frontages
- The number of discharge points shall be minimised
- The number of discharge points from a property to the kerb shall not exceed three (3)
- The minimum spacing between discharge points from the same property is six (6) metres
- Conduit crossings shall take the shortest route to the kerb and shall be generally straight grade with minimal bends. All bends shall be manufactured with a maximum of 45° bend. Conduit crossings shall not cross the frontage of another property without the approval of the City's Representative.
- A maximum of three (3) parallel conduits are permitted at any single discharge point
- Parallel conduits shall have a minimum 300mm separation between centrelines
- Conduits shall not be directly connected to a stormwater pipe or conduit (see Section 4.15.3 for direct connection requirements).

Acceptable conduits are as follows:

- 90 mm uPVC pressure pipe Class 12
- 150 mm wide by 10 0mm high, mild steel, heavily galvanised channel provided the wall thickness is a minimum of 5mm
- 150mm wide by 50mm high, mild steel, heavily galvanised channel can be used for granite paved footpath, 100mm high kerbs or roll over/mountable kerbs provided the wall thickness is a minimum of 5mm.

Where there is no kerb and gutter, the following shall be undertaken:

- Kerb and gutter shall be provided
- Directly connect to the stormwater network as per Section 4.15.3

4.15.2.2 DISCHARGE LIMITS

- The maximum permitted discharge from any property is 25 litres per second for storms up to and including the 5% AEP
- Groundwater, dry weather flows and base flows shall not discharge to the kerb and gutter
- Where property discharge exceeds the maximum permitted kerb outlet discharge or includes groundwater, base flows or dry weather flows, the property shall be directly connected to the stormwater network as outlined in Section 4.15.3.

4.15.2.3 BASEMENT DISCHARGES

- All basements shall connect directly to the stormwater network as outlined in Section 4.15.3.

4.15.3 DIRECT CONNECTIONS

4.15.3.1 GENERAL REQUIREMENTS

Private stormwater drainage shall connect to the public stormwater network at the following locations:

- An existing stormwater inlet pit on the kerb along the property frontage
- An existing stormwater junction pit on a public stormwater network that traverses the property.

Where there is no existing public stormwater network through the property or along the road frontage of the property, the following shall be undertaken:

- A stormwater kerb inlet pit and pipe network shall be provided on the road along the property frontage and connected to the existing public stormwater network
- The new network shall be designed and constructed in accordance with the City's requirements, service the public land and be dedicated to the City
- The private network shall connect to the public network at a kerb inlet pit.

4.15.3.2 CONDUITS

Private conduits on public land connecting to the public stormwater system shall comply with the following:

- The conduits shall not drain public land and shall remain in private ownership
- Conduits shall traverse public land in a straight line from the property boundary to the connection point on a public stormwater pit
- No private stormwater structures are permitted on public land
- Conduits greater than 150mm nominal diameter shall be reinforced concrete
- Conduits less than or equal to 150mm nominal diameter can be uPVC pressure pipe Class 12.

4.15.3.3 BACKFLOW PREVENTION AND SURCHARGING

Where a connection is greater than a single 150mm diameter conduit, backflow prevention shall be provided.

A non-return valve shall be provided within the private property immediately prior to discharge to ensure that the public network does not surcharge into the property.

A surcharge point shall be provided within the property, immediately upstream of the non-return valve, to permit the property to discharge via the surface in situations where the public network capacity is exceeded.

4.15.3.4 OTHER STORMWATER AUTHORITIES

Where a direct connection is proposed to another public authority's network, such as Sydney Water or the Roads and Maritime Service, the direct connection shall comply with the requirements of the other authority in addition to compliance with the City's requirements.

4.15.3.5 POSITIVE COVENANT

All properties with a direct connection to the public stormwater network shall include a positive covenant on the property title.

4.16 ON-SITE DETENTION

4.16.1 REQUIREMENTS

- Compliance is required with the Sydney Water on-site detention requirements
- In addition to Sydney Water requirements, the City may impose on-site detention requirements only if required under section 4.15.2.2.
- Where on-site detention is provided, the City requires a positive covenant to be registered on the property title to ensure proper maintenance and functioning of the on-site detention.

4.17 REVISION REGISTER

Revision	Clause	Description of Revision	Authorised By	Date
Rev. 6	Overall	Reference to Water Asset chance to "Environment & Water"	SA	Aug-23
	Overall	References to 5 year ARI, 10 year ARI, 20 year, 100 year ARI changed to 20% AEP, 10% AEP, 5%, 1% AEP respectively		
	4.6.2	Reference to DXF file changed to shape file		
		Updated to MGA2020		
	4.11.2	Grate loading classification Changed to 240 kN from 210 kN		
	4.12.1.4	Section deleted		

ANNEXURE-A - DESIGN CHECKLIST

Drainage Design Checklist	
General Plan	☐ Yes
Catchment Plan	☐ Yes
Long sections	☐ Yes
Relevant City standard drawings	☐ Yes
Drainage Details or All structures are as per City standard drawings	☐ Yes or ☐ Yes
Utilities Investigation Plan and additional investigation report if required	☐ Yes
Drainage Design Variation Form or No variations from the City's Stormwater Design and Construction Technical Specifications are proposed and any variations discovered post-construction will be rectified prior to asset handover	☐ Yes or ☐ Yes
Statement of Environmental Effects or Development consent already obtained	☐ Yes or ☐ Yes
DRAINS file depicting hydraulic design or Hydraulic Design Report and Hydraulic Design Summary Sheet	☐ Yes or ☐ Yes

ANNEXURE-B - DRAINAGE DESIGN VARIATION FORM AND DRAINAGE VARIATION APPROVALSUMMARY SHEET

DRAINAGE VARIATION APPROVAL SUMMARY SHEET

Item	Clause	Variation Description	Approval*
1			☐ Approve or ☐ Refuse
2			☐ Approve or ☐ Refuse
3			☐ Approve or ☐ Refuse
4			☐ Approve or ☐ Refuse
5			☐ Approve or ☐ Refuse
6			☐ Approve or ☐ Refuse

* To be completed by Environment & Water team

Date

Principal Engineer – Environment & Water
City Infrastructure & Traffic Operations

DRAINAGE DESIGN VARIATION FORM

Item 1
Clause where variation is sought:
Description of variation:
Justification for variation:
*Decision:
☐ Approve or ☐ Refuse
*Notes or conditions:

* To be completed by Environment & Water team

Environment & Water Team

City Infrastructure & Traffic Operations

ANNEXURE-C - HYDROLOGIC AND HYDRAULIC DESIGN SUMMARY TABLES

HYDROLOGIC DESIGN SHEET

Name: ______ Description: ______ Page(s): ______

Job No: ______ Date: ______ AEP: ______

Pit/Structure	Hydrology							Pit / Structure				Overland Flow							
	Area	Impervious / Pervious	Flowpath length	Slope	Additional Time	Total Time	Total Flow	Junction Pit	Grade / Sag	Grate Size	KI Length	Approach Flow	Slope	Flow Depth	Flow Velocity	Velocity X Depth	Inflow	Bypass Flow	Remarks
	(ha)	(%)	(m)	(m/m)	(min)	(min)	(L/s)	(Y / N)	(G / S)	(L m / W m)	(m)	(L/s)	(m/m)	(m)	(m/s)	(m^2/s)	(L/s)	(L/s)	

A4 STORMWATER DRAINAGE DESIGN

CITY OF SYDNEY

HYDRAULIC DESIGN SHEET

Name: Description: Page(s):

Job No: Date: AEP:

Pipe	Branch	Length (m)	Flow rate L/s	Pipe Diameter (mm)	Full Pipe Velocity (m/s)	$V^2/2g$	Upstream Surface Level (m AHD)	Downstream Water Limit (m AHD)	Upstream Water Limit (m AHD)	Upstream Pit Coefficient K_u	$K_uV^2/2g$	User HGL at Downstream Pit (m AHD)	HGL at Downstream Pit (m AHD)	HGL Slope Sf (m/m)	Pipe Friction Loss Sf.L (m)	User HGL at Upstream Pit (m AHD)	Remarks

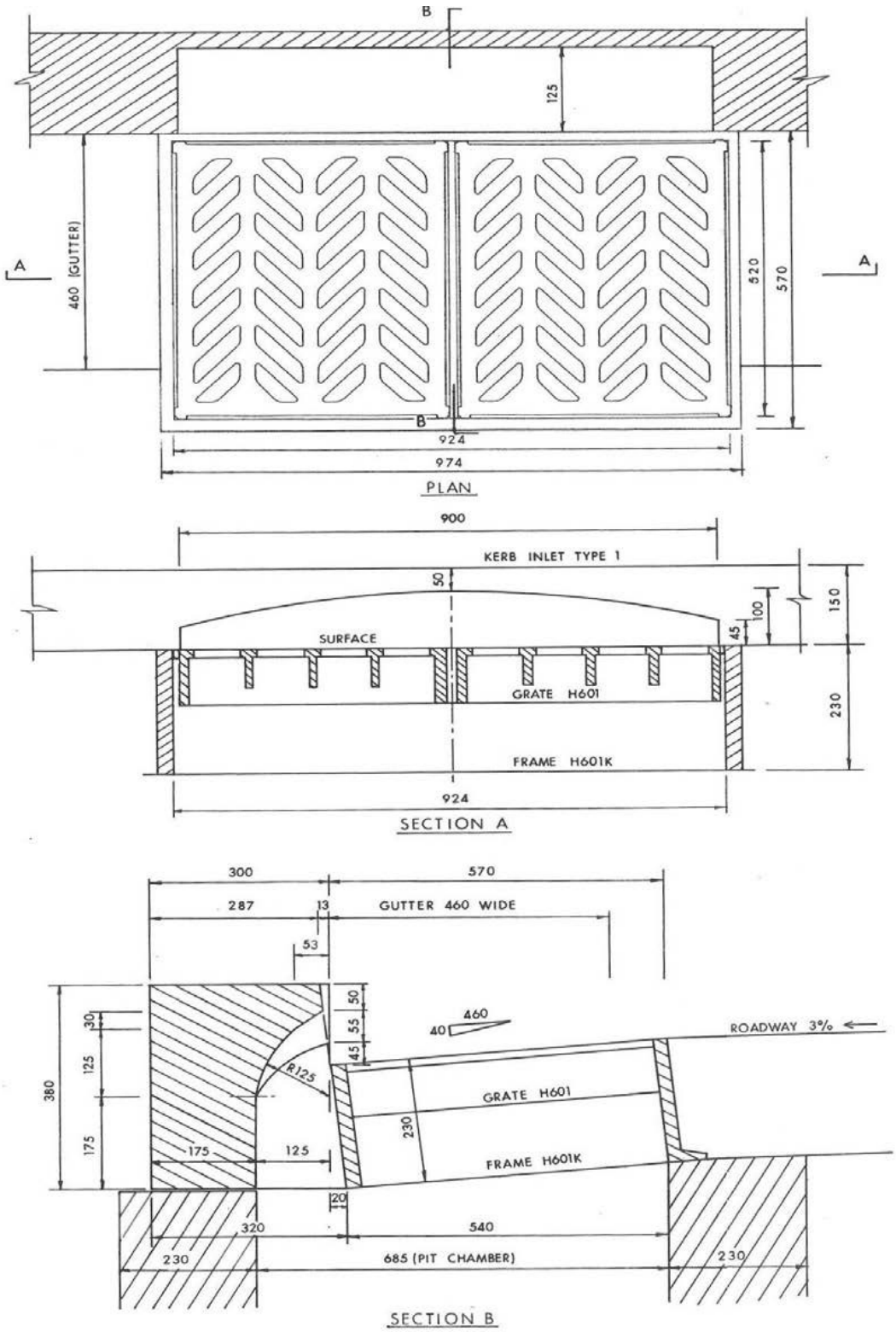
A4 STORMWATER DRAINAGE DESIGN

ANNEXURE- D - ASSET DATASHEETS

ASSET DATA SHEETS ARE AVAILABLE FROM THE CITY OF SYDNEY WEBSITE IN EXCEL FORMAT.

ANNEXURE E - APPROVED STONE KERB INLETS

TRACHYTE KERB INLETS



TYPICAL DETAIL FOR TRACHYTE KERB INLET PIT

Existing trachyte kerb inlets can be re-used provided that a bicycle safe grate is also provided. Pit inlet capacity shall be as per the following tables. For 100mm kerb heights, the grate-only inlet capacities shall be used.

Kerb-only and grate-only pits are not permitted on roads; however, due to the number of existing pits in use, inlet capacity information has been provided below for hydraulic analysis purposes.

CoS trachyte kerb inlet with bicycle-safe grate on 150mm high kerb

0% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
11	11
20	20
25	25
38	38
60	57
82	73
100	83
117	92
140	102
148	105
155	107
226	124

1% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
10	10
29	29
41	41
59	57
81	70
95	76
116	84
146	92
178	101
210	109

3% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
12	12
30	29
45	42
60	53
83	67
97	73
119	83
150	96
209	107

5% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
15	15
33	30
47	39
63	50
85	65
100	72
123	79
152	82
180	86
225	90

7% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
12	12
30	25
55	41
123	70
162	75
197	81

Sag	
Depth (mm)	Inlet Capacity (l/s)
0	0
140	60
155	80
187	125
233	175
253	257
275	295

CoS trachyte kerb inlet only on 150mm high kerb

0% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
100	49
145	57
160	59
227	70

1% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
81	34
95	37
120	43
149	46
181	51
214	56

3% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
85	28
100	32
123	37
153	41
212	45

5% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
15	7
33	12
47	16
63	20
85	26
103	31
125	34
155	36
180	36
225	38

7% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
12	6
30	11
55	15
123	27
162	32
195	33

Sag	
Depth (mm)	Inlet Capacity (l/s)
0	0
145	60
165	80

CoS bicycle-safe grate only

0% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
100	82
140	98
155	99
225	115

1% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
80	62
93	66
115	72
145	80
180	88
210	92

3% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
85	59
99	63
120	70
150	77
209	84

5% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
15	14
33	26
47	33
63	42
85	53
100	58
123	64
153	66
175	68
225	72

7% Longitudinal Fall	
Approach Flow (l/s)	Inlet Capacity (l/s)
0	0
12	10
30	22
55	34
123	55
162	60
198	67

Sag	
Depth (mm)	Inlet Capacity (l/s)
0	0
140	60
155	80
195	125
205	175
275	257
337	295

Data derived from physical modelling outlined in the document: Manly Hydraulics Laboratory; Hydraulic Model Studies of Grate, Lintel and Modified Gully Pit Designs for Pyrmont Redevelopment; Draft Report MHL690; Public Works Report No. 94018; July 1994; ISBN 0 7310 2740.

Stone kerb inlet pits

Approved stone kerb inlets shall be in accordance with standard drawings 1.1.12 and 1.1.13.

A5
Public Domain Lighting Design

Contents

A5 PUBLIC DOMAIN LIGHTING DESIGN

5.1 SCOPE

This specification sets out the Lighting & Electrical design brief, technical requirements, Design Review and approval process and installation requirements for carrying out designs for the Public Domain Lighting including shared pathways, main roads, plazas and parks throughout the City Of Sydney's (the City's) LGA.

This specification shall be applied for all Public Domain Lighting and associated Electrical design required to be carried out for the City.

5.1.1 AUSTRALIAN STANDARDS

Lighting and Electrical design specifications are not to be limited to this document but also need to comply with all relevant Australian standards as well as the City's standard, B8 Public Domain Lighting Construction.

Standard	Description
AS/NZS 1158.0:2005	Lighting for roads and public spaces Part 0: Introduction
AS/NZS 1158.1.1:2005	Lighting for roads and public spaces - Vehicular traffic (Category V) lighting - Performance and design requirements (Under review)
AS/NZS 1158.1.2:2010	Lighting for roads and public spaces Part 1.2: Vehicular traffic (Category V) lighting – Guide to design, installation, operation and maintenance
AS/NZS 1158.2:2005	Lighting for roads and public spaces Part 2: Computer Procedures for the calculation of light technical parameters for Category V and Category P lighting
AS/NZS 1158.3.1:2005	Lighting for roads and public spaces Part 3.1: Pedestrian area (Category P) lighting – Performance and design requirements (Under review)
AS/NZS 1158.4:2015	Lighting for roads and public spaces Part 4: Lighting for roads and public spaces - Lighting of pedestrian crossings
AS/NZS 4282:1997	Control of the obtrusive effects of outdoor lighting
SA/SNZ TS 1158.6:2015/ Amdt 1:2018	Lighting for roads and public spaces - Luminaires – Performance
IES TM-21-11	Projecting Long Term Lumen Maintenance of LED Light Sources
IES LM-79-08	IESNA Approved Method for the Electrical and Photometric Measurements ofSolid-State Lighting Products
IES LM-80-15	IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources
IES LM-84-14	Measuring luminous flux and colour maintenance of LED lamps, lighting engines and luminaires
IES TM-28-14	Projecting Long-Term luminous flux Maintenance of LED lamps and luminaires
IEC 61347-2-13	Particular requirements for D.C. or A.C. supplied electronic control gear for LED modules
IEC 61547:2009	Equipment for general lighting purposes - EMC immunity requirements
IEC 62386 version 2	Digital Addressable Lighting Interface (DALI) standard
AS 3100:2017	Approval and test specification - General requirements for electrical equipment
AS/NZS 60598.1:2017	Luminaires - General requirements and tests
AS/NZS 60598.2.3:2015	Luminaire Particular Requirements – Luminaires for road and street lighting

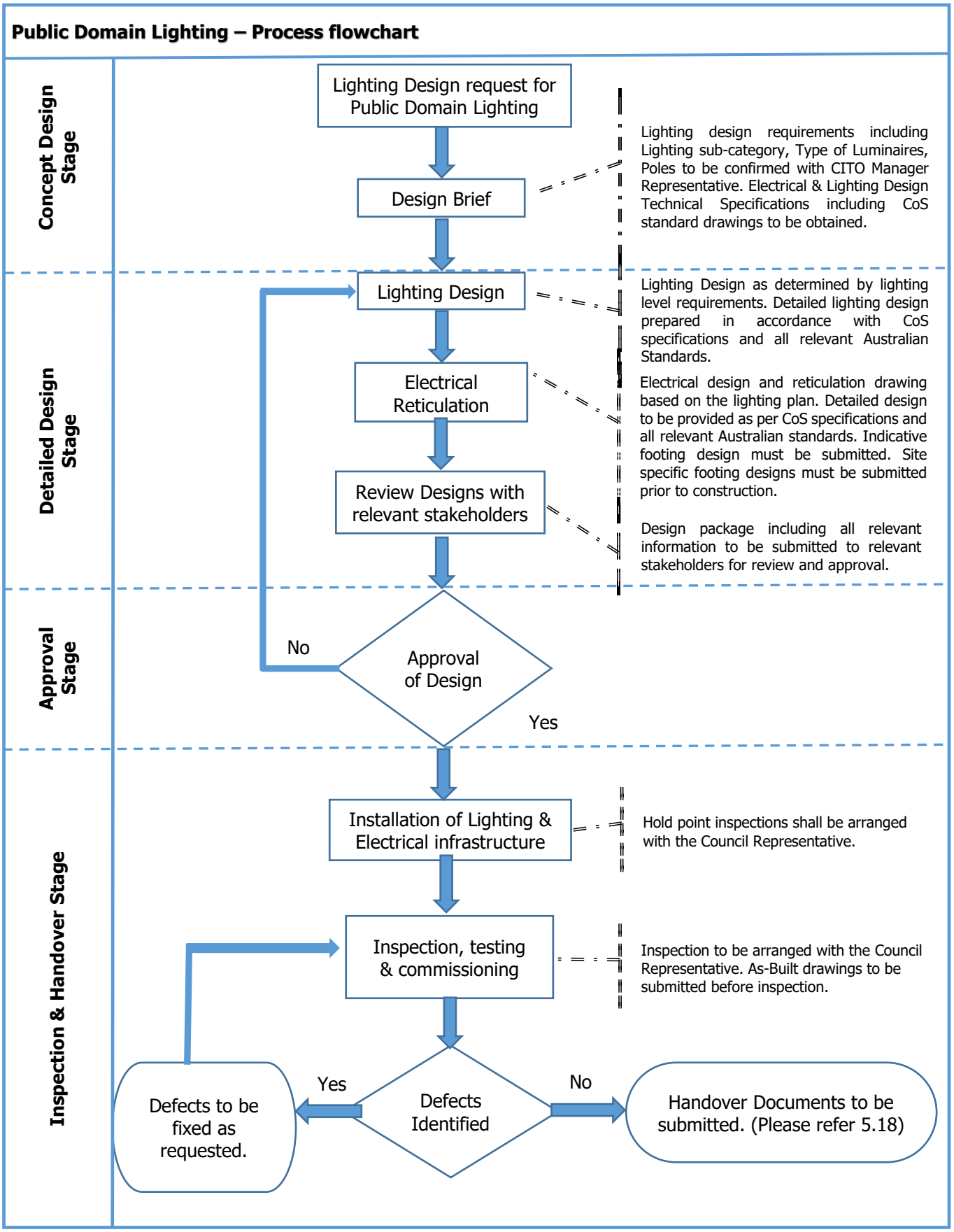
Standard	Description
AS CISPR 15:2017	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
IEC 61643-11:2011	Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods
ANSI C136.2-2018	American National Standard for Roadway and Area Lighting Equipment – Dielectric Withstand and Electrical Transient Immunity Requirements
ANSI C136.41	Dimming Receptacles
Zhaga Interface Specification: Book 18Edition 1.0, July 2018	Luminaire Extension Module & Receptacle
RoHS 2 (2011/65/EU)	Restriction of the use of certain hazardous substances
AS/NZS 3000: 2018	Wiring Rules
AS/NZS 3017:2007	Electrical installations – Verification guidelines
AS/NZS 3008.1.2017	Electrical installations – selection of Cables for alternating voltages up to and including 0.6/1kV – Typical Australian installation conditions.
AS/NZS 3100: 2017	Approval and test specification – General requirements for electrical equipment's.
AS/NZS 3439.1.2002	Low-voltage switchgear and controlgear assemblies – Type-tested and partially type-tested assemblies
Service and Installation Rules of New South Wales, Nov 2018	The electricity industry standard of best practice for customer connection services and installations

5.1.2 ACCEPTABLE LIGHTING DESIGN PROGRAM

The City Of Sydney shall accept lighting design submissions, using these lighting programs:

- AGi32
- Perfect Lite – Road & Outdoor Lighting Design Software

5.2 PUBLIC DOMAIN LIGHTING – PROCESS FLOWCHART



5.3 LIGHTING DESIGN

5.3.1 GENERAL

Lighting schemes must be designed and installed such as to avoid any unwanted light spill and light pollution. The overall lighting scheme must provide maximum safety and shall not be overdesigned. AS/NZS 1158 clearly specifies the choice of whether to install a road lighting scheme in compliance with relevant Australian standards and, if so, the choice of appropriate subcategory of lighting rests with the road controlling authority. The lighting designer shall confirm the lighting level requirements with the City before commencing any lighting design.

5.3.2 LIGHTING DESIGNER

Lighting designs shall be undertaken by a suitably qualified and a competent practising lighting designer.

The designer must be conversant with Australian local codes for outdoor lighting. The designer must provide a lighting design and statement confirming that design complies with the requirements of the specified standards and signed off. It will be the designer's responsibility to ensure that the lighting scheme meets all the relevant City of Sydney and Australian standards requirements.

5.3.3 LUMINAIRES

Luminaires that are owned and maintained by the City shall be as per the City's approved standard suite ofLED luminaires. For more information, refer to the City's Sydney Lights Design Code:

http://www.cityofsydney.nsw.gov.au/development/planning-controls/development-policies/public-domain- design-codes

If non-standard luminaires are proposed, approval must be obtained from the City. The designer must submit the details as per Annexure 11 of this specification.

5.3.4 LIGHTING CATEGORY

Applicable Lighting sub-categories shall be confirmed with the City before commencing any lighting design.

5.3.5 CATEGORY V LIGHTING

This lighting category is applicable to roads on which the visual requirements of motorists are predominant,

e.g. traffic routes. It includes subcategories V1 to V5. Includes provisions for motorways, arterial, sub-arterial and main roads.

The design is to comply with the Light Technical Parameters (LTP) of AS/NZS1158.1 Road Lighting – Vehicular traffic (Category V) lighting. The design should provide a lit environment conducive to the safe and comfortable movement of vehicular and pedestrian traffic at night and discourage illegal acts.

5.3.6 CATEGORY P LIGHTING – LOCAL ROADS, CYCLEWAYS, PATHWAYS AND PLAZAS

This lighting category is applicable to roads on which the visual requirements of pedestrians are dominant

e.g. local roads and to local area traffic management devices. It provides a lit environment to help pedestrians orientate themselves, detect potential hazards, discourage fear of crime and crime against the person. Also, it includes lighting which is applicable to outdoor public areas, other than roads, where the visual requirements of pedestrians are dominant, e.g. plazas, parks and shopping precincts. Subcategories range from P1 to P12.

The design is to comply with the LTP of AS/NZS1158.3 Road Lighting – Pedestrian area (Category P) lighting. The principles of "Crime Prevention through Environmental Design" shall be considered.

5.3.7 PEDESTRIAN (ZEBRA) CROSSINGS

The principal objective is to provide advanced warning to motorists of the presence of the crossing, associated signs and markings. Enhanced pedestrian visibility shall be provided by direct illumination of the pedestrians. The lighting scheme involves both vertical and horizontal illuminance over the designated area.

Lighting requirements shall comply with the LTP as specified in AS/NZS 1158.4:2015. Light spill and glare must be minimized. Supplementary flood lighting on pedestrian crossings shall comply with PX1 or PX2 Sub-category unless otherwise specified.

5.4 LIGHTING DESIGN REVIEW

A Lighting design certified by a suitably qualified practising lighting engineer, shall be submitted to the City for review and approval, prior to commencing any installation work. The lighting design and layout shall be as per the requirements specified for the below lighting design documents and design drawings.

5.4.1 LIGHTING DESIGN DOCUMENTS

The following lighting design documents shall be submitted for review and approval:

- Lighting design drawing
- Records of any non-compliant design elements
- Alternative compliant lighting design
- Lighting design brief and certificate signed-off.by the consultant. Refer to **Annexure 1** of this document.
- Name of the computer program used
- Luminaire intensity distribution tables in IES/CIE format and the origin of photometric data
- Details of the road surface reflection assumed in Category V design calculations, if any.

5.4.2 LIGHTING DESIGN DRAWING

- The luminaire schedule and description shall be provided with the details below:
- Manufacturer, name of luminaire, power consumption (watts), distribution (optics) type, colour temperature, outreach arm dimensions, pole type, mounting height to luminaire optical centre, pole offset, lamp/luminaire lumens, light loss factor (LLF) and luminaire/pole colour.
- The calculation summary shall indicate all relevant LTP and compliance as per AS/NZS 1158 for Category V & P lighting respectively.
- In case of Category V straight sections of road lighting, Perfectlite pole spacing table confirming compliance for the relevant category V shall be submitted along with the lighting layout. The lighting layout shall indicate pole spacing as a reference point.
- Lighting calculation points for horizontal and vertical illuminance shall comply with the requirements as specified in AS/NZS1158.2.
- Luminaire labels with mounting height should be shown.
- Obtrusive lighting calculations on adjacent residential properties as per relevant Australian standards must be provided.
- Luminaire orientation where it is not shown by symbol.
- Highlight all areas of non-compliance.

5.4.3 LIGHTING LAYOUT DRAWINGS

- All engineering drawings shall be legible, clear, readable and complete. They must clearly illustrate the proposal and enable both assessment of compliance with this document and accurate construction.
- Drawings showing pole locations, existing underground services and electrical reticulation must be included on the landscape layout.

- A locality diagram indicating the overall layout and location of works, with all street names must be shown.
- A North point symbol shall be provided on the drawing.
- A luminaire schedule must be included as specified in 5.4.2 above.
- The lighting design details shall include the lighting subcategory that the scheme has been designed to meet.
- Electronic drawings must be prepared in an industry standard format suitable for later addition of As-Built information.
- Drawings shall be supplied in electronic format as DWG (drawn to scale of 1:250@A1) and PDF formats.

5.4.4 LIGHT POLE, MOUNTING AND FOOTINGS

- Specifications for the poles e.g. pole type, colour; must be obtained from the City during the design stage.
- Certification of the structural design is required for all components of structures except manufactured components, which are part of the approved City lighting suite. The structural certificate shall be accompanied by the detailed design calculations for the structure.
- Footing designs and all associated mounting details must be certified by a competent practising structural engineer and shall be submitted to the City for review and approval. Supporting detailed design and calculations must also be submitted along with the certificate.
- Footing designs for frangible energy absorbing poles shall be undertaken in accordance with AS/NZS1158.1.2.
- All structures shall be designed to achieve 50 years of life expectancy and shall be designed in accordance with relevant Australian standards. Provisions for corrosion prevention shall be considered for all members, especially members which are in contact with the ground.
- All electrical conduits and embedded members shall be considered during the design to ensure constructability of the footing without any compromise to the structural integrity of the structure.
- Shop drawings of the poles must be submitted to the City for review and approval prior to manufacture.
- Mount type shall be Ragbolt Assembly with standard pole baseplate.
- Hold-Down (HD) bolts shall not be exposed above the ground including those on new poles to be owned by Ausgrid. Refer to **Annexure 6**, Section A-A for details.
- Certification of footing construction by a suitably qualified structural engineer as per site condition/ approved design, shall be submitted to the Council.

5.5 POLE SETBACK

Below specified pole setbacks shall be applicable to all new poles to be owned by the City and Ausgrid:

- Minimum pole setback shall be 600mm from the face of the kerb, unless otherwise specified.
- Minimum pole setback at intersections shall be 1000mm from the face of the kerb.

5.6 POLE ORIENTATION

Unless otherwise specified, pole outreach arms and luminaires shall:

- Be oriented at 90 degrees to the centreline of the road.
- Have an upcast angle of "0" degrees.

5.7 POLE LOCATIONS

- Pole locations shall be agreed upon before commencing landscape design.
- Pole locations shall be clear of all driveways, existing underground services, obstructions, existing utility pits, awnings etc.
- The location of existing street trees can be a significant constraint to lighting layouts and designs. Tree canopies may conflict with pole installations or light spill from luminaires, and excavation for pole footings and cable trenches can severely affect tree roots. Proper consideration of these constraints is necessary to ensure a viable design and mitigate the impact to trees. Advice should be sought from the City's tree management team.

5.8 TEMPORARY LIGHTING

- If the existing luminaires are to be removed for any construction activity, the designer must provide a temporary lighting design for review and approval by the City. Temporary lighting shall comply with the requirements of AS/NZS 1158.
- Unless temporary lights are operating, existing lights shall not be removed or decommissioned.
- Electrical installations for the construction and demolition sites (including hoardings), shall comply with AS/NZS 3012.

5.9 EXISTING AUSGRID LIGHTING

This section is only applicable, if the Council decides to retain existing Ausgrid lights.

- A suitably qualified practising lighting design engineer shall undertake lighting design to confirm if the existing Ausgrid lights comply with the City's nominated lighting subcategory requirements. Detailed lighting calculations and lighting layout must be submitted to the City for review and approval.
- If the existing street lighting does not comply with the City's nominated lighting subcategory, designers shall propose an alternative compliant lighting design. Detailed lighting calculations and lighting layout must be submitted to the City for review and approval.
- If the proposed alternative lighting layout requires removal, addition or relocation of any poles/luminaires, an ASP level 3 design consultant shall be engaged to undertake design works and to obtain approval from Ausgrid prior to construction.
- ASP level 3 design shall be submitted to the City for review and approval prior to obtaining certification from Ausgrid and before construction commences.
- A lighting consultant or ASP level 3 consultant shall be responsible for lodging applications with Ausgrid for all lighting upgrade-related works with the City's approval on the application form.
- Residual value charges associated with removal of existing Ausgrid assets shall be borne by thedeveloper through the City.

5.10 CBD AREA LIGHTING REQUIREMENTS

- Smartpoles shall be installed within the CBD area in accordance with the Sydney Lights Design Code.
- Intersection traffic lights shall be replaced with Smartpoles.
- Pole layout needs to be confirmed with the City.
- Removal of redundant Ausgrid lights must be arranged via ASP 3 level design process.
- ASP level 3 design shall be submitted to the City for review and approval prior to obtaining certification from Ausgrid and before removal of poles.
- A lighting consultant or ASP level 3 consultant shall be responsible for lodging applications with Ausgrid for all lighting.
- ASP 3 level design and associated Ausgrid charges shall be borne by the developer.

5.11 ELECTRICAL RETICULATION DESIGN

5.11.1 GENERAL

- Electrical designs shall be undertaken by a suitably qualified and a competent practising Electrical designer. The designer must be conversant with relevant Australian and the City of Sydney standards. The designer must provide a design statement confirming it complies with the requirements of the standard and signed off.
- It will be the designer's responsibility to ensure that the electrical design complies with AS/NZS 3000, Service and Installation Rules – NSW, Ausgrid and the City's requirements.
- Electrical design shall be submitted to the Council for review and approval before commencing any installation works on site.

5.11.2 POWER SUPPLY, ELECTRICAL CIRCUITS AND RETICULATION

- The point of power supply can be determined in consultation with the City to determine whether the lights can be powered from existing Main Switch Board (MSB) or whether a new electrical supply connection is required.
- If a new meter supply connection is required, the point of supply location shall be determined by application to Ausgrid.
- If an existing MSB exists, then the consultant must inspect the existing electrical infrastructure to identify the source of supply, and determine its suitability for installation of additional electrical load.
- If a three-phase power supply is adopted then circuits shall be designed to balance the load across all phases, so that adjacent luminaires are not on the same phase. GPOs shall be on a separate single-phase supply as indicated in Figure A below.
- In case of single phase power supply, adjacent lights shall not be connected on the same sub-circuit, separate circuit arrangement shall be used.
- The electrical consultant shall provide electrical schematics, for example:

Figure A

The electrical consultant shall provide the following information:

- Existing current maximum demand
- Maximum demand calculation
- Single line diagram of the MSB
- Electrical cable size and percentage voltage drop/fault loop impedance, calculations shall be provided using PowerPack or PowerCad software programs.
- Detailed electrical reticulation plan indicating conduit depth, pits, and cable size and cable type.
- Electrical supply reticulation design and footing designs shall be provided for approval prior to carrying out any construction activity. Footing designs shall be certified by a competent practising structural engineer.

- All cabling installed underground for public lighting reticulation shall be enclosed in a 63mm diameter Heavy Duty (HD) PVC rigid conduits, unless otherwise specified. No cables shall be directly buried. Electrical warning PVC marker tape shall be installed above all conduits used for reticulation. Use of flexible or corrugated conduits is not permissible.
- The layout and depth of electrical conduits shall comply with the requirements of Annexure 5 of this document.
- Electrical conduits must be installed clear of Tree Protection Zones (TPZ) and any existing underground services.

5.11.3 CABLE ROUTES

The designer shall undertake site investigation to assess the local conditions to decide the cable route.

- Accessibility – All cabling must be wholly within road reserves or public spaces or in the easement to be provided.
- The cable route selection shall aim to reduce sharp bends and lengths.
- There shall be no joints in LV cables.
- All LV cables shall be terminated in cabinets and terminal box at the base of pole.
- The surface layer shall be assessed for excavation and reinstatement – e.g. soil, road crossing and concrete.
- The underground layer shall be assessed for ease of excavation – potholing along the route as required confirming the full trench depth is achievable.
- Conduits shall be installed along the most direct route between columns and between the turret/cabinet and the column.
- Conduits shall cross under footpaths and roads at right angles where possible so that the reinstatement and length of cable is minimal.
- "Before You Dig Australia" information should be obtained to check clearances from other utility services (gas, electrical, water and communication reticulation).

5.11.4 CABLE TYPE, TERMINATIONS AND PROTECTION

- Main underground cables shall be single phase or three phase, 2C + Earth or 4C + Earth Cu/PVC/ XLPE, 0.6/1kV.
- Standard minimum cable size shall be 6 Sq.mm for wall mounted lights and 16 Sq.mm for Street lights and pedestrian lights, to comply with circuit requirements. Unless otherwise specified.
- All cables shall have type V75 or V90 insulation and shall have stranded copper conductors.
- All surface mounted cables shall be fire rated type.
- Main cables shall be terminated at the base of each pole. A dedicated 10 A MCB + 30mA RCD shall be installed at the base of each column for the luminaire supply. Refer to **Figure B** for details.

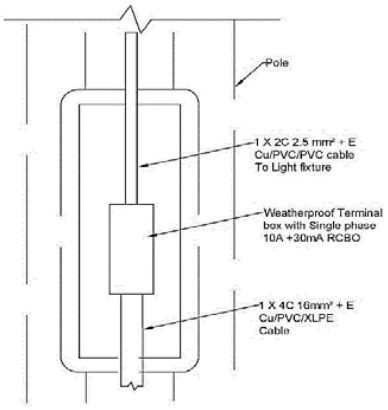


Figure B

- All the cables from the base of the poles to the luminaires shall be a minimum of 2C+Earth 2.5 Sq.mm Cu/PVC/PVC.
- Consultants shall provide detailed drawings indicating the above arrangement clearly.
- The number of circuits shall suit circuit loading and voltage drop calculations.
- All circuits shall be a loop in, loop out arrangement.
- The insulation of the cables shall be coloured as shown in the table below:

Circuit	Type	Colour
Three phase circuits	A Phase	Red
	B Phase	White
	C Phase	Blue
	Earth Conductors	Green and Yellow
	Neutral Conductors	Black

5.11.5 ELECTRICAL PITS

- Pits shall be located adjacent to each pole.
- Pits are required at every road crossing and horizontal/vertical changes of direction of conduits.
- A pit shall be installed adjacent to the MSB.
- Pits shall be located to minimise water ingress and must be finished flush to the Finished Floor Level (FFL).
- Refer to **Annexure 9** for details.

5.12 MAIN SWITCHBOARD (MSB)

- Refer to **Annexure 3.1 and 3.2** for the City's standard drawing for single/three-phase MSB size and details.
- Shop drawings for the MSB must be submitted for review and approval by the City before manufacture.
- If a non-standard MSB is required, shop drawings shall be provided for review; written approval must be obtained before manufacturing and installing the MSB.

5.13 MAIN EARTHING

- Refer to **Annexure 12** for main earthing schematics.
- Earthing shall be Multiple Earthed Neutral (MEN) type.
- Main earth electrode size and depth – Shall comply with AS/NZS 3000 requirements.
- All exposed earth electrodes and clamps shall be galvanised to prevent rusting.
- Suitable earth clamps shall be used for connection of earthing cable to the earth rod, with warning tags engraved with "Main Earthing conductor – Do Not Disconnect"
- Earth pits shall be used to access main earth electrode. To be installed adjacent to the MSB and shall be flushed with the FFL.
- Main earthing cable size shall be designed by an Electrical consultant based on fault levels.
- Main earthing cable shall be run in a PVC HD conduit between the earth pit and the base of the MSB.
- Above earthing arrangement shall be submitted along with the electrical reticulation design, for the City's review and approval.
- The depth of the earth rod and size shall comply with AS/NZS 3000 requirements.

5.14 LIGHTING CONTROL SYSTEM

- All functional lighting shall be supplied from its dedicated lighting circuit and controlled by a PE cell. The PE cell must be installed on a luminaire or pole closer to the MSB.
- No other type of control system apart from that specified above must be used for functional lighting.
- Dynamic/ Decorative lighting – the lighting control system must be approved by the City prior to progressing lighting design.
- Drawings shall be submitted showing mounting details for decorative luminaires and the location of all electronic drivers and control equipment.

5.15 INSTALLATION, TESTING AND INSPECTION

- Installation of all Works shall be as per the drawings approved by the City.
- Any deviation from the approved drawings shall be reported back to the City and written approval must be obtained for any deviation before commencing any Works.
- At the practical completion of installation works, the contractor must organise a handover inspection to be attended by City lighting team representative.
- The City's representative will be available on site to carry out visual site inspections (post installation) of electrical and lighting assets.
- The electrical contractor must carry out all the electrical tests required as per AS/NZS 3017. The electrical contractor must organise and make available all relevant calibrated tools and equipment before commencing any electrical test on site. All electrical tests must be witnessed by the design consultant.
- The City's standard ABLOY padlocks (2) are to be installed to the MSB cabinet. Contact the City'ssecurity team at security@cityofsydney.nsw.gov.au.
- The contractor must supply and install asset ID labels. Refer to **Annexure 10** for details.
- A laminated copy of the As-Built drawing and Single Line Diagram (SLD) must be attached to the inner side of the MSB cabinet door.
- The Council will advise of the defects list, if any. Upon receiving it, the contractor must address the issues and arrange for final inspection.
- The contractor shall provide As-Built drawings before arranging a final inspection. Refer to section 5.17 of this document for As-Built drawing requirements.
- The contractor shall provide a signed copy of the City's "Details of new lighting installation inspection, test and completion certificate" as per **Annexure 2**.
- All lighting and electrical installation works, shall be certified by the design consultants on the project. The electrical consultant on the project must witness the electrical tests and sign off the certificate as per **Annexure 2**.

5.16 HOLD AND WITNESS POINTS

- Refer to Section 8.6 of these specifications in B8: Public Domain Lighting Construction.

5.17 AS-BUILT DRAWINGS REQUIREMENTS

The following information shall be provided on the As-Built drawings in AutoCAD and PDF format:

- Drawings in AutoCAD and PDF format stamped "AS-BUILT" showing pole locations with GPS coordinates and offset dimensions as per site reference points. Plans must be provided in hard copy and electronic format, based on Australian Height Datum (AHD) and Map Grid of Australia 2020 (MGA2020) orientation, Zone 56.
- The pole schedule, including footing type, Asset ID label numbers, pole height, pole offset, pole type, luminaire details, outreach arm length, luminaire mounting height, pole colour and luminaire colour.
- The drawing, indicating electrical conduits layout, pits and cable runs per conduit including depths, offset and circuit labels as installed on site for the complete installation. Cables and conduit size shall be specified on the drawing.
- Location of the MSB and Pillar number from where the MSB is fed from or the Ausgrid Pole number/ location in case of Special Small Services (SSS) supply.
- Footing drawings and designs as installed on site, certified by a suitably qualified practising structural consultant.

5.18 HANDOVER DOCUMENTS

Below documents need to be submitted as part of handover:

- As-built drawings as per the requirements specified in section 5.17 above.
- Certification by a suitably qualified practising structural consultant for footings, stating that the installation is fit for purpose and complies with the approved design and site-specific underground obstructions and soil conditions.
- Electrical contractors must issue a Certificate of Compliance for Electrical Work (CCEW) form for all electrical installation works. CCEW forms are available from NECA. It is essential that the installation work complies with AS/NZS3000 Wiring Rules and any other relevant standard and is tested as required andcertified as being safe.
- A copy of Notification Of Service Work (NOSW) must be provided.
- An electrical design and installation certification from the electrical consultant engaged on the project as per Annexure 2.
- A lighting engineers' certification confirming that the installed lighting complies with the design intent.
- Operation and maintenance manual including product manuals.
- Product warranties.

5.19 REVISION REGISTER

Revision	Clause	Description of Revision	Authorised By	Date
Rev. 6	5.17	Updated to MGA2020	SA	Aug-23
	Title	Titles revised from "A5 - Street Lighting Design" To A5 – Public Domain Lighting Design		

ANNEXURE 1: LIGHTING DESIGN BRIEF AND CERTIFICATE

City of Sydney Technical Services Use Only	
CoS Design Requirements:	Scheme:
DA Number:	Signed by City Infrastructure Lighting Representative:

Location	Lighting Category	Column Type	Lanten Type	Lamp Source

The following sections to be completed by the ACCREDITED LIGHTING DESIGNER and approved by the City of Sydney Council, City Infrastructure PRIOR to any work commencing:

Location				
Lighting Category				
Computer package used				
Mounting Height (m)				
Column arrangement				
Overhang (m)				
Effective Width (m)				
Lantern Type				
Lamp Type & Wattage (W)				
Lamp Design lumens				
Maintenance Factor				

ANNEXURE 1: LIGHTING DESIGN BRIEF AND CERTIFICATE

Location			
Required Maintained Ave			
Calculated Maintained Ave			
Required (Up maint) or (Uo)			
Calculated (Up maint) or (Uo)			
Required Min (Eh maint)			
Calculated (Eh maint)			
Required (Ev maint)			
Calculated (Ev maint)			
Required Min (UL)			
Calculated (UL)			
Required Max Ti			
Calculated (Ti)			
Required Min (Es)			
Calculated (Es)			

Underground Cable size:	mm^2	Cable Type:	
Calculated Volt drop:	V	Calculated Loop Impedance of each leg:	Ω
Overcurrent Protective Device of Outgoing Circuit:	AS	Rating:	A
Calculated Short Circuit current of each leg:	KA		
Maximum disconnection time 0.4 seconds:			

Mains Switch: AS	Type:	Rating:	A
Number of Poles:			
Contactor/Relay type:	Rating: A	No. of Poles:	

Electronic Time Clock:		Type:	
Power	Supply: V	Phases:	
Method of Earthing:			

ANNEXURE 1: LIGHTING DESIGN BRIEF AND CERTIFICATE, CON'T

NOTE: All calculations to be shown on a separate sheet.

I/we being the person(s) responsible (as indicated by my/our signatures below) for the design of the lighting/ electrical installation, particulars of which are described on Page 1 and 2 of this form certify that the said work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with the current Code of Practice for Lighting AS1158, City of Sydney current specification for the installation of public domain lighting and the Rules for Electrical Installations published in AS3000, except for the departures, if any, stated in this certificate. The extent of the liability of the signatory is limited to the work described above as the subject of this

For the design installation at:	
Name of Designer: (BLOCK Letters)	Position:
Company Name:	
Signature:	Date:
For and ON BEHALF of CLIENT:	
Address:	
City of Sydney Technical Services Use Only.	
Checked By: (Name in BLOCK letters)	Position:
Signature:	Date:

Note: LIGHTING DESIGN BRIEF CERTIFICATE TO BE COMPLETED, CERTIFIED AND RETURNEDALONG WITH THE LIGHTING/ELECTRICAL DESIGN

ANNEXURE 2: DETAILS OF NEW LIGHTING INSTALLATION INSPECTION TEST AND COMPLETION CERTIFICATE.

All commissioning and pre-handover inspections are to be carried out by the *contractor and witnessed by an accredited representative from City of Sydney, City Infrastructure. All completed forms are to be submitted to theCity of Sydney. All electrical tests shall be witnessed by the electrical design consultant.*

VISUAL INSPECTION

Location:
Contractor:
Type of Installation: (e.g. street lighting, Park lighting, Plaza lighting, wall lighting, illuminated sign, etc.)
Date of Inspection:

STRUCTURAL INSPECTION

Mark ☑ Satisfactory or ☒ Unsatisfactory On Completion:

☐	1.	Location of Lighting Equipment as per Drawing
☐	2.	Planting Depth/Footing size of Lighting Equipment as per Specification
☐	3.	Location of Cable as per Drawing
☐	4.	Depth of Cable as per Specification
☐	5.	Location of Road Crossing as per Drawing
☐	6.	Depth of Road Crossing as per Specification
☐	7.	Column footing as per Specification
☐	8.	Verticality Correct
☐	9.	Optical Orientation Correct

ANNEXURE 2:
DETAILS OF NEW LIGHTING INSTALLATION INSPECTION TEST AND COMPLETION CERTIFICATE, CON'T

Mark ☑ Satisfactory or ☒ Unsatisfactory On Completion:

1.	☐	Correct termination of cables in the column, lantern and control gear
2.	☐	Circuit conductors identified correctly
3.	☐	Conductor size correct for normal operation (or as specified)
4.	☐	Single pole or fuse in the phase conductor only
5.	☐	Method of Protection against Direct Contact
	☐	a) Insulation of live parts
	☐	b) Barrier or enclosure
	☐	c) Out of reach (overhead lines only)
6.	☐	Method of Protection against Indirect Contact
	☐	a) Presence of Protective Conductors
	☐	b) Presence of main equipotential bonding conductor
	☐	c) Presence of supplementary equipotential bonding conductor including doors of steel columns but excluding that of concrete columns
7.	☐	Presence of method of local isolation
8.	☐	Fuse ratings correctly rated for their purpose
9.	☐	Labelling in control pillar/switchboard enclosure of isolators and fuses
10.	☐	Prevention of mutual detrimental influence. Proximity of non-electrical services (e.g. fences or safety barriers)
11.	☐	Selection of equipment and protective measures appropriate to external influences
12.	☐	Adequate access to installed equipment
12.	☐	Presence of danger notices or other warning notices
14.	☐	Presence of circuit diagrams enclosed within control pillars/switchboard enclosure
15.	☐	Installation method of cables
16.	☐	Deviation from the materials listed in the specification
17.	☐	Other

ANNEXURE 2:
DETAILS OF NEW LIGHTING INSTALLATION INSPECTION TEST AND COMPLETION CERTIFICATE, CON'T

Details of new lighting installation inspection test and completion certificate.

(All entries recorded on this sheet to be determined by measurement. All instruments must bear a current calibration label).

Date of Test:___/_____/ _____

Instruments to be Used Date when calibrated

Voltmeter 240/415V

Ammeter 0–50 amp Megger 500V

Loop Impedance Meter Prospective Short Circuit Tester

Control Pillar

Installation de-energised (with all fuser carriers removed)

Continuity of Protective Conductors **Polarity** (Rph + Re):-

Mark ☑ Satisfactory or ☒ Unsatisfactory

Circuit 1	Ω	Circuit 1	☐
Circuit 2	Ω	Circuit 2	☐
Circuit 3	Ω	Circuit 3	☐
Circuit 4	Ω	Circuit 4	☐

Insulation Resistance
(Note: Remove neutral conductor from PME system)

Circuit 1	P-N	Ω	Circuit	Column No.	
	P-E	Ω		P-E	MΩ
	N-E	Ω		N-E	MΩ
Circuit 2	P-N	Ω	Circuit	Column No.	
	P-E	Ω		P-E	MΩ
	N-E	Ω		N-E	MΩ
Circuit 3	P-N	Ω	Circuit	Column No.	
	P-E	Ω		P-E	MΩ
	N-E	Ω		N-E	MΩ
Circuit 4	P-N	Ω	Circuit	Column No.	
	P-E	Ω		P-E	MΩ
	N-E	Ω		N-E	MΩ

Insulation Resistance (column wiring)
(All columns)

METHOD OF EARTHING: TN-C-S

ANNEXURE 2:
DETAILS OF NEW LIGHTING INSTALLATION INSPECTION TEST AND COMPLETION CERTIFICATE, CON'T

Installation Energised

(Measurements taken under load at cut-out incoming terminals)

Voltage at Origin _____ V

Prospective Short Circuit Current at Origin_____KA

Loop Impedance at Origin _____ Ω

No. of Phases _____

Load at Origin _____ A

Measured Load		**Voltage at end of circuit**	
Circuit 1	A	Circuit 1	V
Circuit 2	A	Circuit 2	V
Circuit 3	A	Circuit 3	V
Circuit 4	A	Circuit 4	V

Loop Impedance at end of each circuit		**Prosp. Short Circuit Current at end of Circuit**	
Circuit 1	Ω	Circuit 1	KA
Circuit 2	Ω	Circuit 2	KA
Circuit 3	Ω	Circuit 3	KA
Circuit 4	Ω	Circuit 4	KA

ANNEXURE 2:
DETAILS OF NEW LIGHTING INSTALLATION INSPECTION TEST AND COMPLETION CERTIFICATE, CON'T

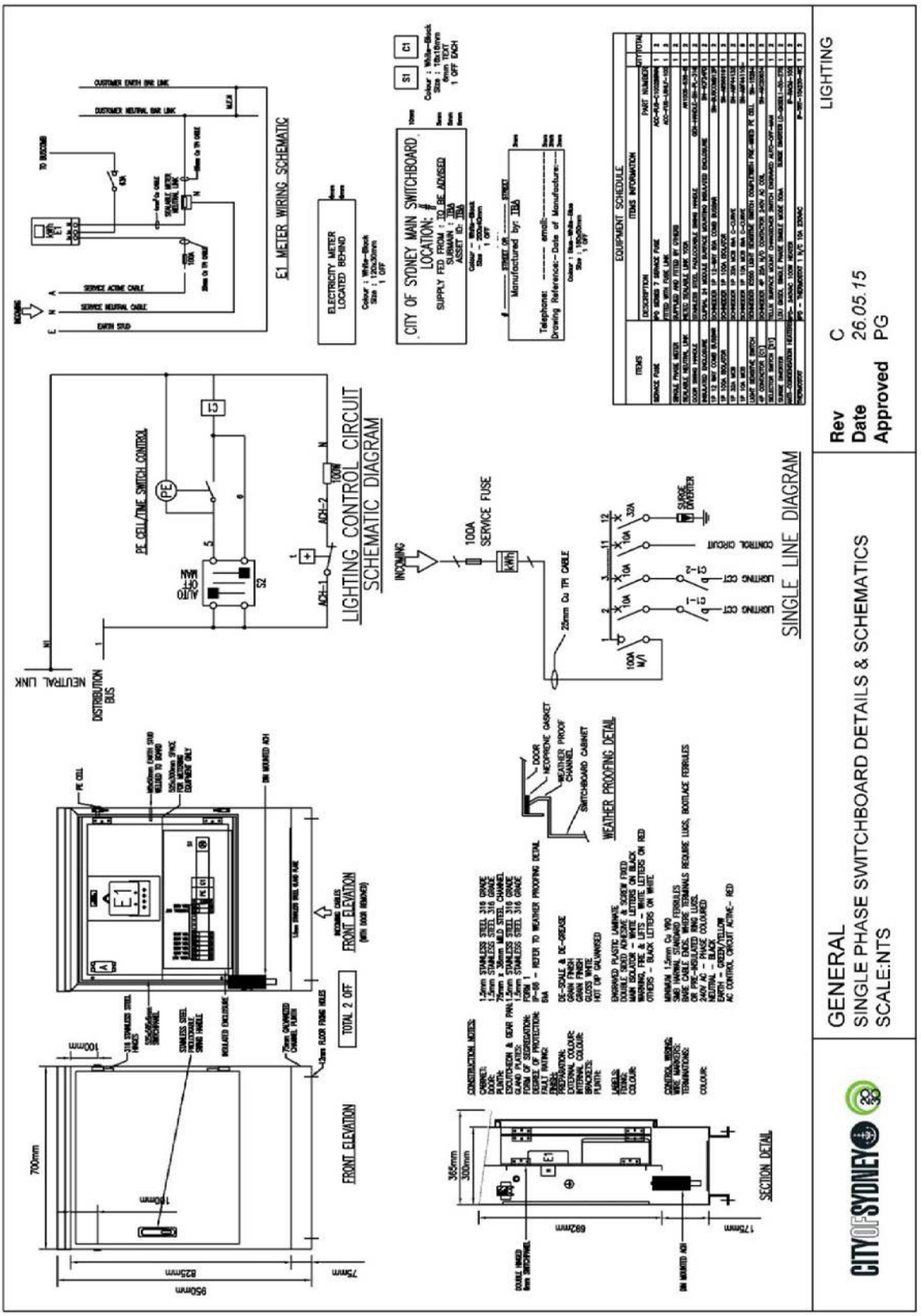
I/We being the person(s) responsible (as indicated by my/our signature(s) below) for the inspection and test of the street lighting and associated electrical installation particulars of which are described on the attached annexures of this form certify that the said work for which I/we have been responsible is to the best of my/ our knowledge and belief in accordance with City of Sydney current Specification for the Installation of Public Domain Lighting and the Rules for Electrical Installations (AS3000) except for departure, if any, stated in this certificate.

The extent of liability of the signatory is limited to the work described above as the subject of this certificate.

For the inspection and test of the installation at:	
Name: (BLOCK Letters)	Position:
Licence No.:	
Company Name:	
Signature: (of Contractor in BLOCK Letters)	Date:
For and ON Behalf of:	
Address:	
Witnessed by (Name) (Design consultant): (Name in BLOCK letters)	Position:
Signature:	Date:

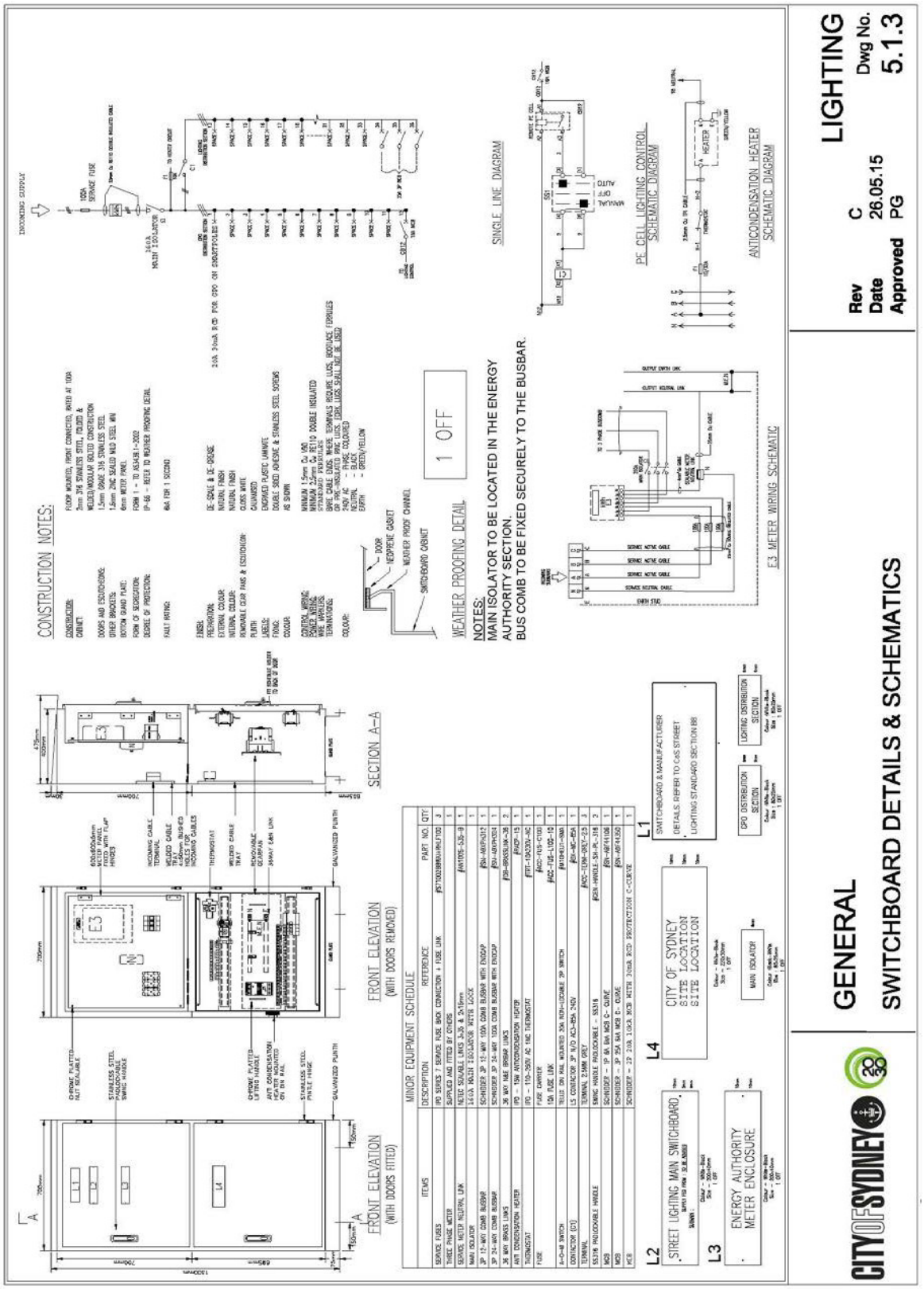
Comments:

ANNEXURE 3.1: STANDARD DRAWING FOR SINGLE PHASE MSB



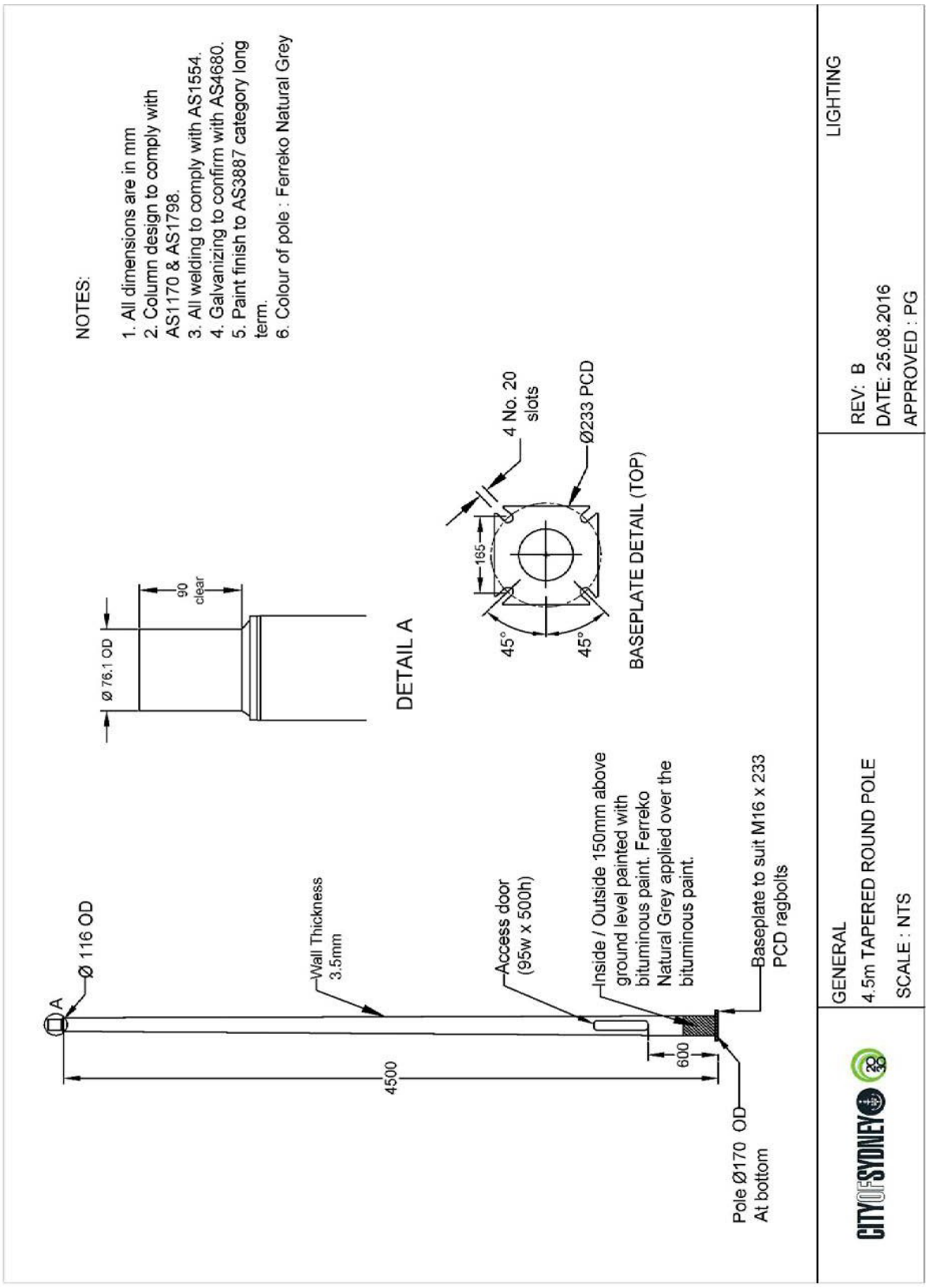
Note: Site-specific shop-floor drawings shall be submitted for approval prior to manufacturing.

ANNEXURE 3.2: STANDARD DRAWING FOR THREE PHASE MSB



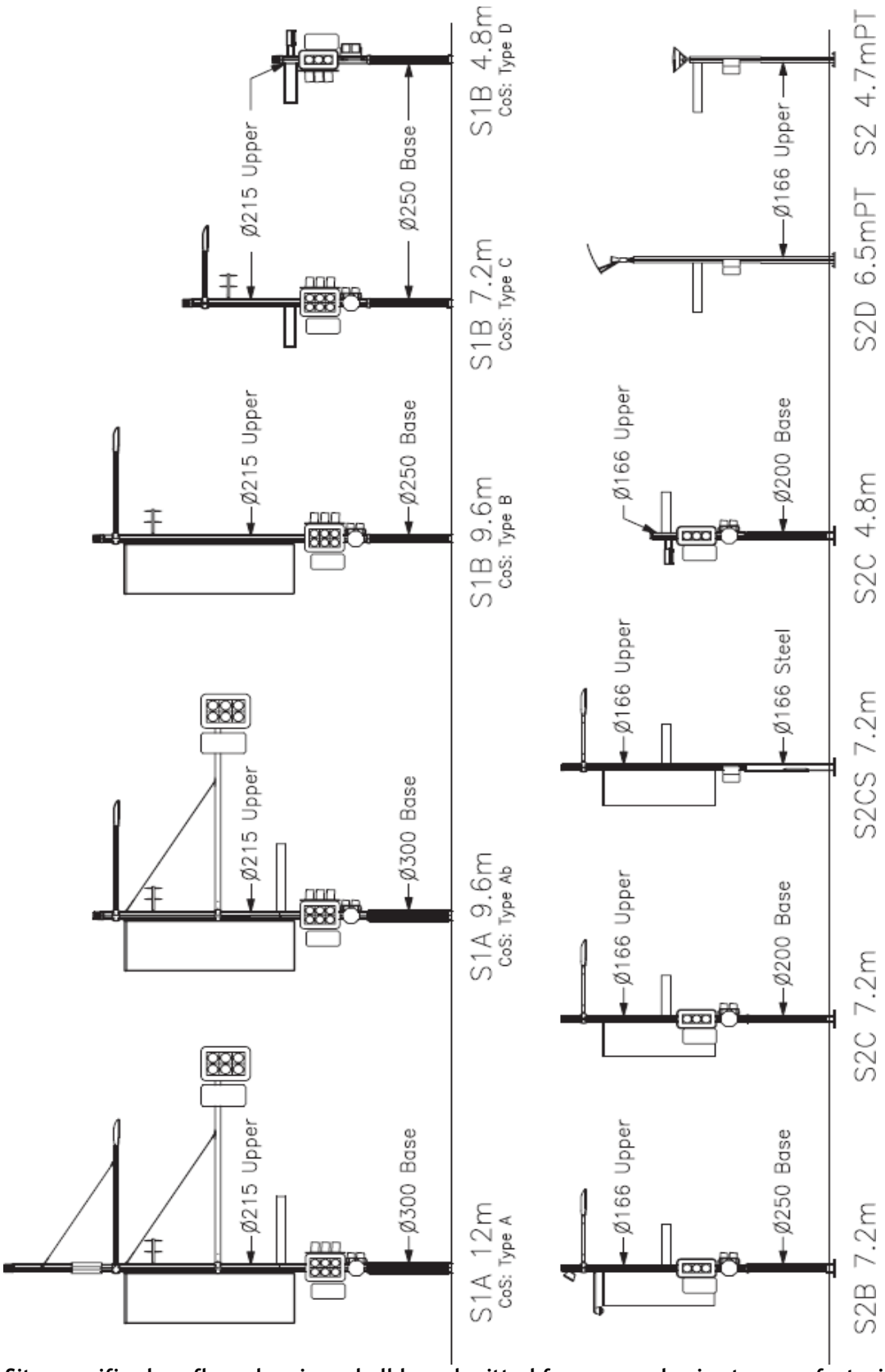
Note: Site-specific shop-floor drawings shall be submitted for approval prior to manufacturing.

ANNEXURE 4.1: STANDARD DRAWING FOR TAPERED PEDESTRIAN POLES (4.5M O)



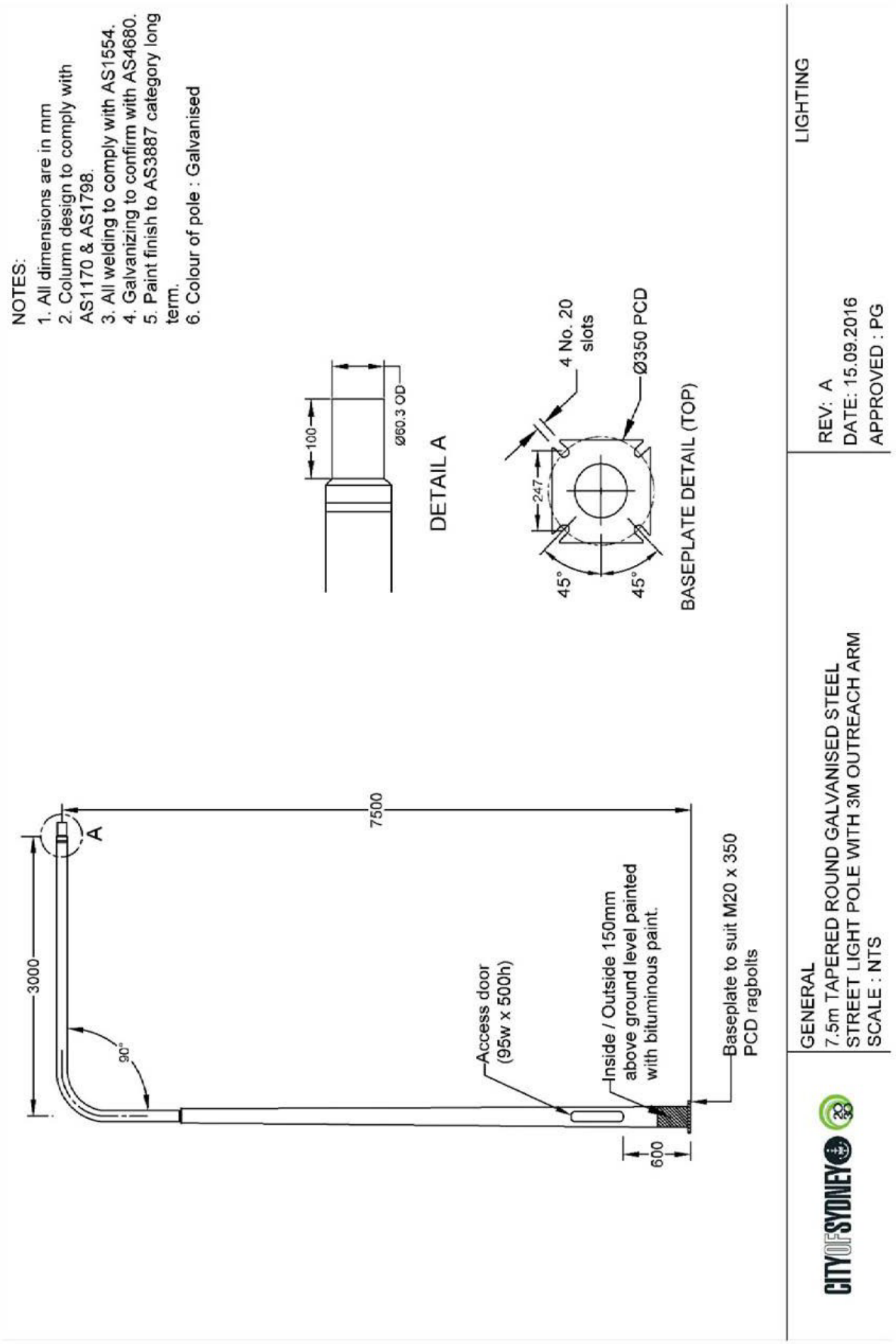
Note: Site-specific shop-floor drawings shall be submitted for approval prior to manufacturing.

ANNEXURE 4.2: STANDARD DRAWING FOR SMART POLES



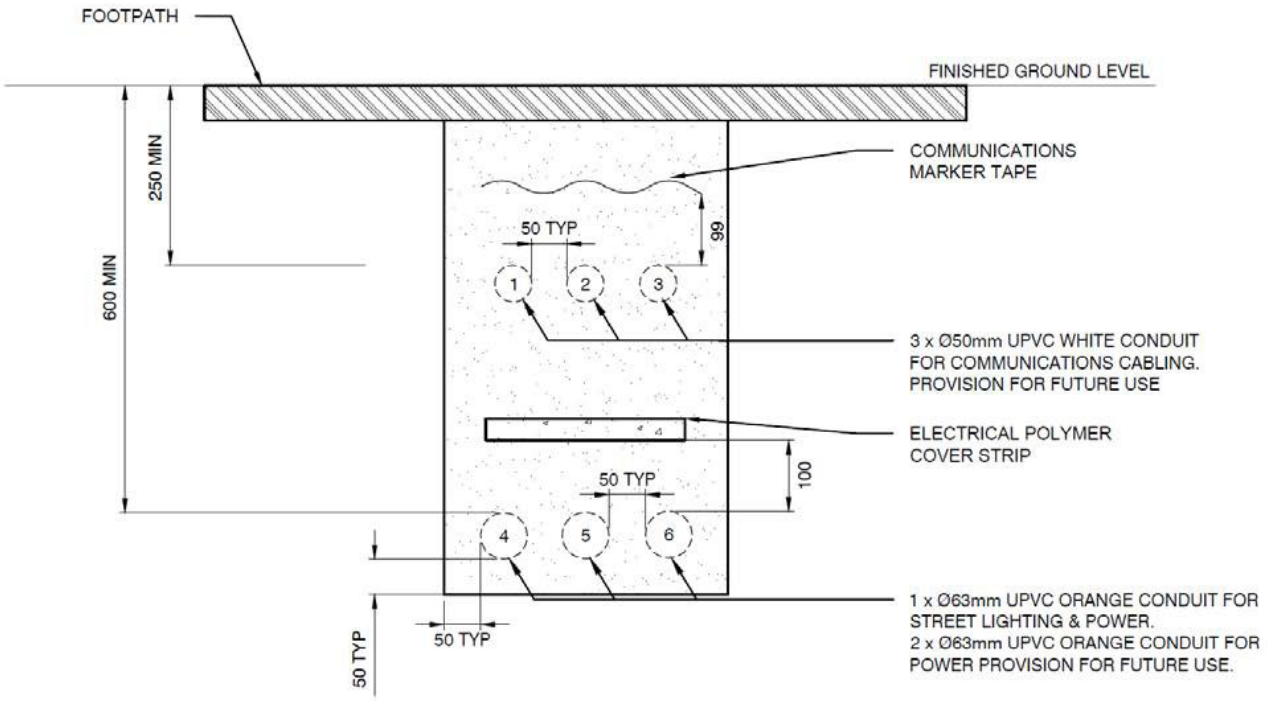
Note: Site-specific shop-floor drawings shall be submitted for approval prior to manufacturing.

ANNEXURE 4.3: STANDARD DRAWING FOR GALVANISED STEEL STREET LIGHT POLES

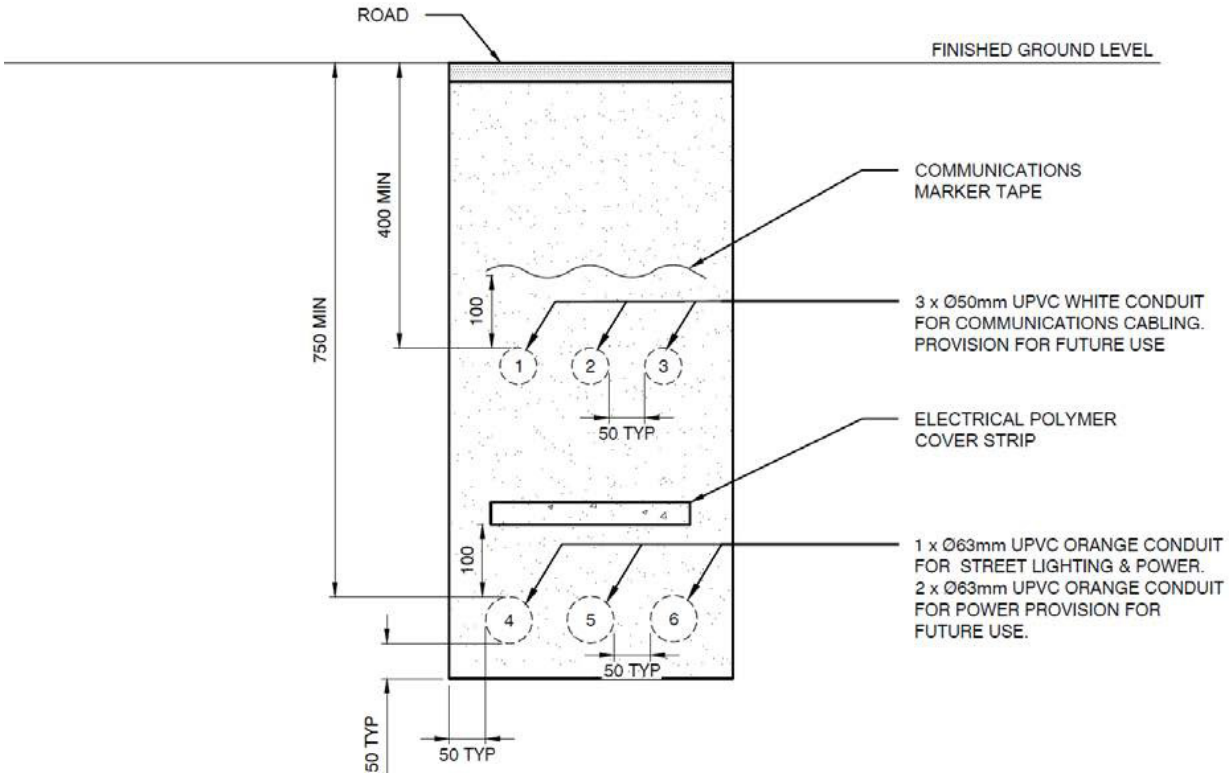


Note: Site-specific shop-floor drawings shall be submitted for approval prior to manufacturing.

ANNEXURE 5: TYPICAL ELECTRICAL AND COMMS CONDUIT ARRANGEMENTS

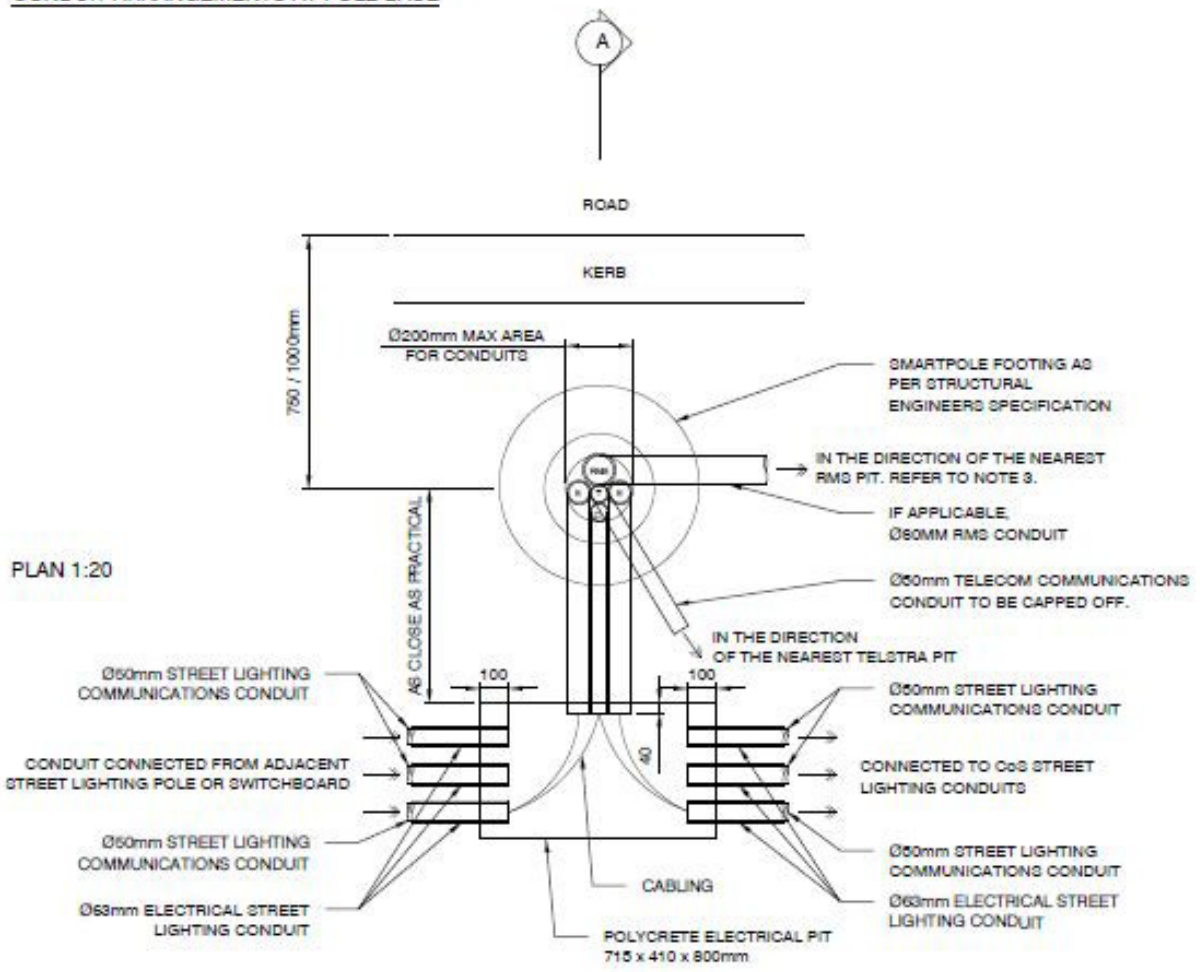


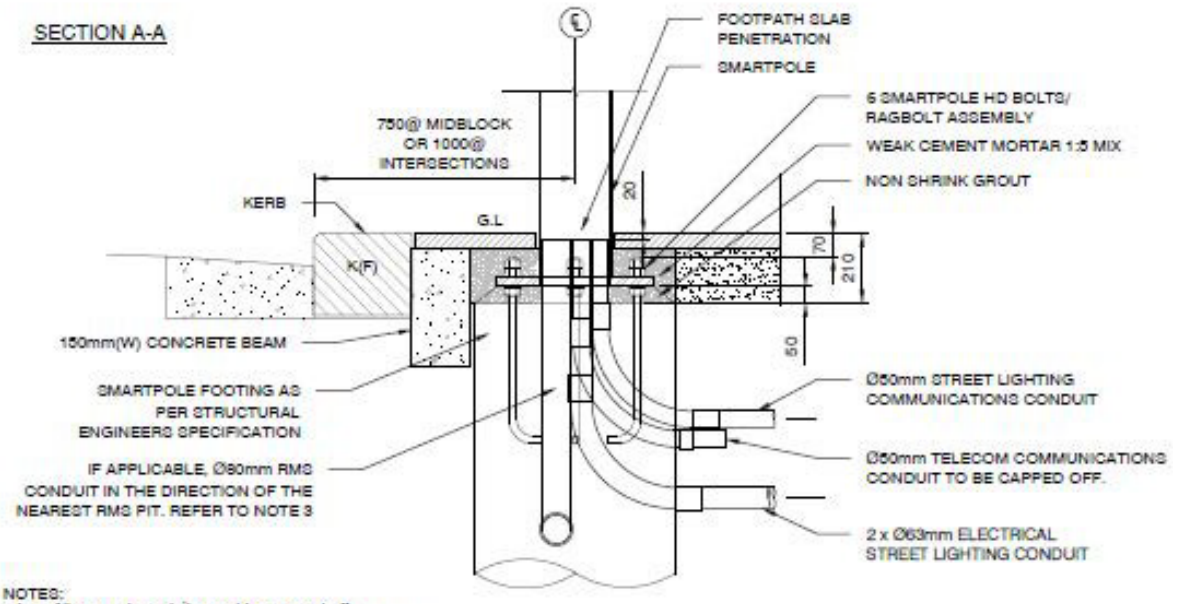
TYPICAL ELECTRICAL & COMMS CONDUIT ARRANGEMENT (ROAD)



ANNEXURE 6: CONDUITS ARRANGEMENT AT THE BASE OF SMARTPOLES

CONDUIT ARRANGEMENTS AT POLE BASE

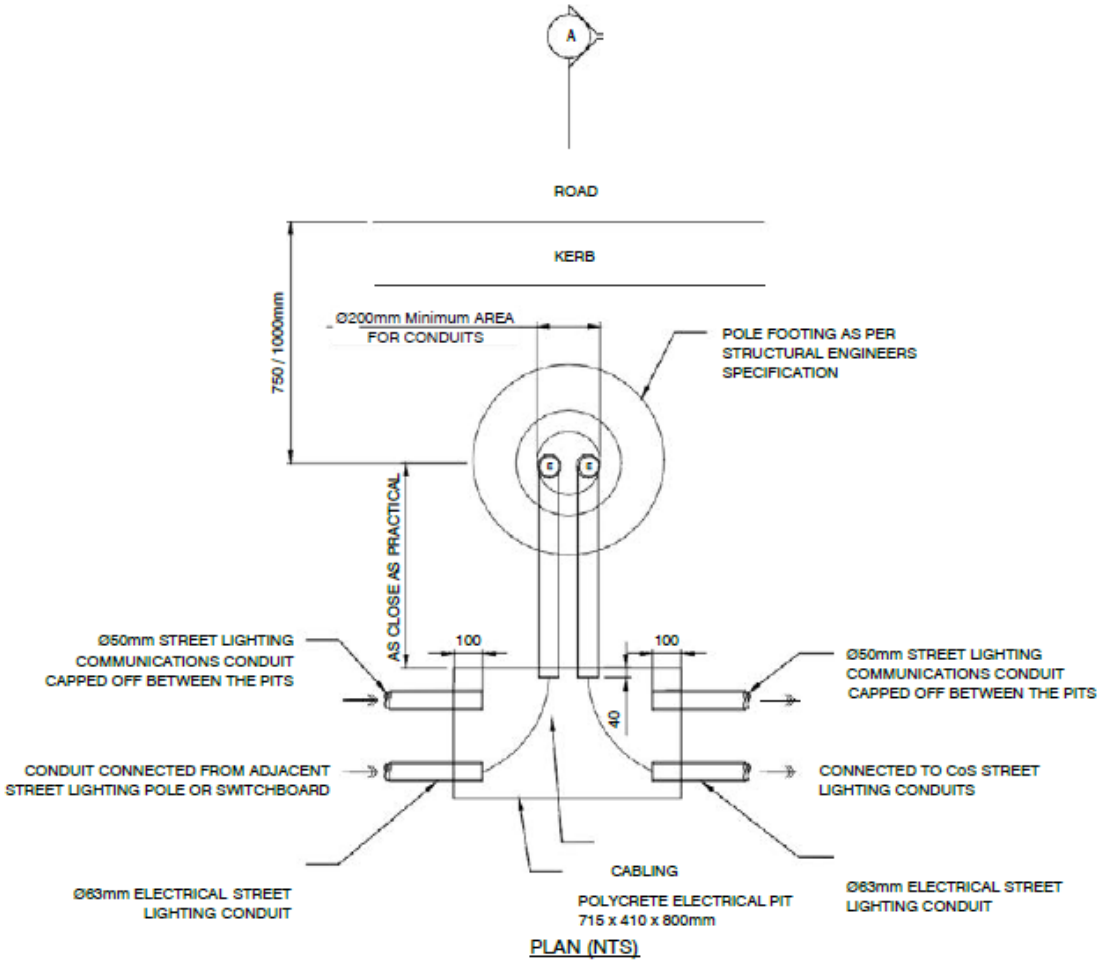




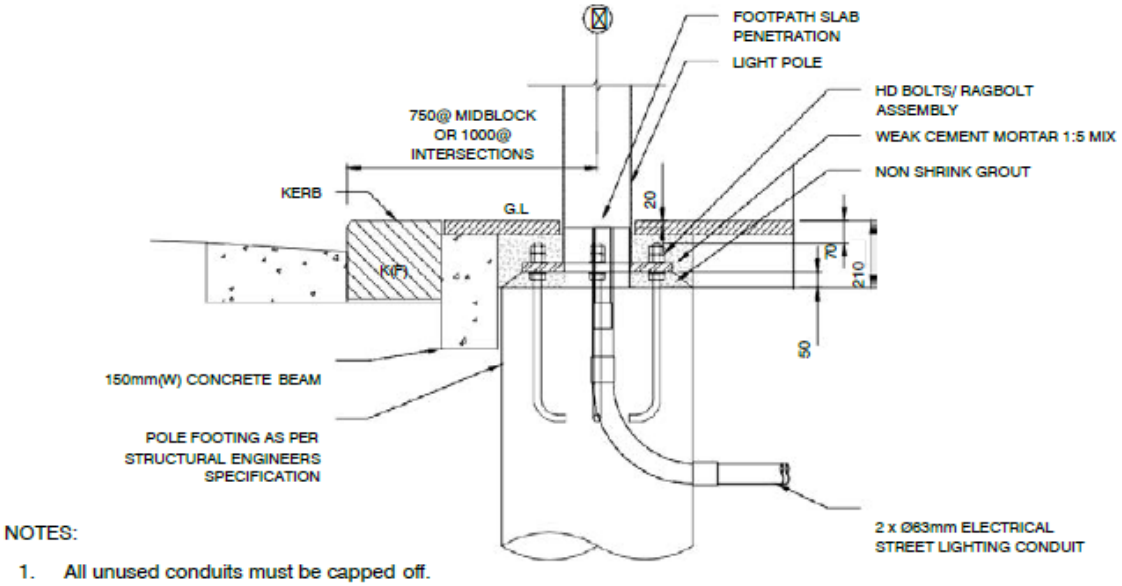
NOTES:
1. All unused conduits must be capped off.
2. Root barriers must be installed in trenches in close proximity to tree roots.
3. All dimensions are in mm.

ANNEXURE 7: CONDUITS ARRANGEMENT AT THE BASE OF STEEL OR PEDESTRIAN POLES

CONDUIT ARRANGEMENTS AT POLE BASE



PLAN (NTS)



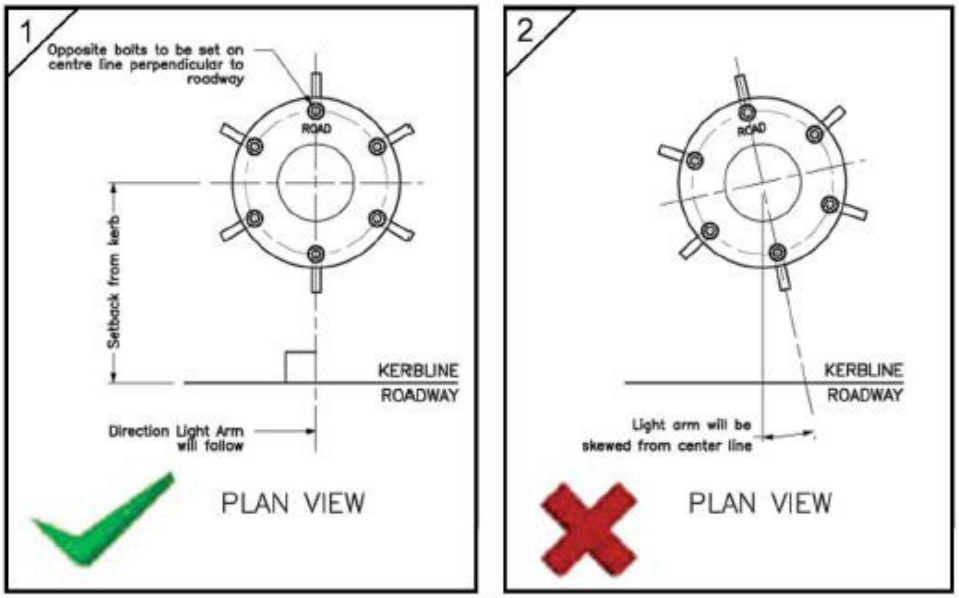
NOTES:

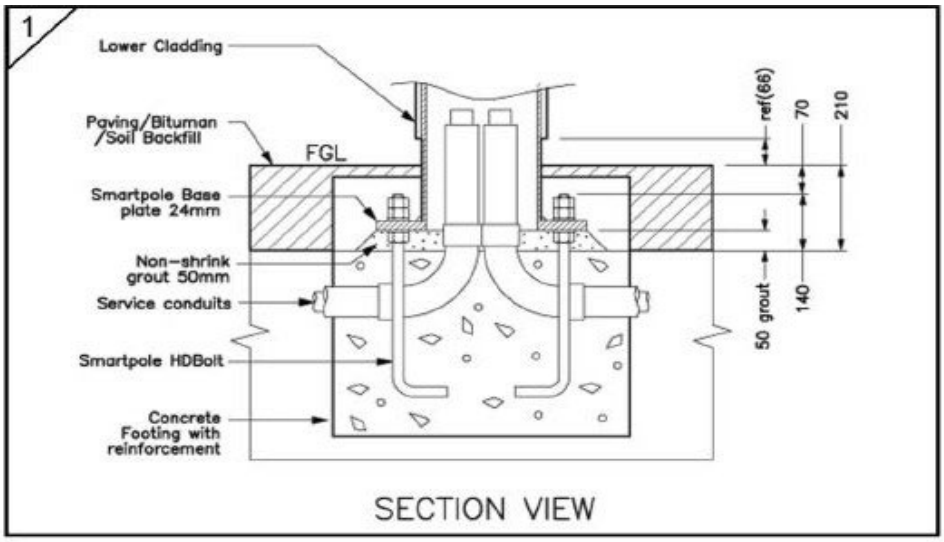
1. All unused conduits must be capped off.
2. Root barriers must be installed in trenches in close proximity to tree roots.
3. All dimensions are in mm.

SECTION A-A

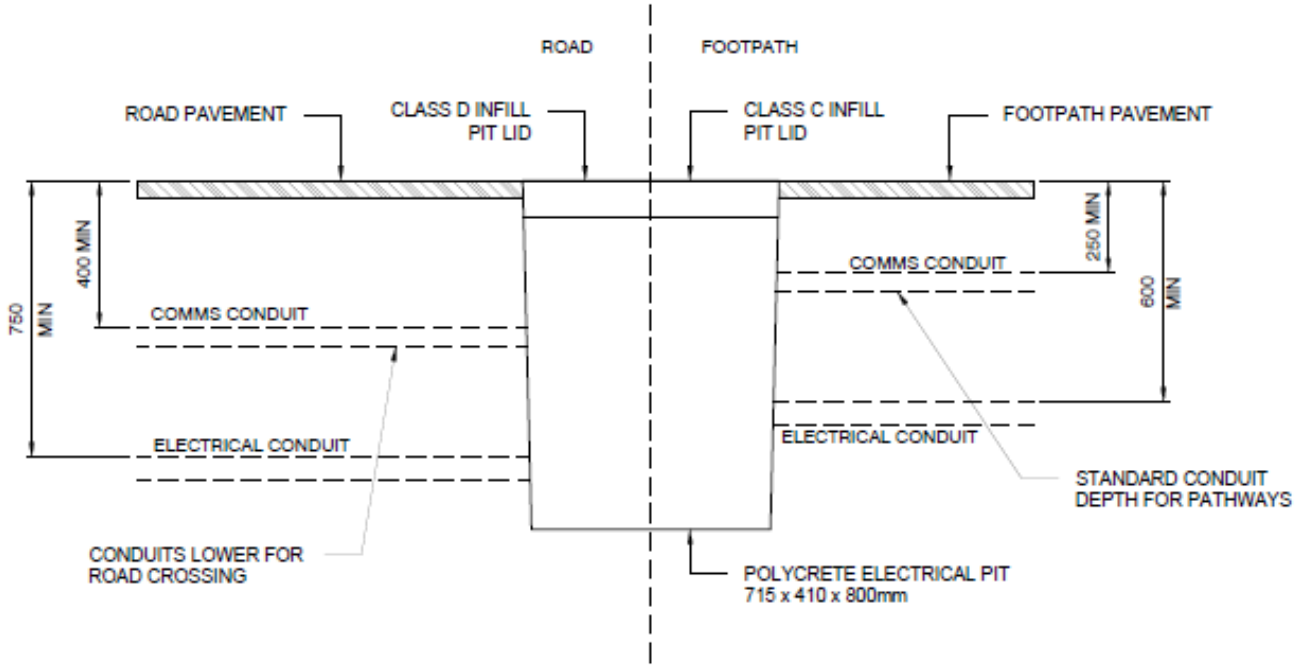
NTS

ANNEXURE 8: SMART POLE HD BOLT SETUP

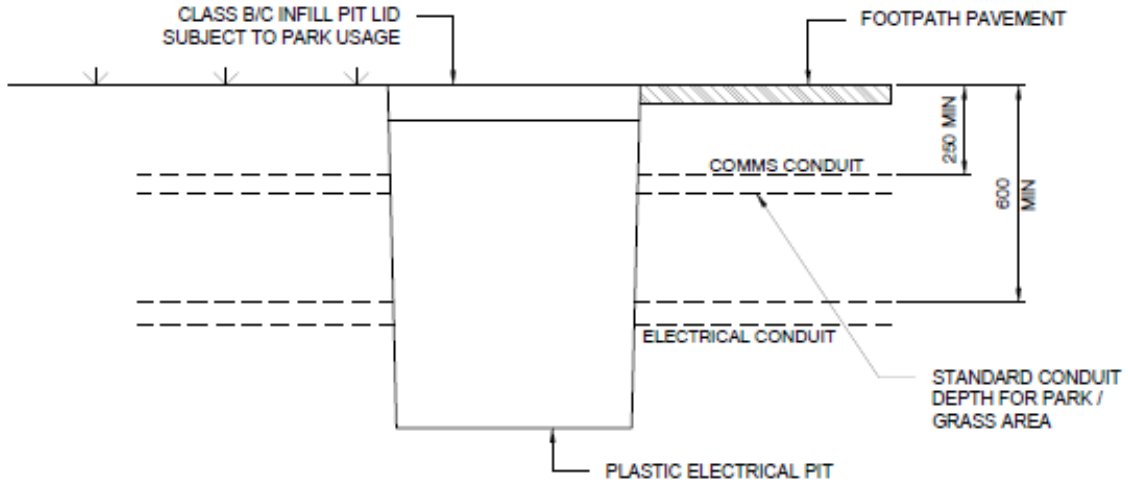




ANNEXURE 9: GENERAL ELECTRICAL PIT ARRANGEMENT



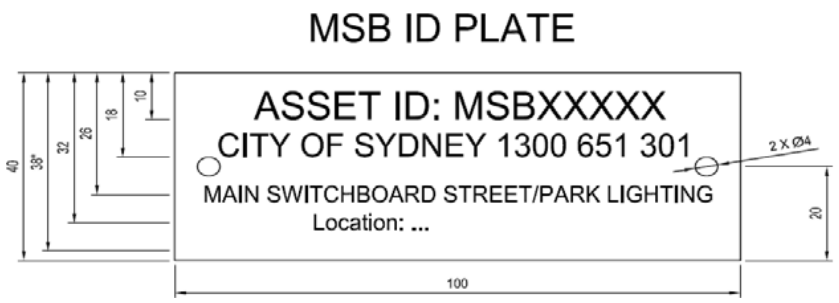
ELECTRICAL PIT ARRANGEMENT FOR ROAD / FOOTPATH



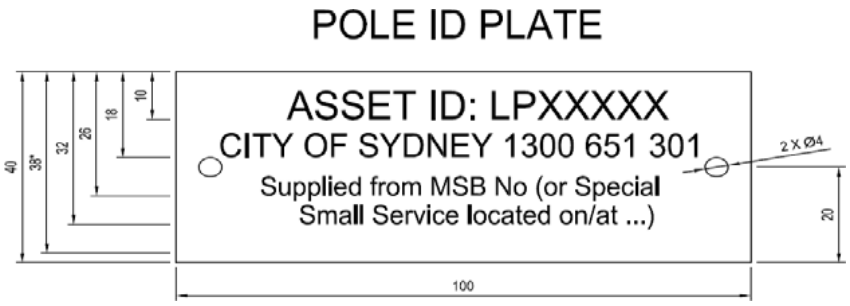
ELECTRICAL PIT ARRANGEMENT FOR PARKS

Pit lid is to have a 75mm diameter Stainless Steel disc engraved "CoS- Electrical" set flush with lid surface using epoxy adhesive.The disc should be slip resistant.

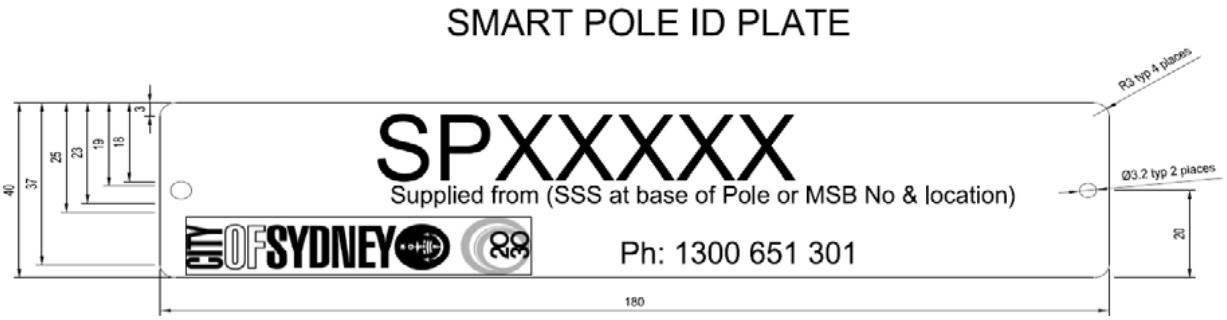
ANNEXURE 10: ASSET ID PLATE DETAILS



MSB ID PLATE DETAILS



POLE ID PLATE DETAILS



SMART POLE ID PLATE DETAILS

NOTES:

- ARIAL NARROW 6mm HIGH FOR THE FIRST LINE OF TEXT
- ARIAL NARROW 5mm HIGH FOR THE SECOND LINE OF TEXT
- ARIAL NARROW 4mm HIGH FOR THE THIRD LINE OF TEXT
- DENOTES SPACE FOR THE 5TH LINE OF TEXT
- MATERIAL IS ALUMINUM 0.8mm THICK
- PLATE IS FITTED WITH 2 STAINLESS STEEL RIVETS OR SELF-DRILLING SCREWS
- TEXT TO BE ENGRAVED

ANNEXURE 11: LUMINAIRE INFORMATION MINIMUM REQUIREMENTS

Item	Description	Minimum Requirement	Units/Format
1	Maximum spacing achievablein meeting lighting design specification	Lighting design calculations to AS/NZS1158 Part 3.1 & Part 1.1 (AGi32 or Perfect Lite) to provide evidence of luminaire performance declared (including for shielding options)	m
2	Luminaire – Brand, Type& Model No.	Luminaire brand, type and explicit model numbering to be provided	Description in text
3	Luminaire System Wattage	Total luminaire system Wattage to be provided	W
4	Luminaire Initial Lumen Output	Total luminaire initial lumen output to be provided	lm
5	Luminaire System Efficacy(As per LM-79)	Total luminaire system efficacy to be provided	lm/W
6	LED Module – Brand, Type & Model	LED model brand, type and explicit model numbering to be provided	Description in text
7	Rated Life of LED Module Hours at L70	LED model lifetime operating hours to 70% ofinitial lumen output	hrs@L70
8	Correlated Colour Temperature	4000K	K
9	Colour Rendering Index	75+ Ra	Ra
10	Chromaticity Tolerance - Average Chromaticity Shift(Δu'v') at 6,000 hours	As per SA/SNZ TS 1158.6 Table 5.3	Δu'v' and tolerance
11	Provide options for glare control devices including unit price	It is preferable to have extra glare control options available (e.g. to address front, rear, front & rear and all around shielding needs)	Y/N
12	Power Supply (Driver) Brand, Type, Model	Power supply brand, type and explicit model numbering to be provided	Description in text
13	Power Supply Dimming & Constant Light Output Capability	DALI 2.0 dimmable power supply required withconstant light output capability. 0-10V Zhaga Book 18 power supplies compatible withDALI 2.0	Y/N
14	Power Supply Programming	Is manufacturer willing to pre-program DALI2.0-enabled power supplies with asset management data to a pre-agreed format?	Y/N
15	Smart Controls and Smart CityReadiness	NEMA/ANSI 7-contact socket and, where Zhaga Book 18 compliant interfaces are provided, these should be wired such that both NEMA/ ANSI 7 and Zhaga devices can control LED module switching and dimming.	Y/N
16	Surge Protection Device	20kV / 10kA	kV / kA
17	Ambient Operating Temp Range	To be stated	-XºC & +YºC

ANNEXURE 11:
LUMINAIRE INFORMATION MINIMUM REQUIREMENTS, CON'T

Item	Description	Minimum Requirement	Units/Format
18	Rated Life of Power Supply	100,000 hours or more preferred	X hrs. with y% total failure rate
19	Predicated Power Supply Failure Rate	0.2% per 1000 operating hours	% failure expected per 1000 hours (Based on Telcordia SR-332)
20	LED Drive Current	To be stated	mA
22	Electrical Class	Class I (single insulated) Class II (double insulated)	Y / N Y / N
23	IP Rating – Optical Module	IP66 preferred, IP65 minimum	IPXX
24	IP Rating – Gear Chamber	IP65 minimum	IPXX
25	IP Rating – Power Supply	IP66 preferred, IP65 minimum unless power supply is located within a gear chamber that isIP65 or greater	IPXX
26	Luminaire Body - Aluminium Alloy – Max Copper Content	As per as per SA/SNZ TS 1158.6 2.3.1 If cast or extruded aluminium alloy, LM6 grade alloy or better shall be used unless the manufacturer can provide acceptable evidence of performance outcomes for a differing alloy composition.	%
27	Luminaire Body Finish	Luminaire to be unpainted, Have all stainless steel fittingspre-greased Have regard to the galvanic series and provide a full list of metal components used in the luminaire along with commentary on the corrosion susceptibility of these materialcombinations Composite materials that are exposed to sunlight UVb tested to a minimum of 2000 hours	Y/N Y/N Description in text Y/N
28	Luminaire Dimensions	Luminaire dimensions to be provided	L x W x H in mm
29	Luminaire IK Rating	Minimum impact resistance (IK) rating of IK08.	IK0X
30	Wiring connection chamber	Have control gear/wiring connection chamberaccessible without the use of tools. Have removable covers secured to fitting in open position and self-supporting during connection/maintenance	Y/N Y/N

ANNEXURE 11:
LUMINAIRE INFORMATION MINIMUM REQUIREMENTS, CON'T

Item	Description	Minimum Requirement	Units/Format
31	Smart Controls Readiness	Top or bottom mounting acceptable. Preference is for luminaires with both NEMA/ ANSI C136.41 compliant 7-contact and ZhagaBook 18 compliant interface	Description in text
32	ROHS 2 Environmental Compliance	ROHS 2 environmental compliance preferred Suppliers are required to comment on environmental soundness of design and materials used in the manufacture of itemsoffered. In particular, reference to: a) Management of waste reduction. b) The use of re-usable and/orrecyclable packing. c) Extended producer responsibility for safe recycling or disposal of materials at the endof their life.	Y/N
33	Does the luminaire have an existing approval under the NSW Energy Savings Scheme?	Approval or willingness to seek approval (ifrequired under ESS Rules)	Y/N (If N, state willingness to apply for approval)
34	Luminaire optic/lens UVstabilisation method	Substantiation that degradation is insignificantover useful lifetime	Description in text
35	No Moving Parts	All luminaires shall have no moving parts (for example fans for thermal management)	Indicate Y/N
36	Component Fixing Devices	Toggle latches, catches, clips and hinges shall be stainless steel of not less than grade 304. In order to avoid electrolysis corrosion, brass and other copper alloys shall not be used in contact with aluminium or aluminium alloy. Control gear/terminal block chamber shall be accessible without the use of tools. Where toggle latches are used to secure an external supplementary visor, they shall be capable of maintaining the IP rating of the optical chamber throughout the design life of the luminaire as well as being capable of resisting inadvertent opening by animals.	Indicate Y/N foreach item

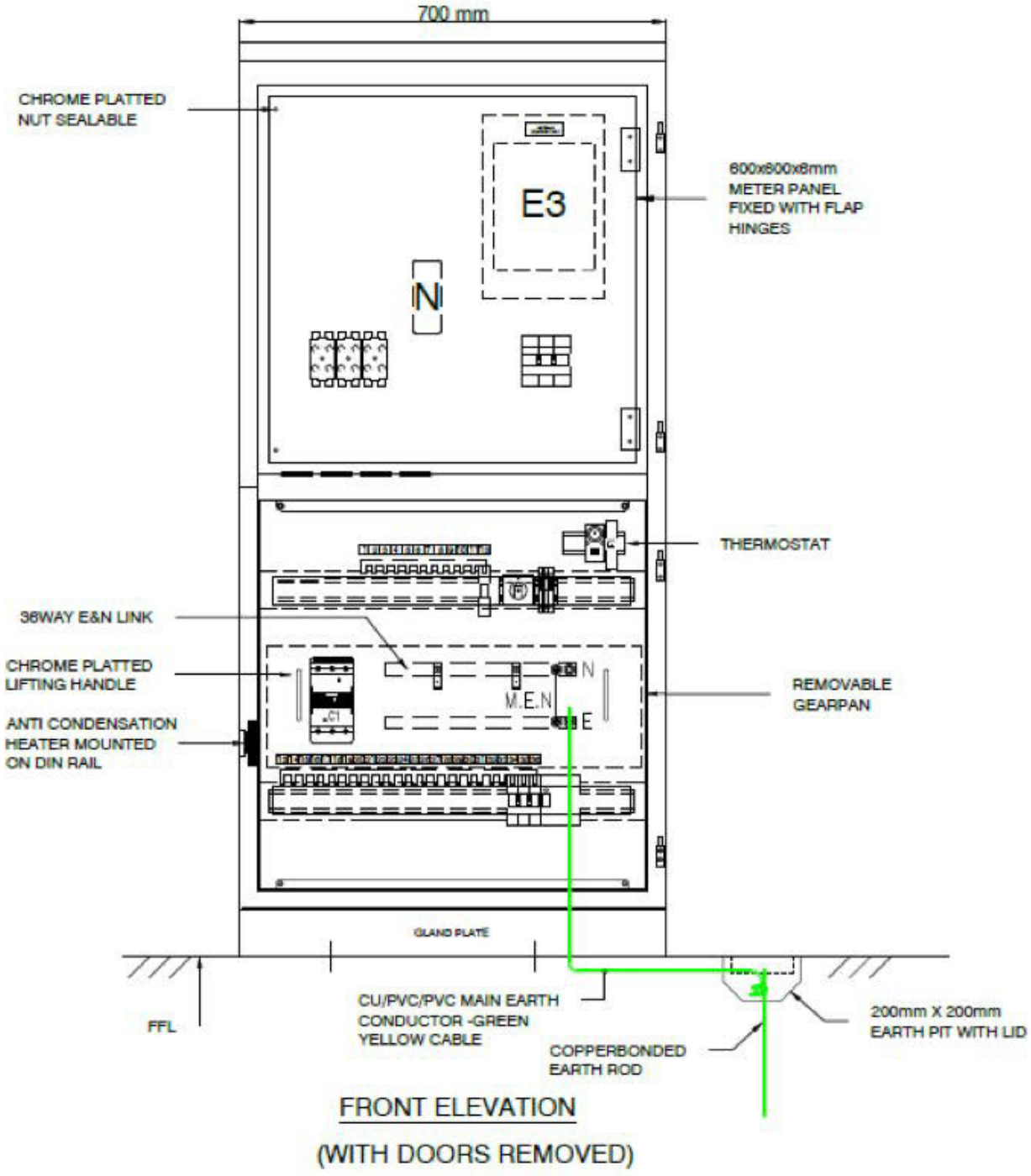
ANNEXURE 11:
LUMINAIRE INFORMATION MINIMUM REQUIREMENTS, CON'T

Item	Description	Minimum Requirement	Units/Format
37	Supporting Documentation (Provide ID number forrelevant file)	Confirm that the following documentation and supporting material (with test reports from a NATA-accredited laboratory or a laboratory whose accreditation is recognised by NATA under the mutual recognition scheme) is available if your product is short listed: 1. Product brochures, technical data sheets (excerpts only, as applicable to the specific product) and dimensioned drawings. Do not provide full range catalogue. 2. IESNA LM-79 test report 3. IESNA LM-80 and IES TM21 calculations and extrapolations 4. Test report or material batch evidenceof aluminium alloy copper content 5. Ingress protection test report as per the requirements of AS/NZS60598.1 6. Resistance to external mechanicalimpact as per AS/NZS 60598.2.3 7. Impulse voltage test as per Clause 5.5 of SA/SNZ TS 1158.6 8. Thermal endurance and thermal testing requirements as per Clause 5.6 of SA/ SNZ TS 1158.6 9. Lens material datasheets demonstrating UV stability 10. A luminous intensity distribution Table (I - Table) for the luminaire in CIE and IES file formats corresponding to the LM-79 report provided 11. Photometric file (IES or CIE) 12. Perfect Lite or AGi32 sampleinstallation analysis including a summary table for inputs todemonstrate conformance 13. A polar diagram clearly identifying peak intensity at 70, 75 and 80 in cd 15. ISTMT (In-SITU Temperature Measurement Test) report	Indicate Y/N for each item (and explanation for each negative response)

ANNEXURE 11:
LUMINAIRE INFORMATION MINIMUM REQUIREMENTS, CON'T

Item	Description	Minimum Requirement	Units/Format
37 Con't	Supporting Documentation (Provide ID number forrelevant file)	16. One operational demonstration sample luminaire of the exact specification tendered, wired in an electrically safe manner with 3m ofelectrical flex and 3-Pin mains plug 17. Supplier's current Quality Assurance accreditation certificate in conformity with AS/NZS ISO 9001 or equivalent international standard. 18. The supplier shall provide with theoffer information on: a. The period of service achieved by items offered within Australian service conditions. b. Customers who have a service history of the items offered. c. Contact names and phone numbers of relevant employees of those customers who can verify the service performance claimed. 19. Requirements beyond the scope of SA/SNZ TS 1158.6: a . Insulation Resistance Test – Clause 8.3.1 of AS 3100 b. Insulation resistance shall be measured at a voltage of 500 V d.c. c. The resistance between live parts and the external metallic body shall be not less than 1 MΩ d. High Voltage (Electric Strength Test) – Clause 8.4.2 of AS 3100 e. Test shall be applied as per clause 8.4.5 of AS 3100 and there shall be no disruptive discharges, that is, flashovers of insulation punctures during any high voltage test f. Spectral distribution graph	Indicate Y/N for each item (and explanation for each negative response)

ANNEXURE 12: MAIN EARTHING SCHEMATICS



FRONT ELEVATION

(WITH DOORS REMOVED)

NOTES:

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH 5.13 MAIN EARTHING REQUIREMENTS.
2. EARTH CABLE SHALL BE RUN IN DIA PVC RIGID HD CONDUIT.
3. EXPOSED EARTH ELECTRODE AND CLAMP TO BE GALVANISED.
4. MAIN EARTH CONDUCTOR SIZE TO BE CALCULATED BASED ON THE FAULT LEVEL
5. EXPOSED EARTH ELECTRODE TO BE INSTALLED IN A PVC CONDUIT

EARTH PIT PHOTO