Specification

Building Design Specification

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Revision details

Version No.	Clause	Description of revision
1		New document

Introduction

This specification outlines the design and construction requirements for Sydney Water buildings.

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Acronyms

Acronym	Definition
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BCA	Building Code of Australia
EPA	Environmental Protection Agency
FRL	Fire Resistance Level
HV	High Voltage
HVAC	Heating Ventilation Air Conditioning
IICATS	Integrated Instrumentation Control Automation and Telemetry System
IPCC	Intergovernmental Panel on Climate Change
LV	Low Voltage
NCC	National Construction Code
PBP	Planning for Bush Fire Protection
SCADA	Supervisory Control And Data Acquisition
SWC	Sydney Water Corporation
UPS	Uninterruptible Power Supply
WSAA	Water Services Association Australia

General Terms & Definitions

Term	Definition
Building	An enclosure within which people work for any duration of time. Even if an enclosure is termed as unmanned, it must be considered as a 'Building' if maintenance activity is undertaken within the enclosure.
Critical Infrastructure asset	The assets, systems and networks required to maintain the security, health and safety, and social and economic prosperity of the society
Essential services	Supply and distribution of water and collection and treatment of untreated wastewater
Network asset	Any asset used in the supply and transfer of drinking water to customers and collection and treatment of untreated wastewater. *Note; This definition is only applicable to this document*

1. General

1.1 Introduction

This specification sets the requirements for the design of Sydney Water buildings associated with operational facilities. This document:

- Specifies the structural requirements,
- Clarifies the National Construction Code (NCC) requirements, and
- References specifications for other disciplines related to the buildings.

Sydney Water infrastructure that provides water and wastewater services to the public is considered 'critical infrastructure assets' under the Australian Government's "Security of Critical Infrastructure Act - 2018". Given that the NCC focuses on typical residential, commercial, and industrial buildings, the design outcomes for Sydney Water's critical infrastructure must exceed the NCC objectives in certain aspects as outlined in this specification. In case of any conflict, the most stringent requirement between the NCC and this document must be followed.

Note: The National Construction Code (NCC) sets the minimum required levels for safety, health, amenity, accessibility, and sustainability of certain buildings, primarily focusing on those intended for human occupation. Some requirements for Sydney Water buildings exceed those specified in the NCC. The NCC does not consider operational continuity, which is a requirement for critical infrastructure. Operational continuity of certain Sydney Water buildings is essential to facilitate the provision of essential services to the public. This specification covers the requirements related to the NCC as well as additional requirements specific to Sydney Water for ensuring operational continuity.

1.2 Scope

This document addresses the structural design requirements for the following buildings commonly found in Sydney Water operational facilities:

- Water pumping stations and in-line booster stations
- Low Voltage (LV) switchrooms
- High Voltage (HV) switchrooms
- Workshops/storage (non-critical) buildings
- Out-loading/dewatering buildings
- Buildings for non-critical equipment/machinery/process units (not part of the system providing essential services to the public)
- Buildings for critical equipment/machinery/process units – the design principles must align with those of water pumping stations.

The designer must consult with Sydney Water at the beginning of the design process to determine the criticality of the building.

1.3 Exclusion

Detailed design for the following engineering disciplines is excluded from this document. However, where relevant, requirements from other disciplines, with respect to the NCC is specified.

The overall design of the building must include, but is not limited to, the following disciplines:

- Architectural
- Geotechnical
- Civil (excluding structural)
- Plumbing (including stormwater)
- Electrical
- Fire safety
- Heating, Ventilation, and Air Conditioning (HVAC)
- Acoustic
- Security
- Signage
- Health and amenities

Following are Sydney Water buildings excluded from this specification:

- Buildings that house office spaces, laboratories, or store/use dangerous or hazardous materials. Such buildings within Sydney Water operation facility have higher safety requirements, hence must be custom designed.
- Enclosure for small In-line booster pumping stations, refer to section 1.8.2.1 for the limitation.

1.4 Standards and specifications

Design and construction of Sydney Water buildings must comply with this specification and the relevant Australian Standards and specifications, including, but not limited to, those listed below.

1.4.1 National Construction Code

NCC Volumes 1 and 2	Building Code of Australia

1.4.2 Sydney Water Specification

CPDMS0023	Technical Specification Civil
BMIS0209	Technical Specification Mechanical
CPDMS0022	Technical Specification Electrical
D0000691	Renewal of Dry Well Sewage Pumping Stations
D0001870	Specialist Engineering Assessment
D0001896	Design Specification for Sewage Pumping Stations Dry Well Ventilation
D0002071	Design Specification for Water Pumping Stations
DOC0018	Technical Specification – HV Switchrooms
DOC0016	Earthing and Lightning Protection
D0002107	Outloading Design Specifications for Biosolids
SDIMS0026	Service delivery safety signage specification
D0000833	Engineering Competence Standard

1.4.3 Water Services Association Australia

WSA 201	Manual for Selection of Protective Coatings
WSAA ‘Bushfire Management’	National Good Practice Operational Guidelines for the Australian Water Industry

1.4.4 Australian Standards

AS/NZS1170, Parts 0-4	Loading Codes
AS 1562.1	Design and Installation of Sheet Roof and Wall Cladding
AS 1657	Fixed Platforms, Walkways, Stairways and Ladders
AS/NZS 1894.1	Industrial fall-arrest systems and devices Part 4: Selection, use and maintenance
AS 2159	Piling – Desing and installation.
AS 2870	Residential slabs and footings
AS/NZS 2904	Damp-proof courses and flashings.
AS 2924	High-Pressure Decorative Laminate - Sheets made from thermosetting resins

AS/NZS 3500.3	Plumbing and drainage Part 3 Stormwater drainage
AS 3740	Waterproofing of domestic wet areas and
AS 3959	Construction in Bushfire-prone Zones
AS 4200.1	Pliable building membranes and underlays, Materials
AS 4200.2	Pliable building membranes and underlays, Installation
AS 4586	Slip resistance classification of new pedestrian surface materials
AS 4654.1	Waterproofing membranes for external above-ground use – Materials
AS 4654.2	Waterproofing membranes for external above-ground use – Design and Installation
AS 5100.5	Bridge design – Concrete
AS/NZS 61779.6:2000	Electrical apparatus for the detection and measurement of flammable gases. Part 6
AS ISO 13822-2005	Basis for design of structures – Assessment of existing structures

1.4.5 Other documents

Security of Critical Infrastructure Act – 2018 (Australia)

The intergovernmental Panel on Climate Change (IPCC)

NSW Rural Fire Service: Planning for Bush Fire Protection (PBP)

Ciria C766 - Control of cracking caused by restrained deformation in concrete

Sydney Water's Climate change adaptation guidebook

1.5 Critical infrastructure assets

All buildings that support Sydney Water's water and untreated wastewater network assets must be considered critical infrastructure assets for the purposes of this specification. Refer to the definition of "network asset" in the General Terms & Definitions section of this document. Designers must consult with Sydney Water to determine if a building supporting a non-network asset should or not be considered as a critical infrastructure.

Throughout this document, the design requirements are set for critical infrastructure assets, and designers must comply with these requirements. The fire rating and bushfire requirements for a building classified as a critical infrastructure asset must comply with Section 2.5 and Section 4 of this specification, respectively.

The design of these buildings must support the operational continuity of the facilities within them.

Note: While the Australian Government's "Security of Critical Infrastructure Act - 2018" considers all or most of Sydney Water's infrastructure as critical infrastructure for security purposes, this document focuses on the design aspects of buildings. Therefore, it will only consider buildings that support water and untreated wastewater "network assets" as critical infrastructure.

1.6 Climate change adaptation

Sydney Water uses Representative Concentration Pathway (RCP) 4.5 of the Intergovernmental Panel on Climate Change (IPCC) as the standard adaptation level. The Sydney Water Climate Change Adaptation Guidebook is a useful reference.

Sydney Water's climate hazard exposures include bushfires, rain, heat, sea level rise, storms, and drought.

1.7 NCC "building classifications" and "type of construction"

For Sydney Water buildings, the "building classification" and "type of construction" must be in accordance with Table 1. The most stringent requirement between Table 1 and the NCC must be adopted during the design. While Sydney Water is the approving authority and Building Consent from the Council is not mandatory, adherence to the current NCC guidelines as noted in this specification is mandatory.

BCA assessment must be carried out by a certified BCA consultant for all new building design and design involving repurposing or renovation of existing buildings as noted in section 5 of this document. Adoption of the recommendations provided by the BCA consultant on existing buildings is left to the discretion of the Sydney Water project team. Recommendation provided by BCA consultant for new buildings must be adopted in the building design.

The BCA consultant must align their assessment with Table 1 and section 3.0 of this document, which specifies stringent requirement to that of the NCC on few design aspects.

It must be noted that this specification takes precedence over other Sydney Water specifications in relation to the NCC "building classification" and "type of construction".

Note: The "type of construction" noted in the NCC refers to the fire resistance of the building, which is based on the "building classification" and number of stories.

Table 1 - "Building classification" and "Type of construction" stated in the NCC

Building type	"Building classification"	NCC sections to comply	"Type of Construction" (fire resistance)
Pumping stations and In-line booster stations	Class 8	Volume One – Sections A to G and J.	Section 2.5 of this document
LV switchrooms	Class 8		Section 2.5 of this document
HV switchrooms	Class 8		Section 2.5 of this document
Workshops	Class 8		Section 2.5 of this document
Storage buildings	Class 7b		Section 2.5 of this document
Outloading /Dewatering buildings	Class 8		Section 2.5 of this document
Buildings for non-critical equipment /machineries	Class 8		Section 2.5 of this document

Note: For Inline booster stations that are housed in enclosure refer to section 1.8.2.1.

1.8 Building layouts

The designer must comply with the following specifications when designing the layouts of Sydney Water buildings.

1.8.1 Pumping stations (Water)

Ref: D0002071 Design Specification for Water Pumping Station –

The building design aspects pertaining to pumping stations, including requirements for doors, lifting facilities, layout, access, amenities, drainage, and more, is addressed in this document.

1.8.2 In-line booster pumping stations

Ref: Appendix 1 – D0002071 Sydney Water Supplement to Water Supply Code of Australia WSA- 3

The building design aspects pertaining to booster pumping stations, including requirements for doors, walls (especially for enclosures), layout, lifting facilities, access, and more, is addressed in this document.

1.8.2.1 Enclosure for small In-line booster pumping stations

Enclosures of small booster pumping stations are exempt from the requirements of this specification. To be exempt, the enclosure must:

a. Be of the shape and size that will restrict personal entry into the enclosure.

b. Be demountable, or

c. Be provided with adequate doors around the enclosure to facilitate maintenance activities from outside the enclosure.

1.8.3 Low voltage switchrooms

Ref: CPDMS0022 Technical Specification Electrical;

The building design aspects pertaining to electrical switchrooms, including requirements for doors, layout, permanent and prefabricated switchrooms, and more, is addressed in this document.

1.8.4 High voltage switchrooms

Ref: DOC0018 Technical Specification – HV switchrooms;

The building design aspects pertaining to HV switchrooms, including requirements for doors, layout, dimensions, services entry, and more, is addressed in this document.

1.8.5 Workshop / storage buildings

The general arrangement for this type of building is project-specific and must be determined in consultation with Sydney Water project team. Provisions must be made for, but are not limited to, the following items:

a. Workshop table/bench
b. Vehicle loading/unloading area
c. Storage racks and/or shelving
d. Sanitary amenity

The layout of the workshop and other requirements within a building may differ for each facility. The designer must consult with plant operational personnel before commencing the building design.

Neither workshops nor storage buildings should include office space. If they do, the building must be considered as a combined administrative building, and undertake a project-specific bespoke design, considering the risks and compliance requirements.

1.8.6 Outloading / Biosolids / Dewatering buildings

Ref: D0002107 V2 – Outloading Design Specifications for Biosolids

The layout of these buildings can be complex and may need to accommodate, but is not limited to:

a. heavy equipment
b. conveyors
c. storage hoppers
d. weigh bridges
e. truck access
f. ventilation systems, etc.

The designer must consult with Sydney Water to determine the specific requirements for these buildings.

The durability of concrete and steel elements within these buildings must consider exposure to sewage, chemical spills, and the potential presence of hydrogen sulphide gas. Specially the Outloading building, where all openings are closed during truck loading. Flooring within these buildings must have a minimum slip resistance as noted in Section 2.4.4 of this document, where floor grating is not provided. Ventilation must be designed in accordance with Section 3.3.3 of this document, considering exposure to airborne contaminants.

Acoustic insulation must be considered for dewatering building to comply with the NCC and EPA requirements.

Structural elements within the outloading area must be designed to withstand accidental collisions by trucks or incorporate preventative measures such as bollards. The minimum design load on bollard must be 45 kN applied at 1 meter above the floor level. Floor grating in truck access zones must be suitably load-rated.

Bunding must be included in the floor design to adequately contain spillage, including sumps and drainage systems. The bund and ground slab must be designed to AS 3735.

2. Structural considerations

2.1 Design loads

Sydney Water buildings must be designed to sustain all expected design loads and load combinations as noted in applicable Australian Standards. Designers must consider that Sydney Water buildings can be subjected to specific loads due to their usage, such as vehicle access, traversing cranes, and equipment vibration.

Dead loads, including the self-weight of the structure and all components and finishes within the building, must be considered. All roof and floor loads, including but not limited to finishes, solar panels, services, and superimposed dead loads, must also be considered in the design.

Imposed loads or live loads must account for transient loads due to the building's usage and other imposed loads from equipment, storage, vehicle access, cranes, etc. Refer to Sydney Water Technical Specification Civil, clause C10.9.3.

The common live loads specific to Sydney Water buildings within water and wastewater facilities are listed below. This is not an exhaustive list, and designers must liaise with Sydney Water to fully understand the building's usage to assess the relevant applied loads:

a. **Pumping Station/In-line Booster Station:** Lifting facilities such as gantry or monorail cranes, pumping units, valves and pipes, platforms, electrical cabinets, building ventilation system, and, if applicable, vehicular access into the building.

b. **LV and HV Switchroom**: Electrical cabinets, venting pressure, HVAC system, earth pressure on trench walls, etc.

c. **Workshop/Storage Buildings**: Storage racks, cranes, and, if applicable, vehicular access into the building.

d. **Out-loading/Dewatering Building**: Dewatering equipment (including vibration), conveyor system, other equipment, chemical storing hoppers, vehicular access, weigh bridge, etc.

e. **Buildings for Equipment/Machinery/Process**: Gensets, engines, compressors, blowers, chemical dosing equipment, cables, racks, etc.

2.2 Durability

Sydney Water buildings must be constructed with high-quality materials and workmanship to achieve the required durability. The minimum durability life for the various components of the building must be as stated in below table**Error! Reference source not found.**.

Table 2 - Minimum durability of building components

Building element	Minimum Durability (years)
Sheeting for roof/wall cladding	30
Purlins and girts	50
Concrete, structural steel, and masonry superstructures	50 (non-critical infrastructure) 100 (Critical infrastructure)
Foundation (all buried components)	100
External platform for LV switchroom	50
Plumbing and drainage fittings	50
Architectural finishes	50
Barriers, handrails and access platforms	50
Sealants	15

2.3 Design Life and Importance Level to derive wind, snow and earthquake loads

Sydney Water buildings must be designed according to the Design Life and Importance Level specified in Table 3. The parameters in the table below must be used to determine wind, snow, and earthquake loads on the structure, in compliance with the AS/NZS 1170 suite of loading codes. For further guidance, please refer to section C10.9.4 of the Sydney Water Civil Specification.

For buildings that are classified as critical infrastructure asset, the deflection check must be based on an annual probability of exceedance of a minimum of 1:100 years.

Table 3 - Design life and Importance level (wind, earthquake and snow loads)

Building type	Importance level	Design life (years)
Pumping station – Wastewater	3	50
Pumping station – Water	4	50
LV switchroom – Wastewater	3	50
LV switchroom – Water	4	50
HV switchroom – Wastewater	3	50
HV switchroom – Water	4	50
Workshop/storage	2	50
Outloading/Dewatering building	3	50
Buildings for non-critical equipment/machinery	3	50

As stated in Note 4 of Table 2.1 in AS/NZS 1170.4, Importance Level 4 structures must demonstrate that they remain serviceable for immediate use following the design event for an Importance Level 2 structure. Deflection must be limited to the values suggested in Table C1 of AS/NZS 1170.0, and cracks must be limited to the serviceability criteria noted in the respective material codes.

Note: Importance Level and Design Life have been assigned for each type of building based on the required operational continuity and post-disaster functionality.

2.4 Structural system

2.4.1 Foundation system

Geotechnical investigations must be conducted in accordance with the Sydney Water Technical Specification - Civil (CPDMS0023) to determine ground conditions for strength, stability, and exposure. A suitable foundation system must be designed in accordance with Sydney Water Technical Specifications – Civil, to meet the operational requirements of the building and cater to the ground conditions.

Any buried services or structures must be identified, and appropriate measures taken to protect these services and structures during the planning, design, and construction phases. A Specialist Engineering Assessment, as per D0001870, must be undertaken if the proposed building impacts existing structures or services around the building.

The foundation system must be designed to safely transfer all design loads from the building and substructure to the ground. Predicted residual movements for the foundation system must be limited to what the building can accommodate without compromising operational requirements or the integrity of architectural finishes.

Special attention is required if the building is close to or on sloped ground, or if the site has issues with ground stability, reactive or weak soil, mine subsidence, etc.

In addition to meeting strength and serviceability requirements, the foundation system must be designed to meet the durability requirements corresponding to the design lives noted in Section 2.2 of this document.

2.4.2 Floors and slabs

All floors must be constructed of reinforced concrete to AS 3600 or AS 3735 as appropriate and of at least 150mm thick. Slabs on the ground must incorporate one layers of 300 µm thick polyethylene damp proof membranes on 50mm thick blinding concrete. Suitable crack control joints must be provided depending on the type of slab, reinforcement quantity, movement tolerance of the finishes, and the requirement of tanking in ground sections.

For slabs, the deflection limit stated in the Sydney Water Technical Specification - Civil takes precedence over AS 1170.1.

The ground floor must be a minimum of 150mm above the surrounding finished ground/pavement level.

Floor level of a building must be above the 1% AEP flood level by a minimum of:

a. 500 mm for HV electrical switchroom

b. 300 mm for all pumping station buildings, LV electrical switchrooms and buildings classified as critical infrastructure as per section 1.5

For all other buildings the floor level must comply with Part F1P2 of the NCC. Even though NCC exempts class 7 and 8 buildings from this requirement, all Sydney Water building design must comply with this requirement.

Buildings in coastal areas where the 1% AEP is impacted by the sea level rise, the designer must consider:

a. The sea level rise when deriving the flood levels.

b. The State Environment Planning Policy (Costal Management) 2018

c. Floodplain Risk Management Guide - Modelling the Interaction of Catchment Flooding and Oceanic Inundation in Coastal Waterways

The site flood level adopted in the design must align with Sydney Water's Climate Change Adaptation Guidebook.

2.4.2.1 Additional requirement for electrical switchroom

The subfloor structure, including the base slab, walls, trenches, and other components, must be designed and detailed to prevent moisture ingress from outside. It should be designed and detailed as a water-retaining structure, with crack widths limited to 0.2 mm. Detailing around openings for conduits, services, and pipes within these elements must be according to a water-retaining structure.

For switchrooms with a subfloor system, a raised external access platform must be provided where necessary at the building's entrance. These platforms should facilitate the movement of switches, equipment, and personnel into and out of the switchroom for installation, access, replacement, and maintenance. Where required, barriers and handrails must be installed in compliance with AS1657. Consultation with Sydney Water is necessary to determine the location of removable handrails for accessing new and replacement switches and equipment. For durability requirements of the platform and handrails, refer to Section 2.2 of this document.

2.4.3 Low voltage (LV) switchroom infinite access floor

The LV switchroom must incorporate a purpose-built infinite access flooring system. The complete flooring system must be sturdy, rigid, firm, and free of vibrations, rocking rattles, squeaks and other noises.

Load rating of the flooring system including the panels and the sub-structure:

a. a uniformly distributed load of 5 kN/sqm with a 1.5 mm maximum deflection or
b. a point load of 4.6 kN applied with a 50 mm diameter disc to give a deflection of no more than 2.0 mm.
c. Sub-structure designed without considering any lateral support from the floor panels.
d. Pedestal arrangement must not obstruct the conduits and/or access for cabling provided in the floor and walls of the substructure. Allow for 1000mm wide cable trays set along few locations within the substructure.

All components must have positive contact for safe continuous electrical continuity of the entire floor under structure. Spring clips and other mechanical devices are not permitted. The under-structure must be connected to the site electrical earth and the total metal under-structure resistance must not exceed 0.5Ω as per the requirements of AS/NZS 3017: Electrical Installations. A minimum of two equipotential bonding points must be provided for the floor to connect to the local earth. The connection must be performed by a qualified electrician.

2.4.3.2 Floor panels

All panels must be:

a. 600 mm square modular panels positioned and supported on all sides by stringers, including along the wall.
b. removable by one person with a suction-type lifting device and
c. Interchangeable, except were cut to suit for position of the floor.
d. Provide a seal to enable maintain a positive pressure in the switchroom and insulation for temperature control. Performance of seal not to be impacted when panels are removed and placed back during normal operation.

Where panels are cut to suit the floor configuration, the cut edges must be suitably treated to prevent corrosion in accordance WSA 201. The floor panels must have straight parallel edges to eliminate any gap between adjacent panels and the switchboard frames.

2.4.3.3 Floor panels surface

The floor panels must be surfaced with a high-pressure laminate of 1.5 mm thickness conforming to Australian Standard AS 2924 "High-Pressure Decorative Laminate - Sheets made from thermosetting resins" and trimmed with extruded soft vinyl. The surface must meet anti-static requirements. The colour of the surface is to be beige or a suitable neutral toned colour. Samples must be submitted to SWC for acceptance.

2.4.3.4 Sub structure

The sub structure for the flooring system must consist of a pedestal and stringer system.

a. All structural elements of the subfloor system must be constructed of 316 stainless steel, if there is any possibility of water ingress or moisture in the subfloor.
b. Where no moisture or water ingress into the subfloor is guaranteed, the structural elements can be of hot dipped galvanized steel with a minimum HDG500.
c. All dissimilar metals must be isolated.
d. Must meet durability, design life of 30 years.

The pedestal assembly must:

e. provide a minimum ± 30 mm height adjustment at each pedestal,
f. Must be welded to a baseplate and securely fastened to the base slab with stainless steel anchor bolts.
g. Baseplate must be levelled. Material used for levelling must be of property similar to concrete.
h. Limit pedestal slenderness to 30. Where required by the design, lateral bracing must be provided. Latreal support from the floor panels and stringers must be ignored in the design.
i. provide a vibration proof positive locking mechanism on each pedestal.

The stringers must:

j. be securely fastened to the pedestal heads,
k. be easily removable without the use of special tools or devices,
l. ensure fasteners are accessible from the top surface of the stringer.

2.4.3.5 Installation

The Manufacturer or his authorised representative must install the flooring system according to the Manufacturers specification. The finished floor height must be as stated on the relevant switchroom civil/structural drawings.

The maximum level variations for the floor must be:

±1.5 mm within 3 metres and

±3.0 mm over the whole installation.

The infinite access floor must be installed only after the switchboard frames are installed. The floor panels must be installed around the frames in straight parallel edges to eliminate any gap between the panels and the switchboard frames and well supported to avoid them tipping.

2.4.4 Floor finish

All Sydney Water buildings must have slip-resistant concrete flooring in accordance with AS4586. The minimum slip resistance rating must be:

a. R11 for outloading / dewatering and similar buildings with potential for wet floors.
b. R10 in all other buildings.

Refer to Section 3.6 of Doc No. DOC0018 Technical Specification HV Switchrooms for specific requirements on floor finish and tolerances for HV Switchroom buildings.

2.4.5 Roof

The roof must be designed and constructed to meet the requirements of the NCC, relevant Australian Standards, and this specification. It must resist all loads it will be subjected to and comply with both ultimate and serviceability criteria. The roof must be designed for loadings in accordance with AS/NZS 1170 Structural Design Actions and Section 2.1 of this document. Additionally, all roofs must make provision for solar panels.

2.4.5.1 Profile

The roof can be either mono-sloped or dual-sloped. The roof projection around the building must be a minimum of 1.2 meters for all buildings. The direction of the roof slope must maximize solar power generation as far as reasonably practicable.

The roof pitch must be a minimum of:

a. 10° to facilitate the self-cleaning of the solar panels, or
b. 5° if additional framing is provided to achieve the 10° slope for the solar panels.
c. Comply with appendix D of AS 1562.1

For buildings classified as critical infrastructure, the design must ensure that integrity, weathertightness, and watertightness are not compromised under service conditions, refer section 2.3 for annual probability of exceedance. Watertightness detailing must comply with appendix B of AS1562.1: Design and Installation of Sheet Roof and Wall Cladding. This includes proper lapping of the roof sheets, enhanced flashing details, etc.

The most severe load combination must be considered when deriving the roof deflection/sag. The roof deflection/sag must be limited to ensure that there will be no water ponding on the roof.

2.4.5.2 Bushfire impact on roof

Buildings in bushfire prone area, must be assessed to determine the Bush Fire Attack Level (BAL). Following are the additional requirements of roof in a bushfire prone area:

a. Must comply with AS3959 Construction of buildings in bushfire prone areas

b. Pumping stations and electrical LV and HV switchroom – with BAL rating 29 or higher, must be provided with concrete roof.

c. A secondary roof must be provided over a flat concrete roof for rainwater drainage. This roof can be supported off the main concrete roof.

d. Other buildings classified as critical infrastructure and with BAL rating 29 or higher must comply with section 2.4.5.3.c.

2.4.5.3 Ceiling fire rating

The fire rating of the ceiling must be in accordance with Section 2.5 of this document.

a. Withstand forces it may be subjected to in additional to the internal wind pressure, like pressure from top venting of arc flash, or

   Provisions made to prevent such pressure to the ceiling.

b. Services or ducts running below the ceiling must be supported by a separate structural beam system placed below the ceiling, or

   Design to ensure that the seismic restraints passing through the ceiling do not impact fire performance of the ceiling.

c. Ceiling in buildings that are classified as critical infrastructure and with BAL rating 29 or higher, must be of a self-supporting system (not impacted by bushfire), be weatherproof, waterproof and be able to drain any water that accumulate over the ceiling.

Note: Intense bushfire can likely compromise fire rating, weathertightness and waterproofing of a roof. This is caused by excessive deformation/failure of light steel purlins that support the roof and ceiling system. Measures noted in point c will ensure operation continuity of the facility.

2.4.5.4 Other requirements of Roofs

Roof construction details must comply with the NCC for dampness and weatherproofing, ventilation, insulation, and energy efficiency of the building. Any additional acoustics if required by the EPA must also be complied with. For further detail refer to section 3 of this document.

A fall prevention system must be provided to ensure safe access for roof and gutter maintenance, in accordance with working at heights WHS (Work, Health and Safety) compliance requirements and AS 1891.4. The designer must consult with Sydney Water project team, regarding project specific requirements for rooftop safety access walkways, fall arrest anchor points, and vertical cage ladders.

2.4.6 Walls

Structural double brick, concrete masonry, or concrete panels must form the building envelope of the pumping station and electrical buildings classified as critical infrastructure. Movement joints must be provided along the walls to allow for shrinkage and swelling of the wall material. Joints and sealants must comply with the required fire rating and durability.

Since clay is more sustainable than concrete, cavity clay (brick) masonry is preferred whenever practical.

2.4.6.1 Bushfire impact on walls

0Refer to Section 4 for specific requirements for walls in bushfire-prone areas.

2.4.6.2 Fire rated walls

Refer to Section 2.5 for the required fire rating for each type of Sydney Water building. Doors and windows on the walls must have the same fire ratings as the walls.

Precast wall connections must:

a. Be designed to have the same fire rating as the panels.

b. Not compromise the stability of the structure by failing prematurely during or after a fire event.

Failure mechanisms of the building affected by fire must be designed to ensure the safety of people and property around the building.

2.4.6.3 Other requirements of walls

Wall section assembly and detailing must comply with the NCC for damp and weatherproofing, ventilation, insulation, and energy efficiency of the building. Additionally, acoustic insulation where required, must comply with EPA requirements. For further detail refer to section 3 of this document.

The external colour of the buildings must blend in with the surroundings, especially if located close to residential and public areas. Refer to other Sydney Water specifications like pumping stations for details on the building colour. Anti-graffiti paint must be applied on external walls up to 3 meters from ground level.

2.5 Fire rating of buildings

Apart from the fire rating addressed in this section, the overall fire design must generally comply with Section C of the NCC. For further details, refer to Section 3.2 of this document.

Table 4 lists the required FRLs for Sydney Water buildings, which take precedence over the FRLs stated in the NCC for the same class of buildings.

The building fire rating must consider the following:

a. Based on current and future expected fire source.

b. The external cladding must be non-combustible,

c. No external fire source must be closer than 3 meters to the building envelope.

d. Buildings in a bushfire zone, must in addition comply with Section 4 of this document.

2.5.1 Fire rating for buildings classified as a critical infrastructure asset

For buildings classified as critical infrastructure assets, the fire rating in Table 4 applies to:

a. External wall: Applies to both the internal and external surfaces.

b. Fire compartment wall: Applies to both the internal surfaces.

c. Roof in a bushfire zone with a BAL rating less than 29: Applies to the internal surface.

d. Roof in a bushfire zone with a BAL rating greater than or equal to 29: Applies both ways and in addition, must comply with section c2.4.5.3c.

The most stringent values between Table 4 and site-specific fire rating requirements must be adopted for all required surfaces.

2.5.2 Fire rating for buildings not classified as a critical infrastructure asset

For buildings not classified as critical infrastructure assets, the fire rating in Table 4 applies to:

a. External wall: Applies to both the internal and external surfaces.

b. Fire compartment wall: Applies to both the internal surfaces.

c. Roof in a bushfire zone with a BAL less than 29: Applies to the internal surfaces

d. Roof in a bushfire zone with a BAL rating greater than or equal to 29: Applies to the internal surfaces.

The most stringent values between Table 4 and site-specific fire rating requirements must be adopted for all required surfaces.

Table 4 - Minimum fire rating for Sydney Water buildings

Building type	NCC "Building classification"	Fire rating – external wall and fire compartment* wall (minutes) (Structural adequacy / Integrity / Insulation)
Pumping station / In-line booster pumping station	Class 8	120/120/120**
LV switchroom	Class 8	120/120/120** (including roof)
HV switchroom	Class 8	120/120/120** (including roof)
Workshop	Class 8	Type C construction**
Storage buildings (nonhazardous material)	Class 7b	Type C construction**
Out-loading /Dewatering building	Class 8	Type C construction
Buildings for non-critical equipment/machinery (no fire-risk)	Class 8	Type C construction**
Buildings classified as critical infrastructure and with BAL rating 29 or higher	Class 8	120/120/120** (including roof)

*Fire compartment wall – walls between areas like control room or Switchroom within a building.
** Fire rating provided here is for single storey buildings only. Fire rating for buildings with more than one storey must be derived by a competent Fire engineer.

Note Sydney Water operational buildings facilitate the provision of essential services to the public. Therefore, the fire rating of these buildings is greater than that of standard residential, commercial, or industrial buildings.

3. Compliance with NCC section D to F and J

The building design must comply with the Performance Requirements specified in the NCC. Verification methods and the Deemed-to-Satisfy Provisions outlined in the NCC, will not be accepted if the Performance Requirements—based on the building's purpose and associated risks—are not met.

3.1 Access and Egress.

Access, egress, escape, safe movement within the building, fall prevention, slips, access platforms, and handrails must comply with the following requirements, with the most stringent requirement being provided:

a. Section D of NCC Vol 1, must meet the performance requirements set under this section.

b. Section 1.7 of this specification (Building layout)

c. Section C10.7 of Sydney Water Technical Specification, Civil (Platforms, walkways, open flooring, stairways, and handrails)

d. Requirements set in other Sydney Water specifications that are relevant to the type of building.

3.1.1 Exemptions

As noted in NCC part D4D5 areas that are deemed inappropriate, unsafe or pose a health and safety risk for people with a disability, the following requirements are exempted:

a. E3P2 Evacuation lifts are not mandatory in Sydney Water operation buildings where building height is not greater than 25m.

b. D1P8 Carparking for people with a disability for buildings that meet NCC part D4D5.

c. D1P9 Communication system for people with hearing impairment at buildings that meet NCC part D4D5.

3.2 Services, equipment and fire safety

Fire safety design, firefighting equipment, smoke hazard management, lighting, and visibility in an emergency must comply with the following requirements, with the most stringent requirement being provided:

a. Section E of the NCC Vol 1, must meet the performance requirements set under this section.

b. Requirements set in other Sydney Water specifications that are relevant to the type of building.

A fire safety engineer must undertake a performance-based fire design in consultation with the project and plant operating team, in compliance with NCC Schedule 7.

For further requirements specific to the type of building, refer to the following documents:

- Doc No. DOC0018 Technical Specification HV Switchroom for:
    - Fire and smoke detection
    - Distribution board
    - Lighting
    - General power
- Doc No. CPDMS0022 Technical Specification Electrical for:

  - Emergency lighting and smoke detector
  - Lighting
  - General power
  - Fire detector and security equipment
  - Flammable gas detector system
- Doc No. D0002071 Design Specification for Water Pumping Station for:
  - Power supply
  - High voltage equipment
  - Low voltage equipment
  - Lighting
- Doc No. DOC0016 Earthing and Lightning Protection

3.2.1 Exemptions

Fire hose reels, fire hydrants, sprinklers, and other water-based equipment are exempt from use in switchrooms, pumping stations, and facilities where water is unsuitable for fire suppression.

3.3 Health and amenity

Health and amenity requirements must comply with Section F of the NCC and the requirements set in other Sydney Water specifications that are relevant to the type of building, when designing health and amenity requirements within the building.

Though the NCC exempts the followings sections for Class 8 buildings, these sections must be complied with for application of this specification:

a. NCC section F1P2 Preventing rainwater from entering building
b. NCC section F1P4 Rising dampness
c. NCC section F3P1 Weatherproofing

3.3.1 Damp and weatherproofing

The building design must comply with relevant standards for damp-proofing and weatherproofing. Some of the codes to refer to, but not limited to, are:

- AS/NZS 3500.3 - Plumbing and Drainage Part 3: Stormwater drainage
- AS 4654.1 and AS 4654.2 - Waterproofing membranes for external above-ground use
- AS 3740 - Waterproofing of domestic wet areas
- AS/NZS 2904 - Damp-proof courses and flashings
- Condensation management – Sarking or underlay must comply with:
  - AS 4200.1: Pliable building membranes and underlays – Materials
  - AS 4200.2: Pliable building membranes and underlays – Installation requirements
- This specification - section 2.4.5 Roof and section 2.4.6 Wall.

3.3.2 Sanitary and other amenities

The provision of amenities within a Sydney Water building must comply with performance requirements of the National Construction Code (NCC). Consult with the plant operational personal to understand the number of occupants and the proximity of sanitary facilities in nearby buildings. Also, refer to other Sydney Water specifications that are relevant to the type of building, for requirements on the amenities.

Switchrooms buildings for wastewater pumping station must be provided with a toilet and hand basin

3.3.2.1 Exemption

Sanitary amenities are exempt in standalone Switchroom buildings. Designers must consult with the plant operation team for exemption of such facilities in a Sydney Water building.

3.3.3 Ventilation

The air quality and temperature within the building must safeguard occupants' health and or the equipment's functionality. Following is list of standards to comply with but not limited to:

- NCC part F6.
- Workplace exposure standards for airborne contaminants
- BMIS0209 – Technical Specification - Mechanical
- D0002071 Design Specification for Water Pumping Station
- Appendix 1 of D0002071 – In-line pressure booster pumping station
- D0001896 Design Specification for Sewage Pumping Stations Dry Well Ventilation
- DOC0018 Technical Specification HV Switchroom
- CPDMS0022 Technical Specification Electrical

Air conditioning and ventilation systems must be fitted with H_2S (Hydrogen Sulphide) scrubbers in electrical Switchrooms and zones containing electrical equipment to ensure durability and proper functioning of the equipment.

3.3.4 Flammable gas detection system

A flammable gas detector system must be provided at all gas hazardous area(s). The alarm signal must be wired to the IICATS and plant SCADA system. The control panel must be installed outside the gas hazardous area. Upon detection of gas, the system must cut off the electrical power supply to the gas hazardous area, including batteries and UPS.

Flammable gas detection system must comply with AS/NZS 61779.6:2000 – Electrical apparatus for the detection and measurement of flammable gases. Part 6: Guidance for the selection, installation, use and maintenance of apparatus for the detection and measurement of flammable gases (IEC 61779-6:1999 MOD)

3.3.5 Sound transmission (insulation)

The building acoustic design must comply with the requirements of NCC and the EPA NSW Noise Policy for Industry.

3.4 Energy efficiency

The energy efficiency of the building must in general comply with the NCC Section J. Building energy efficiency must consider Sydney Water's requirements for climate change adaptation, as noted in Section 1.6 of this document.

A project-specific design must be developed to address the building's thermal performance and energy use, particularly for buildings where temperature control is essential.

The external envelope of buildings requiring air conditioning for temperature regulation must have a minimum thermal resistance rating of R2.5 or higher.

4. Bushfire Protection

A bushfire report must be prepared by a bushfire consultant if the site is deemed bushfire-prone. The report must include measures to reduce bushfire risk to the building.

The design must comply with the following even though NCC Part G5 'Construction in Bushfire Prone Areas' does not specifically apply to Class 5-8 buildings;

- NSW Rural Fire Service document 'Planning for Bush Fire Protection' (PBP) -2019.
- AS3959 Construction of buildings in bushfire prone areas.
- Section 4.0 of WSAA 'Bushfire Management – National Good Practice Operational Guidelines for the Australian Water Industry.

Chemical storage buildings must not be in a bushfire prone area without proper assessment of the risk.

4.1 Critical infrastructure asset in bushfire zone

For buildings classified as critical infrastructure assets as per Section 1.5, and if the bush fire attack level (BAL) rating of the building is greater than or equal to 29, the designer must comply with the following requirements in addition to the above list:

a. Provide an adequate asset protection zone (APZ) in accordance with NSW Rural Fire Service document 'Planning for Bush Fire Protection' (PBP) -2019 and WSAA 'Bushfire Management'.
b. 2 hours fire rated building enclosure on both external and internal surface, including all external doors, windows and other openings, satisfying structural adequacy, integrity and insulation.
c. External walls of pumping stations and electrical buildings must be constructed of brick, masonry or concrete.
d. For requirements of roof refer to section 2.4.5.2 and 2.4.5.3.
e. All amber protection mesh and sealants on external openings must be 2 hr fire rated.
f. Amber protection mesh with maximum 2mm aperture of non-combustible, corrosion-resistant steel, bronze or aluminium.
g. Air intake into building through louvers or other system if required, must be placed on wall opposite to the one facing the bushland.

The outcome must ensure operational continuity of the critical infrastructure asset as far as practically possible. Though existing assets and services around the building in its present condition may not meet the current standards, proposed new assets and modifications of existing buildings must meet the above-stated requirements.

Note: Although NCC Part G5 'Construction in Bushfire Prone Areas' does not specifically apply to Class 5-8 buildings, compliance with Australian Standard AS3959 'Construction of Buildings in Bushfire-Prone Areas' - 2018 is mandatory for Sydney Water buildings. Note that AS3959 is a residential bushfire standard, and critical infrastructure design outcomes must exceed AS3959 objectives.

5. Repurposing existing buildings

5.1 General

Existing buildings must be assessed before they are intended to be reused or repurposed. The assessment must be in accordance with:

- AS ISO 13822-2005; Basis for design of structures - Assessment of existing structures.
- NCC handbook on Upgrading of Existing Buildings
- AS 3826-1998 Strengthening existing buildings for earthquake.

The assessment and strengthening must cover all aspects of the building, including but not limited to structural, fire resistance, access & egress, services & equipment, health & amenity, and bushfire. A structural assessment must be undertaken to determine the remaining service life of the building. Strengthening, rectification, and repair must be undertaken if required, to enable the building to be reused or repurposed for a minimum period of 25 years or as specified in the contract document.

Condition assessment must be conducted during the concept or scoping stage of the design. This will help determine the feasibility and implications of repurposing or reusing an existing building.

5.2 Structural assessment and strengthening

5.2.1 Minimum requirements

The structural assessment and strengthening must comply with the relevant current standards and this specification. The assessment and strengthening must be based on the design margin in as-is condition with respect to strength, stability, and serviceability, also considering the future deterioration of the structure. Strength values and capacity reduction factors of structural materials must be in accordance with Table 1 of AS 3826.

Other design aspects of the NCC, such as fire, access and egress, services and equipment, health and amenity, and energy efficiency, must be checked and, as required, upgraded to suit the new requirements of the repurposed building.

5.2.2 Exemption

A structural assessment may be exempted when reusing or repurposing a building that meets all the following criteria:

a. less than 50 years old,
b. no change in usage including the importance level to AS/NZS 1170.0,
c. requires no structural modification to the building and
d. does not show any signs of deterioration.

Nevertheless, a general condition assessment of the building must be carried out to ensure it is fit for purposes.

5.2.2.1 Minor and local modifications

Minor modifications that increase demand on the overall structure or decrease its capacity by 5% or less need not be considered as a change in usage or modification of the structure for the application of Section 5.2.2.

However, local modifications that are likely to increase demand or reduce capacity of structural elements must be assessed. This can be limited to the elements that are structurally impacted by the modification, this must include all the structural elements in the load path, including foundation.

6. Security

Building security must be part of the design submission, and security requirements must be established in consultation with Sydney Water. Reference must be made to the document “Sydney Water Site Security,” which is currently under development. Specific security requirements will be made available to designers upon request.

7. Signages

Signages must be provided in compliance with SDIMS0026 - Service Delivery Safety Signage Specification. This section must be read in conjunction with the signage requirements specified in other Sydney Water specifications related to the building design.

8. Stormwater management

Stormwater drainage on the roof and around the building must be in accordance with NCC Part F1 and designed to AS/NZS 3500.3 - Stormwater Drainage as follows:

- The intensity of rain considered for the roof design must be in accordance with Cl 3.3.4 of AS/NZS 3500.3 and
- The intensity of rain considered for the surface water design must be in accordance with Cl 5.2.3 of AS/NZS 3500.3.

Stormwater collected from the building site must be drained into the designated stormwater system. The stormwater design must avoid soil erosion, ponding of water around the building, and ingress into the building. Special attention must be given to avoid water entry into building floors and subfloors that has electrical equipment.

9. Access to and around the building

A minimum of 600mm wide concrete pavement must be provided all around the building to protect the foundation from soil erosion and avoid water ponding next to the foundation.

All pedestrian access ways must be a minimum of 1000mm wide concrete pavement, including the path leading from the road to the buildings and any access paths required around the building.

A sealed area for parking spaces must be provided adjacent to the building site. The required number of parking spaces, loading/unloading areas, or other project-specific requirements around the building must be determined in consultation with the Sydney Water project and operations team.

Driveways, car parks, and all access paths to the building must be designed to sustain the relevant traffic load. Buildings accessed by trucks must be provided with suitable access for manoeuvring the vehicle into and out of the building and turning.

10. Architectural specifications

Architectural specifications must be submitted along with the other building design documents. The specifications must refer to the general conditions of the contract and specific quality assurance requirements. The architectural specifications must be in the form of drawing notes or a standalone document, as required by Sydney Water. Below are some of the items that must be included but not limited to.

- Adhesives and Sealants
- Fasteners
- Fire stopping
- Metals and Prefinishes
- Building Access and Safety system
- Steel Finishes and Protective coating
- Colourbond steel and Zinculume steel in roof
- Doors, Windows and Louvers
- Thermal insulation and Pliable membrane
- Acoustic insulation
- Lining
- Suspended ceilings – Ceiling units
- Metalwork-Fabricated
- Signage
- Cementitious Toppings
- Ceramic Tiling
- Painting
- Sanitary fixture
- Termite management
- Waterproofing – wet area

11. Deliverables

Below is a list of documents and drawings to be submitted to Sydney Water upon completion of various stages of the building design, as agreed with the Sydney Water project team.

The listed items must be submitted as individual documents for medium, major, and complex projects. For minor projects the individual documents can be combined, for example combined Architecture and Structural documentation or combined Fire and Building services documentation, where deemed appropriate.

Buildings must be designed by qualified engineers and categorized as noted in the Sydney Water Engineering Competence Standard D0000833.

- BCA report and final certification
- Architectural drawings
- Architectural specification
- Structural design report, including calculations and certification
- Structural drawings, Specification/General notes
- Geotechnical design report, Specification/General notes
- Fire design report, including calculations and certification
- Fire design drawing, Specification
- Civil design report, including calculations and certification
- Civil drawings, Specification/General noted
- Building services design report, including calculations and certification
- Building services drawing, Specification/General notes
- Building services specification
- Plumbing design report, including calculations and certification
- Plumbing drawing, Specification/General notes
- Plumbing specification
- Safety in design and risk assessment report

Ownership

Ownership

Role	Title
Group	Engineering, Engineering and Technical Support
Owner	Norbert Schaeper, Engineering Manager
Author	Sushma Manjunatha

Change history

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1	Sushma Manjunatha	Christie Sebaratnam	1/08/2025	Norbert Schaeper	11/08/2025