Fire Safety Systems Guideline

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Acronyms

Table 1: Acronyms

Acronym	Term	Definition
AFSS	Annual Fire Safety Statement	Document issued annually that states that each essential fire safety measure specified in the statement has been assessed by an accredited practitioner (fire safety) as capable of performing to a standard no less than that specified in the schedule, and that the building has been inspected by an accredited practitioner (fire safety) and was found, when it was inspected, to be in a condition that did not disclose grounds for a prosecution.
AIDGC	Australian Institute of Dangerous Goods Consultants	Industry body for accredited dangerous goods consultants.
BCA	Building Code of Australia	Mandatory national technical standards for building design and construction. The BCA is included in the NCC volumes one and two.
BPAD	Bushfire Planning and Design	An accreditation scheme developed by FPA for practitioners undertaking development on land subject to bushfire impact.
CC	Construction Certificate	The approval that is granted before any building works can begin in accordance with development consent. This is a part of the Part 4 planning pathway under the EP&A Act. Construction Certificates do not apply to certain Crown building work pathways; applicability depends on project approval pathway. **Crown Certificates** are issued under s.6.28 of the EP&A Act prior to commencement of Crown Building Work. It certifies compliance with the BCA. They are issued for Crown Building Work that requires a Crown DA, SSDA, or REF.
CCP	Critical Control Point	A specific step in a process where a hazard can be prevented, eliminated, or reduced to an acceptable level.
CDA	Complying Development Application	Fast-track approval for development that meets set standards, combining planning and construction approval in a single certificate.
CDC	Complying Development Certificate	A fast-track planning approval for some types of development that meet prescribed development standards and other requirements.

Acronym	Term	Definition
CHAIR	Construction Hazard Assessment and Implication Review	Safety in Design deliverable in the form of risk assessments to identify and reduce construction, maintenance and operational safety risks.
CHAZOP	Control Systems Hazard and Operability	Safety in Design deliverable that is a risk assessment used to identify potential safety, reliability, or operational failures in control systems.
CIRMP	Critical Infrastructure Risk Management Program	A regulatory framework for managing risks to critical infrastructure.
CISC	Critical Infrastructure Security Centre	Regulatory body that assists critical infrastructure owners and operators to understand the risk environment and meet their regulatory requirements.
DA	Development Application	An application for development consent under Part 4 of the EP&A Act.
DGR	Dangerous Goods Report	A compliance report covering dangerous goods storage and management.
DtS	Deemed-to-Satisfy	Provisions that are considered pre-approved, prescriptive building solutions that comply with the NCC/BCA Performance Requirements.
EFSM	Essential Fire Safety Measures	Items of equipment, forms of construction, or fire safety strategies that are implemented in a building to ensure the safety of occupants during a fire emergency. They include statutory fire safety measures that are listed in s. 79(4) of the *Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021* (NSW).
EIS	Environmental Impact Statement	A detailed assessment of environmental impacts that complies with requirements in the EP&A Act and Regulations. It often contains mitigation measures that are required to be implemented.
EPA	Environment Protection Authority	NSW's independent environmental regulator which regulates the protection of human health and the environment from pollution, waste and noise.
EP&A Act	Environmental Planning and Assessment Act 1979	The Act that provides the framework for regulating land use planning and development assessment in NSW.
EPIRMP	Emergency & Pollution Incident Response Management Plan	A management plan that minimises the risk of a pollution incident and establishes notification, action and communication procedures during a pollution incident.
EWIS	Emergency Warning and Intercommunication System	A Fire Safety System in large buildings that manages evacuations through automated, audible alert tones, voice instructions, and emergency warden phone systems.

Acronym	Term	Definition
FECDR	Fire Engineering Concept Design Report	Report establishing the fire engineering strategy at the concept design stage.
FEIR	Fire Engineering Inspection Report	Report confirming that the fire engineering outcomes from the Fire Engineering Report have been implemented during construction.
FER	Fire Engineering Report	Report demonstrating compliance with NCC/BCA fire requirements.
FFSR	Final Fire Safety Report	FRNSW written report issued in applicable cases, typically at pre-occupation stage, addressing relevant performance solution compliance and hydrant access/compatibility matters.
FMECA	Failure Mode, Effects, and Criticality Analysis	Systematic risk-based tool used to identify potential system failures, their causes and their effects.
FPAA	Fire Protection Association Australia	Non-profit organisation that supports and informs the fire protection industry in Australia.
FRL	Fire Resistance Level	A rating provided to materials and systems that determine their performance during a fire, as tested to AS 1530.4
FRNSW	Fire and Rescue New South Wales	NSW emergency service responsible for firefighting and rescue.
FSC	Fire Safety Certificate	Document certifying that each essential fire safety measure specified in the current fire safety schedule for the building has been assessed by an accredited practitioner (fire safety) as capable of performing to at least the standard required by the current fire safety schedule. It is required before the issue of a BCA Completion Certificate (Occupation certificate is used for Private Sector) for a new building or a change of use of an existing building. It can be a final certificates for the whole of the building or interim certificates for part of a building.
FSS	Fire Safety Study	A Fire Safety Study identifies and evaluates site-specific fire risks and recommends appropriate protection measures based on the facility's unique hazards. It includes a HAZID and risk assessment to analyse likelihood, consequences, and controls.
FSSc	Fire Safety Schedule	Document listing the current and proposed fire safety measures that must be implemented for the building, including statutory and other fire safety measures.
HAZID	Hazard Identification	A qualitative or semi-quantitative study used in early project development stages to identify potential hazards, threats, and environmental impacts.

Acronym	Term	Definition
HAZOP	Hazard and Operability Study	A risk assessment methodology used to identify potential hazards and operational inefficiencies.
HIDRA	Hazard Identification and Risk Assessment	An extension of HAZID that enables the Design Team to assess risk severity, evaluate existing mitigation measures and recommend risk reduction measures.
HV	High voltage	Refers to electrical systems typically operating above 1,000V AC or 1,500V DC.
IFC	Issued for Construction	Refers to drawings approved by architects and engineers that are used for construction.
IFSR	Initial Fire Safety Report	Report from FRNSW during design phase documenting their feedback from the Fire Engineering Report including the relevant performance solution matters
IFSS	Interim Fire Safety Strategy	Temporary fire safety measures during construction or staged occupation.
IICATS	Integrated Instrumentation, Controls, Automation and Telemetry System	A system monitoring and managing the SCADA network for controlling systems like pumping stations, reservoirs and valves.
ISO	International Organization for Standardization	Organisation that develops international standards for quality, safety and efficiency across many industries.
ITPs & ITCs	Inspection Test Plans & Inspection Test Checklists	Documents specifying inspections, tests, and verification activities that are typically part of project QA requirements.
LPG	Liquefied petroleum gas	Versatile and portable hydrocarbon fuel consisting of propane, butane or a mixture of both.
LV	Low voltage	Refers to electrical systems typically operating below 1,000V AC or 1,500V DC.
MIUP	Management In Use Plan	A project-specific operational document that describes how a facility will be used, managed, and maintained to support ongoing safety and compliance, particularly where fire engineering performance solutions rely on operational assumptions.
MoU	Memorandum of Understanding	A formal, non-binding agreement outlining collaboration between parties.
NCC	National Construction Code	Mandatory national technical standards for building design and construction. The NCC is a three-volume document with the Building Code of Australia included in volumes one and two and the plumbing code in volume three.
NFPA	National Fire Protection Association	International non-profit organisation dedicated to reducing fire, electrical, and related hazards, based in the United States of America.

Acronym	Term	Definition
OC	Occupation Certificate	The approval granted to occupy a building after construction works have been completed in accordance with development consent. This is a part of the Part 4 planning pathway under the EP&A Act. OCs do not apply to certain Crown building work pathways; applicability depends on project approval pathway.
PBDB/FEBQ	Performance-Based Design Brief / Fire Engineering Brief Questionnaire	Document outlining objectives and methods for fire engineering design. Previously known as a Fire Engineering Brief Questionnaire.
PCBU	Person Conducting a Business or Undertaking	A legal entity responsible under WHS legislation for ensuring health and safety.
PHA	Preliminary Hazard Assessment	An early-stage study identifying hazards and evaluating risks.
P&IDs	Piping and Instrumentation Diagrams	Engineering drawings showing piping, instrumentation, and controls.
PPE	Personal Protective Equipment	Specialised clothing or equipment used to minimise exposure to hazards that can cause injury or illness.
PSR	Performance Solutions Report	Explains how alternative designs meet Performance Requirements.
RACI	Responsible, Accountable, Consulted, Informed	A RACI matrix (Responsible, Accountable, Consulted, Informed) is a project management tool that maps stakeholders to tasks to clarify roles.
REF	Review of Environmental Factors	Document prepared to examine and take into account matters affecting or likely to affect the environment by reason of an activity under Part 5 of the EP&A Act.
RFS	Rural Fire Service (NSW)	Volunteer-based emergency service. It responds to bushfires and protects life, property, and the environment.
SDS	Safety Data Sheets	Document providing comprehensive information on hazardous chemicals, including properties, health hazards, protective measures, and safety precautions.
SEE	Statement of Environmental Effects	Document outlining the likely impacts of proposed development of land and other matters forming part of DAs under Part 4 of the EP&A Act.
SEPP	State Environmental Planning Policy	An environmental planning instrument made under the EP&A Act that applies across the State of NSW.
SCADA	Supervisory Control and Data Acquisition	System that allows industrial organisations to control processes locally or remotely, gather real-time data, and interact with devices such as sensors and motors.

Acronym	Term	Definition
SFAIRP	So Far As Is Reasonably Practicable	A WHS principle requiring risks to be managed considering likelihood, severity, and cost-effectiveness as defined by the WHS Act and Sydney Water Safety in Design Procedure.
SiD	Safety in Design	A process ensuring hazards are identified and controlled during design.
SIP	Standard Incident Procedure	A procedure that provides a structured, multi-stage approach to identify and resolve unexpected events. These include immediate response and safety, mandatory reporting to authorities, documentation, investigation and implementation of corrective actions.
SSD	*State Significant Development*	State-declared development of economic, environmental, or social significance assessed at the State level.
SSI	State Significant Infrastructure	Infrastructure development declared under the *Environmental Planning and Assessment Act 1979 (NSW)* as being of State significance due to its economic, environmental, or social importance, and assessed under a State-level approval pathway.
SOCI Act	*Security of Critical Infrastructure Act 2018* (Cth)	The Act that mandates the security obligations for the eleven (11) vital sectors such as water, energy and transport to manage national security risks.
SOP	Standard Operating Procedures	Document that provides step-by-step instructions in carrying out operations for consistency, quality and compliance across an organisation.
SSDA	State Significant Development Application	Development Consent issued by the NSW Department of Planning, Housing and Infrastructure.
SWMS	Safe Work Method Statement	Mandatory document for site-specific construction work that outlines the safety hazards and control measures.
TISEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021	Policy that streamlines and regulates the planning and delivery of transport and infrastructure projects across NSW.
VESDA	Very Early Smoke Detection Apparatus	A high sensitivity aspirating smoke detection system that continuously samples the air for rapid detection.
WHS Act	Work Health and Safety Act 2011	The Act that governs workplace safety, aimed at protecting workers and others from harm by eliminating or minimising risks.

1. Introduction

1.1 Background and Context

One of the key challenges encountered in developing this guideline was aligning fire engineering systems delivery with water engineering project delivery. Fire engineering is focused on building compliance, whereas water engineering is focused on process performance, with an emphasis on service delivery and environmental protection. A fundamental distinction between the two lies in the number of applicable Acts and Regulations, as well as the inherent complexity of water and wastewater processes.

Key Acts reviewed as part of this guideline include the *Work Health and Safety Act 2011 (NSW)*, *Sydney Water Act 1994 (NSW), Environmental Planning and Assessment Act 1979 (NSW), the Security of Critical Infrastructure Act 2018 (Cth)*, as well as the *National Construction Code (NCC),* which includes the *Building Code of Australia (BCA)*.

In NSW, buildings subject to NCC compliance obligations must demonstrate compliance through the relevant statutory pathway. The NCC/BCA classifies buildings into ten different classes and provides Deemed-to-Satisfy (DtS) Solutions to address mandated Performance Requirements. It also allows Performance Solutions as an alternative to the DtS Solutions, or a combination of both.

While Performance Solutions offer greater flexibility, they introduce additional complexity through the burden of proof, increased validation, complex compliance tied to EP&A Act planning pathways, and additional engineering input. This complexity is further compounded by the need to align the Performance Solutions, driven by people and “adjacent property” protection, with Sydney Water’s requirement to protect its own critical assets, ensure service continuity, protect public health and meet its own specifications and operational requirements.

This guideline aligns the Fire Safety Systems life cycle with Sydney Water’s asset life cycle. Each stage - planning, design, construction, commissioning, operation, and maintenance - is addressed, with Fire Safety Systems deliverables added and explained. A role-based RACI table is presented, identifying key stakeholders and their respective Fire Safety Systems responsibilities.

The Guideline emphasises that fire safety extends beyond design and construction into the operational phase. Ongoing compliance relies on the maintenance of Fire Safety Systems to AS 1851, regular testing and certification, and the implementation of operational controls that support the assumptions underpinning the fire safety strategy. Where Performance Solutions are adopted, these controls must be clearly defined, documented, and integrated into existing operational systems and procedures.

When developing Performance Solutions to address fire risks, this guideline presents the common underlying principles identified in the International Fire Safety Standards. These principles include prevention, detection, communication, occupant protection, containment, and extinguishment. The Guideline emphasises the application of the hierarchy of control when proposing solutions, ensuring risks are addressed in a structured and defensible manner.

Acknowledging the challenges associated with project-specific Performance Solutions, this guideline introduces a structured fire risk assessment approach within the existing Safety in Design (SiD) procedure to ensure proposed designs address Sydney Water's requirements and risk universe, including enterprise, business, and operational risks. Additional fire-related keywords have been added into the SiD CHAIR 1 and CHAIR 2 templates. The same keywords can also be used for HAZOP workshops.

1.2 Scope and Applicability

This guideline applies primarily to new Sydney Water assets and projects, including major upgrades, renewals and significant modifications to existing assets. Asset types include treatment plants, pumping stations, chemical storage and dosing facilities, switch rooms, reservoirs and associated structures.

The guideline provides:

- Guidance on fire compliance including legislative, regulatory and governance expectations;
- Direction on integrating the fire asset life cycle with the water asset life cycle; and
- A framework and principles for fire safety design and risk assessment.

This guideline defines what needs to be considered, when it should be considered, and who should be involved. It does not prescribe detailed technical design solutions, nor does it provide detailed fire engineering calculations, installation manuals or asset-specific fire system designs.

This guideline should be read in conjunction with Sydney Water technical specifications, project delivery frameworks, risk management documentation and emergency management procedures. Where conflicts arise, legislative requirements and approved Sydney Water governance documents take precedence.

1.3 Intended Audience

This guideline is primarily intended for Sydney Water Project Managers, Asset Owners and Operators, Delivery and Assurance Teams, and risk and governance functions. It is also relevant to Designers, Fire Safety Practitioners, Certifying Authorities, Regulatory Authorities and other stakeholders. The guideline provides high-level direction and does not replace the need for suitably qualified specialists,

including Fire Safety Engineers, Dangerous Goods Consultants, BCA Compliance Consultants and other specialists, where required.

1.4 How to Use This Guideline

This guideline is not intended to be read cover to cover by all users. Rather, stakeholders should refer to the sections most relevant to their role within the asset life cycle. The guideline is divided into three main sections:

- Sections 2 and 3 address fire safety legislative, regulatory, and National Construction Code (NCC) requirements, and are primarily intended for planners and concept designers.
- Section 4 aligns fire safety requirements with the water asset creation life cycle and is relevant to designers, constructors, commissioning personnel, and operations teams.
- Section 5 covers fire safety risk assessment methodologies and design principles for Fire Safety Systems, including systems designed to address site-specific hazards and those developed as NCC Performance Solutions.

All Performance Solutions, complex hazard assessments, and Fire Safety Systems for non-standard assets should be undertaken by suitably qualified fire safety specialists.

2. Legislative and Regulatory Requirements

Fire safety obligations arise from multiple legislative and regulatory frameworks, including workplace health and safety, planning and building controls, and critical infrastructure protection. A general review of legislative requirements is presented below.

2.1 Work Health and Safety Act 2011 (NSW)

The *Work Health and Safety Act 2011 (NSW)* (WHS Act) focuses on the health and safety of workers and workplaces and is regulated by SafeWork NSW. The WHS Act assigns duties to both individuals and corporations with legal responsibilities for safety, including safety from fire, burns, and other hazards.

2.1.1 Fire Emergency Plan

The *Work Health and Safety Regulation 2025 (NSW)* mandates that a Person Conducting a Business or Undertaking (PCBU) must create, maintain, test, and implement an emergency plan that includes procedures for responding to emergencies, evacuating, notifying emergency services, and providing medical assistance. The WHS Regulation also requires the PCBU to consult with workers and provide training to ensure the emergency plan reflects the workplace's hazards, size, location, and personnel.

2.1.2 Safety Report and Effective Communication

The WHS Act requires effective communication between stakeholders involved in asset creation and operation where fire risks may arise. Designers must, so far as is reasonably practicable, provide a written safety report that identifies hazards unique to their design. The Act also requires the person constructing or commissioning the work to consult with designers to eliminate or minimise foreseeable risks and to pass all known information regarding site-specific hazards and risks to the principal contractor. This exchange of safety information, including fire-related hazards, must be documented and communicated to personnel involved in the project and throughout the asset's operational life cycle.

2.1.3 Flammable and Combustible Chemicals Management

The *Work Health and Safety Regulation 2025 (NSW)* specifies that the PCBU must manage flammable and combustible chemicals and keep their volumes to the lowest practicable quantities. The PCBU must prohibit ignition sources in areas where a fire or explosion is possible near hazardous chemicals. The PCBU must ensure safe storage and stability of these chemicals by following the manufacturer's instructions, including correct ingredient proportions and temperature controls.

2.1.4 Fire Protection and Firefighting Equipment

A PCBU must also provide fire protection and firefighting equipment specifically designed for the types and quantities of hazardous chemicals present, taking into account the total fire load and chemical compatibility. The equipment must be compatible with local emergency services, be properly maintained, readily accessible at all times, and supported by up-to-date inspection and testing records. If any firefighting equipment becomes unserviceable, the PCBU must assess the risks, implement alternative safety measures immediately, and restore the Fire Safety System as soon as practicable.

2.2 Environmental Planning and Assessment Act 1979 (NSW)

The *Environmental Planning and Assessment Act 1979 (NSW)* (EP&A Act) establishes the framework for land use planning and development assessment in NSW. While the EP&A Act does not stipulate fire safety requirements directly, it governs the pathways for development approval, and these pathways determine (via the NCC/BCA and AS 1851) how fire safety requirements are applied.

2.2.1 Approval Pathways Under the EP&A Act

Sydney Water may deliver infrastructure through several planning pathways established under the EP&A Act. Each pathway determines the applicable environmental assessment requirements and NCC/BCA obligations that include fire safety compliance. For more details, refer to Sydney Water document SWEMS0019 – Environmental Impact Assessment and Approval Pathways. The approval pathways are detailed in section 9.1 Appendix A - EP&A Act Approval Pathways and summarised in Figure 1 below.

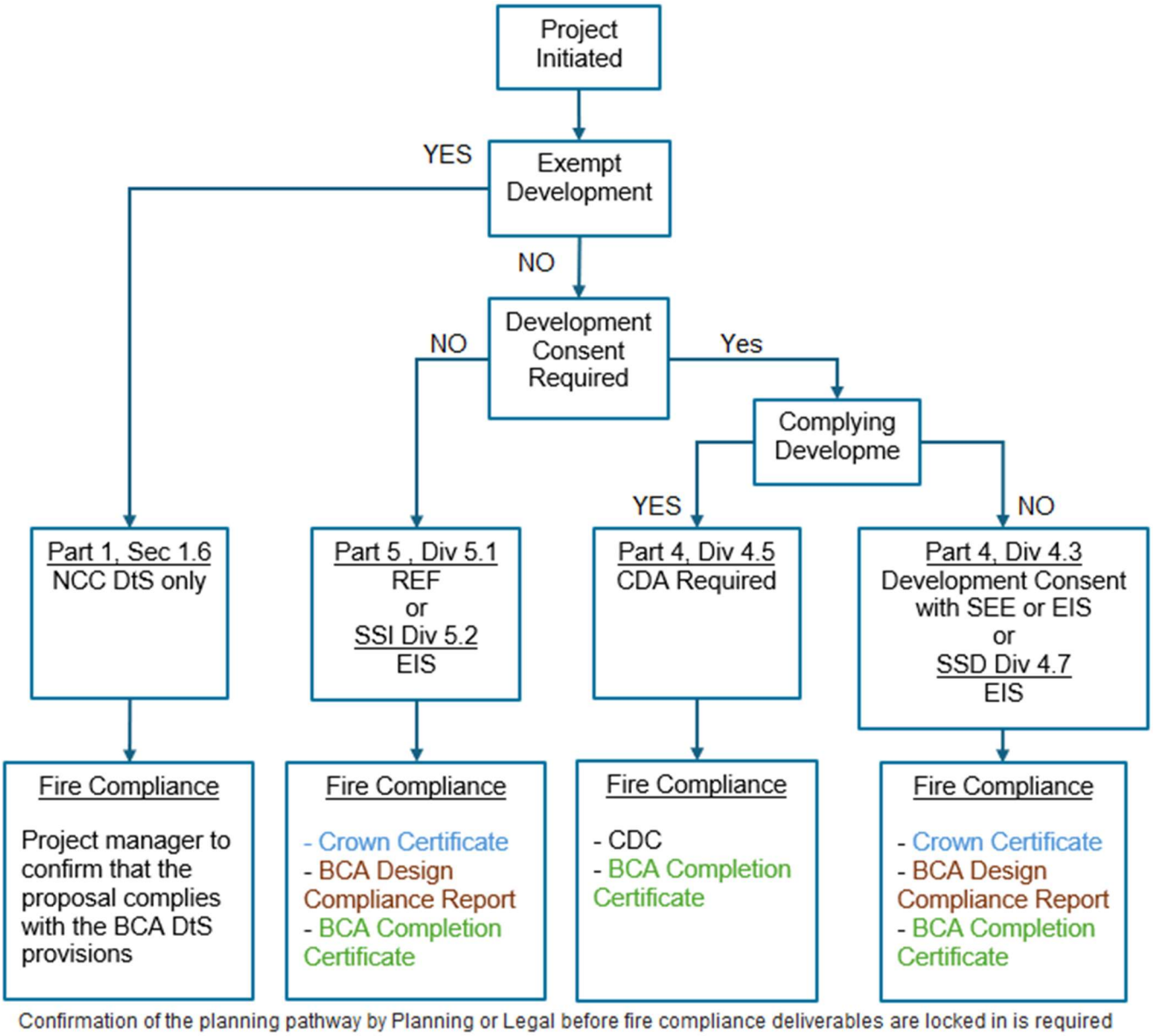


Figure 1: Fire compliance requirements as influenced by EP&A Act

2.2.2 Crown Building Work

Sydney Water is a public authority and the Crown for the purposes of the EP&A Act. Crown building work is development (other than exempt development) or an activity that is subject to environmental impact assessment under part 4 or 5, by the Crown that comprises the following:

- the erection of a building, or
- the demolition of a building or work, or
- the doing of anything that is incidental to the erection of a building or the demolition of a building or work.

Crown building work cannot be commenced unless it is certified by or on behalf of the Crown to comply with the NCC/BCA under Part 6 of the EP&A Act (see s. 6.28 of the EP&A Act). Compliance is typically certified in a document that is often called a Crown Certificate. For the purposes of this guideline, the term *Crown Certificate* is used in this sense to refer to certification of Crown building work required under s. 6.28 of the *Environmental Planning and Assessment Act*.

As part of issuing this certification, the Certifier reviews building drawings for NCC/BCA compliance, updates Fire Safety Schedules, and consults with Fire Safety Engineers and Accredited Certifier - Fire Safety (formerly C10 Certifier) for more complex buildings or structures where classifications are not straightforward. Project-specific legal advice with regard to pathway-specific fire compliance certification will be required. Additionally, building surveyors and FRNSW engagement will also be required, particularly for SSI and other modified pathways.

Sydney Water remains responsible for ensuring all completed buildings and structures, including Fire Safety Systems, comply with the NCC/BCA. To demonstrate due diligence, project teams may engage a Certifier (Building Surveyor Unrestricted (formerly A1 Certifier)) to issue a BCA Completion Certificate once construction is finished, which can then be filed with project closeout documentation. Common examples of works delivered under this pathway include sewage treatment plants, biosolids treatment facilities, and water recycling facilities.

2.2.3 Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021

The *Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021* (NSW) regulates fire safety requirements for certain buildings, including office buildings, carparks, storage-type buildings such as warehouses, buildings in which a process is carried out for trade, sale or gain and laboratories. For buildings other than Class 1a (single dwellings) or Class 10 buildings (non-habitable structures like sheds, carports and garages associated with a house) or temporary structures, it requires:

1) A Fire Safety Schedule to be issued in the approved form in certain circumstances, such as when a Crown Certificate for building work is issued. This specifies the current and proposed fire safety measures that must be implemented for the building.

2) Maintenance as per AS 1851-2012 (Routine service of fire protection systems and equipment) including inspection, testing and servicing of Essential Fire Safety Measures and that certain records are kept on site at the building for a minimum of seven years and made available for inspection by Fire and Rescue NSW (the Fire Commissioner) or the relevant local council upon request. There are various offences for failing to do so.

3) Fire Safety Certificates (either final or interim) to be issued in the approved form, which certifies that each essential fire safety measure specified in the current fire safety schedule for the part of the building has been assessed by an accredited practitioner (fire safety) as capable of performing to at least the standard required by the current Fire Safety Schedule. This is required to be provided to the Fire Commissioner and be prominently displayed in the building.

4) Annual Fire Safety Statements (AFSS) to be issued by or on behalf of the building owner to ensure each Essential Fire Safety Measure specified in the statement has been assessed by an accredited practitioner (fire safety) as capable of performing to a standard no less than that specified in the Fire Safety Schedule and that the building has been inspected by an accredited practitioner (fire safety) and was found, when it was inspected, to be in a condition that did not disclose grounds for a prosecution. The owner of the building has a duty to provide the AFSS to the council.

5) Smoke alarms to be installed in certain buildings.

There are various offences that may be committed if there is a failure to comply with the Fire Safety Regulations.

2.2.4 Maintenance of Essential Fire Safety Measures under AS 1851:2012

From 13 February 2026, the Australian Standard AS 1851:2012 for Routine Service of Fire Protection Systems and Equipment is mandatory in the *Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation* under Clause 81A. Building owners must ensure maintenance by inspecting, testing and servicing essential fire safety measures for the building in accordance with a Performance Solution or AS 1851:2012.

AS 1851:2012 details the routine service process and procedures, frequency and record keeping for the relevant fire safety measures as shown in Table 2. However, it should be noted that the *Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation* specifies thirty (30) statutory fire safety measures that are not all covered by AS 1851 for maintenance and routine servicing. Where not covered by AS 1851, the fire safety measure may have an alternative maintenance standard such as Sydney Water Electrical Specification or AS 2293.2 for emergency lighting and exit signs or maintained as per the requirements of NCC/BCA such as perimeter vehicle access for emergency vehicles. A summary of the statutory fire safety measures and their maintenance requirements is provided in Table 3.

Table 2: Routine service frequencies for each fire safety measure in AS 1851

AS 1851 Section		Monthly	Three-monthly	Six-monthly	Yearly	Five-yearly	Ten-yearly	Twenty-five-yearly	Thirty-yearly
1	Automatic fire sprinkler systems	✓		✓	✓	✓	✓	✓	✓
2	Fire pumpsets	✓		✓	✓	✓	✓		
3	Fire hydrant systems	✓*			✓	✓			
	Hydrant valves			✓	✓				
4	Water storage tanks for fire protection systems	✓		✓	✓		✓		
5	Fire detection and alarm systems	✓		✓	✓	✓			
6	Special hazard systems	✓		✓	✓		✓		
7	Delivery lay flat fire hose				✓				
8	Fire hose reels			✓	✓				
9	Portable and wheeled fire extinguishers			✓	✓	✓			
10	Fire blankets			✓					
11	Passive fire and smoke systems		✓**	✓	✓				
12	Fire and smoke control features of mechanical services	✓	✓	✓	✓	✓			
13	Emergency planning in facilities	✓		✓	✓				

* Where pumpsets are fitted.

** Where horizontal sliding doors are fitted.

NOTE: The responsible entity may elect to conduct monthly activities on a weekly frequency

It should be noted that Table 3 does not contain emergency planning despite it being in AS 1851:2012. Other fire safety measures can be documented on fire safety schedules, fire safety certificates and fire safety statements. These can include emergency planning, fire alarm monitoring, paths of travel and outcomes arising from Performance Solutions. Hence, a Performance Solution can be documented and captured on fire safety schedules, fire safety certificates and fire safety statements to amend the frequency of routine servicing of fire safety measures.

Table 3: Statutory fire safety measures and the associated maintenance requirements

Statutory Fire Safety Measure	Maintenance Requirement	Statutory Fire Safety Measure	Maintenance Requirement
Access panels, doors and hoppers to fire-resisting shafts	AS 1851:2012 Section 12	Fire windows	AS 1851:2012 Section 12
Automatic fire-safe devices	AS 1851:2012 Section 6 & Appendix D	Lightweight construction	AS 1851:2012 Section 12
Automatic fire detection and alarm systems	AS 1851:2012 Section 6 and 7	Mechanical air handling systems	AS 1851:2012 Section 13
Automatic fire suppression systems	AS 1851:2012 Section 2, 3 & 5	Perimeter vehicle access for emergency vehicles	NCC/BCA Clause C3D5
Emergency lifts	NCC/BCA Part E3	Portable fire extinguishers	AS 1851:2012 Section 10
Emergency lighting	AS 2293.2:2019	Safety curtains in proscenium openings	AS 1851:2012 Section 13
Emergency warning and intercommunication systems	AS 1851:2012 Section 6	Smoke alarms and heat alarms	AS 1851:2012 Section 6
Exit signs	AS 2293.2:2019	Smoke and heat vents	AS 1851:2012 Section 13
Fire control centres and rooms	NCC/BCA Clause E1D15 and Spec 19	Smoke dampers	AS 1851:2012 Section 13
Fire dampers	AS 1851:2012 Section 12 & 13	Smoke detectors and heat detectors	AS 1851:2012 Section 6
Fire doors	AS 1851:2012 Section 12	Smoke doors	AS 1851:2012 Section 12
Fire hose reel systems	AS 1851:2012 Section 9	Solid core doors	AS 1851:2012 Section 12
Fire hydrant systems	AS 1851:2012 Section 3, 4, 5 & 8	Standby power systems	AS 1851:2012 Section 13
Fire seals protecting openings in fire-resisting components of the building	AS 1851:2012 Section 12	Wall-wetting sprinkler and drencher systems	AS 1851:2012 Section 2
Fire shutters	AS 1851:2012 Section 12	Warning and operational signs	EP&A & NCC/BCA Section D

2.3 Security of Critical Infrastructure Act 2018 (Cth)

The *Security of Critical Infrastructure Act 2018 (Cth)* (SOCI Act) establishes a federal regulatory framework to safeguard critical infrastructure and essential services against security threats. Sydney Water is a declared critical infrastructure entity under the Act, with obligations to protect its infrastructure by addressing threats that may impact the availability, integrity, or reliability of essential services. Entities subject to the SOCI Act must implement and maintain a Critical Infrastructure Risk Management Program (CIRMP). The CIRMP applies an all-hazards risk management approach, including cascading, compounding and converging risks (refer to the CISC Water and Sewerage Sector Advisory). Fire safety forms a critical component of the CIRMP's physical security, natural hazards and operational resilience requirements. Key CIRMP applicable points include:

- Implementing risk-based fire protection measures for essential assets such as treatment plants, pumping stations, chemical storage, switch rooms, control buildings, etc.,
- Aligning fire system design, commissioning and maintenance with CIRMP governance, including documentation and evidence of control effectiveness,
- Ensuring Fire Safety Systems (detection, suppression, alarm and monitoring) do not create single points of failure within Operational Technology (OT) environments, and
- Coordinating with NCC/BCA, WHS, insurance and operational standards to eliminate compliance gaps.

Failure of Fire Safety Systems can create material risks under the SOCI Act, particularly where loss of a critical asset compromises the delivery of drinking water, wastewater treatment or environmental protection.

2.3.1 Challenges and Gaps

Integrating SOCI obligations with Fire Safety Systems in water utilities presents challenges, including:

- NCC/BCA classification limitations for water utility assets, noting that compliance is administered under the EP&A Act and is primarily designed for conventional occupied buildings. Many Sydney Water assets fall outside typical NCC/BCA classifications, creating ambiguity where NCC/BCA driven fire protection requirements do not specifically address SOCI Act driven risk obligations relating to operational continuity, asset criticality and systemic failure.
- Cyber-physical vulnerabilities, where fire system networks and SCADA interfaces may be exploited (refer to CISC Annual Risk Review).
- Interdependencies with other critical sectors where water supply continuity during fire scenarios is required for the protection of other critical assets (energy, telecommunications, transportation).

These gaps necessitate a holistic approach when determining the requirements for fire protection. Consideration should extend from NCC and WHS driven buildings and people fire protection to

include fire protection for critical water and sewer assets as well as the protection of other non-Sydney Water critical assets dependent on adequate flow and pressure for their fire protection.

2.4 Sydney Water Act

The *Sydney Water Act 1994* (NSW) establishes Sydney Water as a State-Owned Corporation with primary objectives that include safeguarding public health, protecting the environment, and operating as a commercially successful business. Under this Act, an Operating Licence was introduced, requiring Sydney Water to deliver services such as water supply, sewerage, stormwater drainage, recycled water, and wastewater management in an efficient, resilient, reliable, sustainable, and equitable manner.

While the Sydney Water Act and its associated instruments (including regulations, the Operating Licence, and the Customer Contract) do not prescribe detailed fire safety specifications comparable to those in the NCC/BCA, they do impose general requirements related to fire service connections and operational coordination as listed below.

2.4.1 Fire Hydrants

The Operating Licence prohibits the use of fire hydrants for any purpose other than firefighting or approved testing. Any unauthorised use may constitute an offence under the Act. In addition, a Customer Contract, included in the Operating Licence, permits Sydney Water to require the installation of a dedicated fire service water meter as part of the connection approval process. Other installation requirements for Fire Safety Systems, such as the provision of backflow prevention devices, are governed by separate Sydney Water policies. Refer to Section 3.5.1 Fire Hydrants for more details.

2.4.2 Minimum Hydrant Pressure

Under the Operating Licence, Sydney Water is required to provide a minimum head pressure of 15 metres at the point of connection. Where higher pressure or additional hydrant coverage is necessary - such as for high-rise buildings, large developments, or facilities with high-risk processes - the responsibility lies with the customer (or project team) to install booster pumps, storage tanks, and additional hydrants to meet specific fire protection needs. The maintenance and compliance of all private hydrants and Fire Safety Systems remain the responsibility of the property owner or Sydney Water Property Group.

2.4.3 Fire and Rescue NSW

The Operating Licence also requires Sydney Water to enter into a Memorandum of Understanding (MoU) with Fire and Rescue NSW (FRNSW). The MoU requires Sydney Water to consult with FRNSW during the design of new assets and to provide advance notice of planned maintenance activities that

could affect water flow or pressure. Furthermore, Sydney Water is expected to supply FRNSW with detailed information on fire hydrants across its network, including 95th percentile flow and pressure data. These flow and pressure details are essential for Fire Safety Engineers when preparing Development Applications for new buildings. To support this, Sydney Water maintains a comprehensive hydraulic model of its water supply network - including pipes, pumps, reservoirs, and hydrants - to generate Statements of Available Pressure and Flow upon request.

2.5 Relevant Australian Standards

The following list includes various Australian Standards and guidelines likely to be referenced in the development of Fire Safety Systems design, maintenance and safety procedures.

Table 4: Relevant Australian Standards

Standard Code	Title	Scope / Description
AS 1530.1	Methods for fire tests on building materials – Combustibility test for materials	Determines whether a material is combustible
AS 1530.2	Methods for fire tests on building materials – Test for flammability of materials	Determines the flammability index of a material
AS 1530.3	Methods for fire tests on building materials – Simultaneous determination of ignitability, flame propagation, heat release and smoke release	Fire hazard properties of materials including smoke-developed index and spread-of-flame index
AS 1530.4	Methods for fire tests on building materials – Fire resistance tests for elements of construction	Determines the fire-resistance level (FRL) i.e. structural adequacy / integrity / insulation
AS 1530.8.1	Methods for fire tests on building materials – Tests on elements of construction for building exposed to simulated bushfire attack – Radiant heat and small flaming sources	Determines the performance of building elements in bushfire prone areas
AS 1668.1	The use of ventilation and air conditioning in buildings – Fire and smoke control	Design of mechanical systems for fire and smoke control
AS 1668.2	The use of ventilation and air conditioning in buildings – Mechanical ventilation in buildings	Design of mechanical ventilation in buildings for air quality, odour control and humidity management

Standard Code	Title	Scope / Description
AS 1670.1	Fire detection, warning, control and intercom systems – System design, installation and commissioning - Fire	System design, installation, commissioning of general fire detection and alarm systems
AS 1670.3	Fire detection, warning, control and intercom systems - System design, installation and commissioning – Fire alarm monitoring	System design, installation, commissioning of fire alarm monitoring systems
AS 1670.4	Fire detection, warning, control and intercom systems – System design, installation and commissioning - Emergency warning and intercom systems	System design, installation, commissioning of EWIS system requirements
AS/NZS 1841.1	Portable fire extinguishers	General requirements for extinguishers
AS/NZS 1841.5	Portable fire extinguishers	Specific requirements for powder type extinguishers
AS 1851	Routine service of fire protection systems	Sets out the requirements for routine servicing, including inspection, testing, preventive maintenance, and survey of fire protection systems and equipment. It covers systems such as fire sprinkler systems, pump sets, hydrants, storage tanks, detection and alarm systems, special hazard systems, lay-flat hoses, hose reels, fire extinguishers, fire blankets, smoke control systems, and emergency planning measures.
AS 1905	Fire-resistant doorsets	Construction and performance of fire-resistant doors
AS 2118.1	Automatic fire sprinkler systems	System design, installation, commissioning of general sprinkler systems
AS/NZS 2293.1	Emergency lighting and exit signs for buildings	Design, installation and operation requirements
AS 2419.1	Fire hydrant installations	Design, installation and commissioning of hydrant systems
AS/NZS 1221	Fire hose reels	Design, construction, performance and testing of hose reels
AS 2441	Fire hose reels	Installation requirements
AS 2444	Portable fire extinguishers and fire blankets	Selection and location

Standard Code	Title	Scope / Description
AS 2941	Fixed fire protection installations – Pumpset systems	Design and installation of fire pumps for sprinklers and hydrants
AS/NZS 3000	Electrical installations	Design, construction and verification of electrical installations
AS 3959	Construction of buildings in bushfire-prone areas	Requirements for building materials and design to improve performance when exposed to bushfire attack
AS 4825	Tunnel Fire Safety	Guideline for fire safety for road, rail and bus tunnels

3. National Construction Code Overview

The National Construction Code (NCC) is a three-volume document with the Building Code of Australia (BCA) included in volumes one and two and the Plumbing Code included in volume three. It is predominantly applied to occupied buildings with limited provisions for structures. The applicable NCC edition must be confirmed at project approval/certification date. The NCC offers Deemed-to-Satisfy (DtS) solutions to its Performance Requirements as well as provision for performance solutions.

Many Sydney Water buildings are not easily classified under the NCC/BCA and may require performance-based fire solutions. Regardless of classification challenges, Sydney Water adopts compliance with the NCC/BCA Performance Requirements as a minimum benchmark noting that the legislative mechanism by which this compliance is demonstrated depends on project approval under the EP&A Act.

The NCC/BCA briefly brings up provisions for special hazards but provides little detail to the appropriate approach to determine the additional provisions required for fire spread mitigation and firefighting activities associated with special hazards. Additionally, bushfire considerations in the NCC/BCA are mainly applicable to residential buildings, health-care buildings, assembly buildings (such as early childhood centres and schools) and residential care buildings. Hence, the risks for special hazards and bushfires for Sydney Water facilities will need to be assessed and mitigated as part of Sydney Water's risk assessment procedures. Furthermore, the NCC/BCA does not explicitly address service continuity, which is a requirement under the *Sydney Water Act 1994* (NSW) or infrastructure protection, which is a requirement under the *SOCI Act*.

The NCC/BCA is divided into the following Sections covering different aspects of building construction:

- Section A – Governing Requirements

  This section provides guidance on complying with the NCC/BCA and references documents such as standards and manuals, documentation required for design and construction and the different building classifications.

- Section B – Structure

  This section provides Deemed-to-Satisfy (DtS) Provisions that aim to safeguard against injuries and physical damage caused by structural failure or failure of glazing and loss of amenity caused by structural behaviour.

- Section C – Fire Resistance

  This section focuses on providing adequate protection during evacuation, reduce fire spread within and between buildings and minimise the risk of fire spread to the public and occupants in buildings nearby.

- Section D – Access and Egress

  This section specifies the number and location of exits, construction and dimensions of exits to enable safe evacuation and providing access to and within buildings for people with disability with measures intended to reduce overall slips, trips and falls.

- Section E – Services and Equipment

  This section focuses on the provision of firefighting equipment to help occupants fight fire during the early stages and/or used to evacuate the building safely, provides automatic warning to occupants and maintain tenable conditions in a fire event for safe evacuation, provides adequate visibility along evacuation routes to locate exits, facilitate fire brigade intervention and minimise the risk of fire spread within and between buildings

- Section F – Health and Amenity

  This part provides guidance on surface water management, wet areas, roof and wall cladding, sanitary areas, room heights, light and ventilation, and sound transmission and insulation.

- Section G – Ancillary Provisions

  This section covers provisions to specific structures, buildings and their associated features such as swimming pools, boilers, fireplaces, chimneys, atriums, outdoor areas and buildings in alpine and bushfire prone areas.

- Section H – Class 1 and 10 Buildings

  This section can be found in NCC/BCA Volume 2 and stipulates the Deemed-to-Satisfy Provisions for Class 1 and 10 buildings in relation to the above sections such as structure, damp and weatherproofing, fire safety, health and amenity, safe movement and access, energy efficiency and additional construction requirements.

- Section I – Special Use Buildings

  This section provides further guidance on Class 9b buildings, public transport buildings, farm buildings and sheds.

- Section J – Energy Efficiency

  This section contains provisions for energy efficiency, building sealing, air-conditioning and ventilation, artificial lighting and power, heated water supply and energy monitoring.

For the purposes of this guideline, the sections relating to fire safety for Sydney Water assets would predominantly be in Sections C, D, E and F.

3.1 NCC/BCA Building Classifications for Sydney Water Facilities

The NCC/BCA categorises building classifications based on their function and use with the consideration of these buildings being occupiable. The building classifications set out the required Deemed-to-Satisfy Provisions for the building. However, some Sydney Water assets may not neatly fit into the NCC/BCA building classifications as they are not occupiable buildings. The closest building

classification to such assets may be Class 10a for non-habitable buildings and Class 10b which refers to a structure that is a fence, mast, retaining wall, free-standing wall, swimming pool or the like.

The below outlines the common building classifications for Sydney Water facilities.

- Class 5 Buildings – Refers to an office building used for professional or commercial purposes. For Sydney Water facilities, these would be office and admin buildings.
- Class 7 buildings – Refers to the storage-type buildings with the sub-classifications Class 7a for covered carparks and Class 7b for buildings used for the storage or display of goods or produce for sale by wholesale. For Sydney Water facilities, these would primarily be warehouse type buildings or large sheds with storage and would be classified as Class 7b.
- Class 8 buildings – Refers to process-type buildings which include laboratories and buildings where production, assembling, altering, repairing, packing, finishing, or cleaning of goods or produce for sale takes place. These may be similar to the Class 7b buildings in terms of construction i.e. warehouse shell/large shed with water or wastewater treatment processes occurring within those buildings. For Sydney Water facilities, these would include Blower houses, Dewatering Buildings and/or other buildings housing process units.
- Class 10 buildings - Refers to *non-habitable buildings* or *structures*. Class 10 is further classified into Class 10a for non-habitable buildings including private garage, carport, shed or the like, Class 10b for structures such as a fence, mast, antenna, retaining wall or free-standing wall or swimming pool or the like and Class 10c buildings are private bushfire shelters. For Sydney Water facilities, these may be the smaller sheds, reservoirs and other non-habitable structures.

There may be situations where buildings will have different uses, and these will have multiple classifications. Buildings of this nature will need to meet the higher fire-resisting type of construction applicable to the building classification or provide fire separation between the different building classifications achieving the higher fire-resistance of the building classification.

It should be noted that the NCC/BCA provides an exemption under clause A6G1 where a part of a building that is designed, constructed or adapted for a different purpose and is less than 10% of the floor area of the storey, the classification of the other part of the storey may apply to the whole storey. For example, if a single storey Class 7b warehouse-type building of 200 m^2 contains a Class 5 office portion of 15 m^2, the office portion is considered to be ancillary to the warehouse, and the building will be classified as Class 7b only. However, the above exemption cannot be applied to laboratories due to the high fire hazard potential.

3.1.1 Building Classifications of Sydney Water Assets

The following table provides guidance on the relevant building classifications for Sydney Water assets subject to confirmation by a BCA Consultant or Certifying Authority.

Table 5: Sydney Water assets and the relevant NCC/BCA building classifications

Sydney Water Asset	**Building Classification** *(Note 1)*
Blower House	Process-type building – Class 8
Chemical Dosing and Storage	Enclosed Storage building – Class 7b Awning covered structure - Class 10a
Dam	Non-habitable structure – Class 10b
Desalination Plant	Process-type building – Class 8
Electrical Switch Rooms	Non-habitable building - Class 10a Process-type building – Class 8 *(Note 2)* Classification depends on occupancy, use and project context.
Office and admin buildings	Class 5
SCADA/Server/Control Rooms	Office-type building – Class 5 *(Note 3)*
Pumping Stations	Process-type building – Class 8
Reservoir	Non-habitable structure – Class 10b
Sludge Holding Bays	Storage-type building – Class 7b
Maintenance workshops	Process-type/storage building – Class 7/8
Plant Equipment Storage Rooms (Forklift, tractors, buggies, tools and critical spares)	Storage-type building – Class 7b
Plant Operators Laundry Rooms	Process-type building – Class 8
Demountable project office buildings	May fall outside conventional NCC classification frameworks and require project-specific assessment.
Pipe, Cable & Pump Galleries	May fall outside conventional NCC classification frameworks and require project-specific assessment. Refer to NFPA 820 or AS 4825:2011 discussed in section 3.1.2.
Tunnels & Caverns	May fall outside conventional NCC classification frameworks and require project-specific assessment. Refer to NFPA 820 or AS 4825:2011 discussed in section 3.1.2.

Notes:

1. These classifications might change depending on project requirements. Confirm with Certifying Authority as required.

2. Class 8 electricity network substation is a defined term in the NCC/BCA as a building in which high voltage supply is converted or transformed and is controlled by a licensed network service provider designated under a power of legislation. Refer to NCC/BCA Clauses C3D13 and C3D14 for fire-resistance requirements for electricity switch rooms/substations

3. As per NCC/BCA Clause A6G1, these rooms will be classified as the same classification as a major part of the principal use of the building or fire compartment it is located in e.g. server room in Class 5 admin building will adhere to the requirements of a Class 5 building. In most cases, additional measures will be required due to criticality of the equipment.

It should be noted that the DtS Provisions for the different building classifications are provided throughout the NCC/BCA in Sections C to J. For example, a Class 7b warehouse will have DtS Provisions for fire resistance in Section C, egress requirements in Section D and required Fire Safety Systems in Section E. It is recommended that a BCA Consultant be engaged to provide clarification for the applicable DtS requirements.

3.1.2 Underground Facilities and Tunnels

In some Sydney Water facilities, wastewater treatment processes occur below ground in underground caverns, tunnels and galleries which are accessible and trafficable. These areas become difficult to classify as they do not strictly conform to the traditional definition of a 'building'. However, as the use of some of the underground facilities is considered to be process-related, the most applicable building classification would be Class 8.

Where these underground facilities are connected to above ground buildings of different classifications, fire separation would need to be provided to mitigate fire spread between different compartments. For example, an underground process-type facility that can be accessed via a lift from a Class 5 administration building would need to have fire separation between the different classifications. The floor of the above ground building located directly above may need to achieve a fire-resistance level depending on the applicable type of construction. The lift shaft serving both the above ground building and the underground facility will need to be fire-rated if the lift connects more than two (2) storeys or three (3) storeys if the building is sprinkler protected. The lift doors will need to achieve -/60/- FRL, comply with AS 1735.11 and are to remain closed except when discharging or receiving passengers, goods or vehicles.

Additionally, it should be noted that emergency lifts must be contained within a fire-resisting shaft of at least 120/120/120 FRL as per BCA Clause C3D11. Further mitigation measures outside of the NCC/BCA DtS Provisions can be implemented to prevent fire and smoke spread between the below ground facilities and the above ground buildings.

Where underground facilities are not connected to an above ground building, the underground facility generally falls outside of the BCA/NCC and may not meet all NCC/BCA Performance Requirements. However, underground facilities can still utilise the NCC/BCA Performance Requirements and DtS Provisions as a benchmark for fire and life safety assessments.

The NCC/BCA makes limited references to tunnels and underground passageways and it should be noted that it occurs in the South Australian variations for bulk grain storage facilities. Hence, fire safety for tunnels and underground areas would require guidance from the following documents:

1) NFPA 820 – American National Standard Institute approved standard for fire protection in wastewater treatment and collection facilities, where applicable; and

2) AS 4825:2011 – Australian Standard for tunnel fire safety which is applicable to road, rail and bus tunnels.

NFPA 820 documents safeguarding procedures and measures against fire and explosion hazards specific to wastewater treatment plants and associated collection systems. The standard establishes minimum requirements to reduce or eliminate the effects of fire or explosion by maintaining structural integrity, controlling flame spread and smoke generation, preventing the release of toxic products of combustion, and maintaining serviceability and operation of the facility. The requirements of NFPA 820 can be used in risk assessments that are vulnerable to fire or other loss.

The NFPA standard establishes the minimum criteria for protection against fire and explosion hazards for collection systems, liquid stream treatment processes and solids treatment processes including areas for underground areas such as galleries and tunnels. It also details requirements for fire and explosion prevention and protection measures, construction materials, ventilation systems and administrative controls.

Conversely, AS 4825:2011 provides a generic framework for establishing Fire Safety Systems that are required in road, rail and bus tunnels to provide an acceptable level of safety in case of fire.

While the standard does not apply to service tunnels or enclosed roadway or track-ways less than 80m in length, the standard's safety objectives include safety of occupants, facilitation of effective emergency services intervention and protection of adjoining properties and third parties which are still applicable to Sydney Water underground tunnels. The standard covers many design considerations such as preventative measures, asset protection, business interruption, maintainability, reliability and redundancy. Additionally, AS 4825 outlines the following:

1) The fire engineering process which is in line with the asset life-cycle process further detailed in Section 4 of this guideline;
2) Fire safety measures and their performance requirements;
3) Fire engineering assessment including fire hazard identification, fire scenarios and design fires, smoke and egress analysis, structural fire resistance analysis and emergency services intervention;
4) Installation and construction considerations;
5) Testing and commissioning considerations;
6) Maintenance considerations; and
7) Emergency management and fire brigade intervention considerations.

With the above designs or other building/structure designs where the NCC/BCA building classifications and DtS Provisions are not fully applicable, it is recommended for the NCC/BCA Performance Requirements and DtS Provisions to be used as the benchmark criteria. All fire and life safety issues identified by assessing against the NCC/BCA are to be mitigated as part of Sydney Water's risk assessment procedures detailed in Section 5.3 or on a performance basis.

3.2 Deemed-to-Satisfy vs Performance Solutions

When working on Sydney Water developments, particularly Class 5 (offices), Class 7 (carparks/warehouses), Class 8 (laboratories/process buildings) and Class 10 (sheds, tanks, ancillary structures), it is important to understand how fire safety compliance requirements are applied under the NCC/BCA. Two compliance pathways exist: Deemed-to-Satisfy Solutions and Performance Solutions. Both can be used independently or together (a "combination solution") as shown in Figure 2 below, depending on the needs of the project.

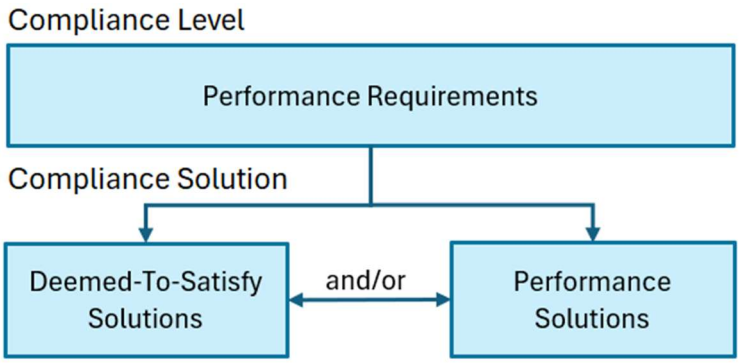


Figure 2: NCC/BCA compliance requirements

3.2.1 Deemed-to-Satisfy (DtS) Provisions

Deemed-to-Satisfy (DtS) Provisions follow the NCC/BCA's prescriptive rules. If a design meets those rules exactly, it is automatically considered compliant. A DtS design is typically simpler to implement, and faster for approval because it utilises known, standardised construction and fire-safety measures. A DtS compliant design is generally preferred for typical buildings where the building's use is in line with the NCC/BCA's building classifications.

3.2.2 Performance Solutions

Performance Solutions are used when a project cannot meet DtS Provisions, or when the DtS pathway is overly restrictive, impractical, or inappropriate for the building use. Performance Solutions rely on fire engineering and evidence-based analysis to show that the design still achieves the NCC/BCA Performance Requirements. Performance Solutions should follow the mandated process in accordance with BCA Clause A2G2 as shown in Figure 3 but allow custom-designed fire and life safety outcomes appropriate to the risks and operations of the facility.

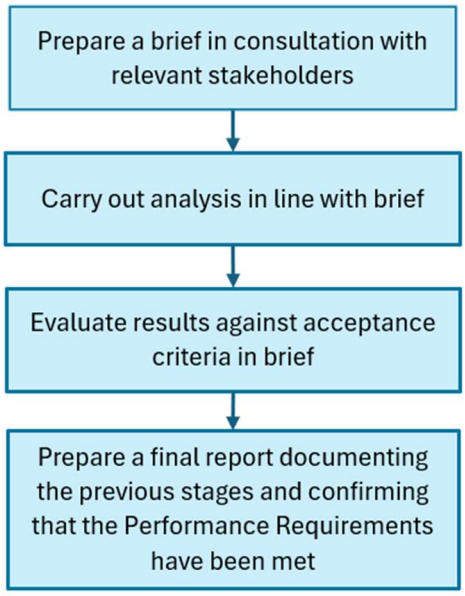


Figure 3: Performance Solution process as per BCA Clause A2G2(4)

3.3 Section C - Fire Resistance

Section C of the NCC/BCA relates to fire resistance of buildings and is broken into four (4) parts with a number of specifications that provide further detail to specific NCC/BCA clauses. Part C1 outlines the Performance Requirements for fire resistance that need to be met by either a Deemed-to-Satisfy Solution or Performance Solution. Part C1 also contains verification methods that determine whether a Performance Solution complies with the relevant Performance Requirements. The relevant Performance Requirements for Sydney Water include:

1. Structural stability during a fire,
2. Prevention of the spread of fire,
3. Safe conditions for evacuation,
4. Behaviour of concrete external walls in a fire,
5. Fire protection of service equipment,
6. Fire protection of emergency equipment,
7. Fire protection of openings and penetrations, and
8. Provision of fire brigade access.

All buildings are expected to meet the Performance Requirements nominated in the NCC/BCA. These requirements should also be considered for new Sydney Water buildings and structures that may not align neatly with the building classifications, e.g. pipes and pumps galleries and for existing buildings or structures, where project work is likely to change site conditions.

Parts C2, C3 and C4 outline the Deemed-to-Satisfy (DtS) Provisions for the Performance Requirements nominated in Part C1. For projects under Exempt Development (Section 1.6 of the EP&A Act 1979), DtS Solutions are normally applied as performance solutions may be difficult to justify or certify under Exempt Development. Any deviation from the DtS Provisions will require the use of a Performance Solution through a different approval pathway.

Part C2, titled Fire Resistance and Stability, sets out the types of fire-resisting construction based on building height, number of storeys, size, use and other relevant factors, and fire hazard properties. Part C2 also introduces Types of Construction being Type A, B and C, with Type A being the most fire-resistant. Refer to Sydney Water Building design specification (D0002084) for construction types applicable to each class.

Part C3, titled Compartmentation and Separation, covers compartmentation to limit fire size and spread, separation to limit fire spread between fire compartments, parts with different classifications, stairways, lift shafts, equipment, electricity supplies and public corridors. It also contains construction requirements to facilitate fire brigade intervention.

Part C4, titled Protection of Openings, covers the protection of openings such as windows, doors, services and construction joints to reduce the risk of fire spread within or between buildings. Fire door requirements for the various building classifications are covered in this part.

Various specifications are listed in Part C. They cover fire-resisting construction, fire hazard properties, performance of external walls in fire, fire doors, smoke doors, fire windows and shutters, and penetration of walls, floors and ceilings by services, amongst many other things. Refer to the latest NCC/BCA for more details.

3.4 Section D – Access and Egress

Section D provides guidance on access and egress provisions for buildings. Similar to Section C, Section D is divided into four (4) parts with specifications providing further detail to specific clauses in Section D. Part D1 contains the Performance Requirements relating to safe movement to and within a building, fall prevention barriers, exits, fire-isolated exits, paths of travel and evacuation lifts.

Part D2 sets out required numbers, dimensions and placement of exits, travel distances to exits, places exit lead to and the use of horizontal exits within a building. Part D3 covers safety aspects of a building including stairways, ramps, handrails, balustrades, fall prevention barriers and operation of exit doors. Part D4 relates to the accessibility of a building for people with disability, which covers braille and tactile signage, hearing augmentation and tactile ground surface indicators. Refer to the latest NCC/BCA for further details relating to access and egress.

3.5 Section E – Services and Equipment

Section E is also divided into four (4) parts with various specifications for the different Fire Safety Systems such as sprinklers, smoke detection and alarms and smoke exhaust. The Performance Requirements for Section E can be found at the beginning of each part of Section E instead of being located in Part E1. Part E1 focuses on firefighting equipment like hydrants, fire hose reels, sprinklers, portable fire extinguishers and fire control centres. Part E2 DtS Provisions are intended to reduce the risk of injury due to smoke inhalation via the use of smoke detection and alarm systems, air and zone pressurisation systems, smoke and heat vents, smoke exhaust systems. Part E3 relates to lift requirements for people with a disability and emergency services personnel. Part E4 provides guidance on the minimum visibility levels in evacuation routes in an emergency for emergency lighting and signage to locate and identify exits. It also contains the requirements for emergency warning and intercom systems to alert occupants and assist evacuation.

3.5.1 Fire Hydrants

Fire hydrants are installed within buildings or sites for use by the fire brigade and other trained firefighting personnel and are only used for firefighting purposes. Hence, the hydrant system provided must meet the firefighting personnel operational requirements. The requirements for fire hydrant systems are not only provided by the NCC/BCA but also detailed in the Australian Standard AS 2419.1.

As previously discussed, the NCC/BCA is predominantly applied to occupied buildings. AS 2419.1 can also be applied to sites, including any storage yard, marina, wharf, plant or infrastructure. A fire hydrant system designed and installed to AS 2419.1 needs to provide coverage to all parts of open yards. The standard identifies an open yard as a designated area in industrial or commercial premises that may be used for combustible storage or processing of any kind and having an area more than 500 m^2. Furthermore, the standard provides design requirements for open yards. These include:

1. Number of fire hydrant outlets required to flow simultaneously based on yard area,
2. Distance of external feed fire hydrants from fire brigade pumping appliance (i.e. fire truck) for open yards, and
3. Distance of external fire hydrants (including attack and feed fire hydrants) providing coverage to open yards.

Where a Sydney Water facility with processing equipment meets the AS 2419.1 definition of an open yard, or where combustible storage/processing and FRNSW operational requirements trigger hydrant coverage, the hydrant system should be assessed against AS 2419.1.

Where an existing hydrant system was designed and installed to Ordinance 70 and Ministerial Specification 10 (or earlier), it may be necessary to upgrade the hydrant system partially when there are building works proposed. The intent being to meet the operational requirements of FRNSW in accordance with their position statement for Fire Hydrant Systems in Existing Buildings or Premises.

The position statement also states that a bespoke upgrade solution may be required where it cannot meet AS 2419.1:2021 due to limitations of the existing hydrant system or building/premises constraints. A Performance Solution can be undertaken to rationalise variations to hydrant requirements subject to consultation with FRNSW, NSW RFS and other approval authorities, as applicable.

3.6 Common NCC/BCA DtS Variations

The below outlines the common NCC/BCA DtS variations that are capable of being addressed as Performance Solutions.

3.6.1 Class 5 Buildings

Class 5 spaces often appear within larger operational facilities as site offices, administration buildings or control rooms inside a treatment plant. Common DtS variations include:

- Internal linings and finishes provided for operational requirements not complying with fire hazard properties of BCA Specification 7.
- Egress distances to an exit exceeding 20 m for a single exit or 40 m to 2 exits in different directions.
- Reduced egress widths of less than 1 m wide.

3.6.2 Class 7 Buildings

Sydney Water sites frequently include Class 7 areas such as vehicle storage bays, warehouses and service yards. Common DtS variations include:

- Large fire compartment areas and volumes exceeding DtS Provision limits.
- Inadequate fire-resistance levels for Class 7b storage areas.
- Designing tilt-up or pre-cast concrete external walls to collapse outwards (to protect, where applicable, critical equipment stored inside) noting that they should collapse away from any fire truck hardstand area.
- Increased fire loads associated with stored assets or equipment.
- Inadequate fire and smoke compartmentation between compartments or building classifications.
- Egress distances to an exit exceeding 20 m for a single exit or 40 m to 2 exits in different directions.
- Reduced hydrant coverage due to irregular site layouts or outdoor canopies.
- Ventilation requirements that differ from prescriptive DtS smoke control provisions.

3.6.3 Class 8 Buildings

Many Sydney Water buildings contain Class 8 zones such as water testing labs, chlorination rooms, dewatering buildings, blower houses and chemical dosing spaces. Common DtS variations include:

- Inadequate fire separation between the chemical hazard storage areas and the rest of the building.
- Storage of chemicals or other materials beyond NCC/BCA DtS Provisions that may require additional fire safety measures for firefighting purposes or smoke hazard management due to special hazards that may exist.
- Mechanical ventilation requirements that vary from the NCC/BCA Provisions, e.g. maintaining ventilation to manage H_2S levels versus shutting off ventilation in the event of a fire alarm.

4. Fire Systems and Water Assets Life Cycle

The sections below provide an overview of key Fire Safety Systems deliverables throughout the various asset creation phases at Sydney Water. A list of key stakeholders involved is provided in the RACI table in Section 4.6.

The deliverables below do not apply to all projects and are to be assessed for each project individually taking into consideration size, scope, risk and compliance requirements. Quite often, like for like replacement and minor upgrades will not require the items below.

4.1 Planning Phase

Fire risks can influence site selection, process and equipment choices, and future operational and maintenance requirements. Identifying fire risks early helps avoid costly redesigns and reduces downstream project impacts.

The following sections outline key fire-related deliverables associated with this phase, noting that some documents may be combined, omitted, or prepared during the design phase.

4.1.1 Preliminary Hazard Analysis

A Preliminary Hazard Analysis (PHA) is required in NSW when a proposed development is classified as "potentially hazardous industry" or "potentially offensive industry" under State Environmental Planning Policy (Resilience and Hazards) 2021. The PHA, prepared by the Risk Engineer, offers an early, high-level evaluation of potential hazards including fire hazards linked to the project. The PHA aims to maintain the health and safety of employees and the surrounding community by considering both potential internal and external hazards. The PHA will highlight key risks, their possible causes, and general mitigation strategies, ensuring stakeholders are aware of safety concerns before finalising project direction. The PHA may be updated at the end of the design phase as a Final Hazard Assessment.

4.1.2 Dangerous Goods Assessment

For dangerous goods that may be stored, handled or generated on a site, a Dangerous Goods Assessment (DGA) is prepared by a Dangerous Goods Consultant accredited by the Australasian Institute of Dangerous Goods Consultants. This assessment reviews compliance requirements for dangerous goods, separation distances, storage requirements, major hazard facility identification, fire and explosion risks and recommends controls for the site to meet regulatory obligations and safe operation. The DGA can also be carried out during the early phases of design.

4.1.3 Bushfire Assessment Report

A Bushfire Assessment Report prepared by a Bushfire Consultant with a Bushfire Planning and Design accreditation would be required should a site be located on bushfire-prone land. While site location cannot always be determined during planning, early identification can reduce costly redesigns particularly if the asset has an elevated bushfire hazard level. The Bushfire Assessment Report will determine the level of exposure to bushfire hazards and will outline the required protection measures such as asset protection zones, water supply requirements, access provisions and construction standards.

4.2 Design Phase

The following sections outline key fire safety deliverables during the concept and detailed design phases. Depending on the fire risk profile and the complexity of the project, some documents may be combined or may not be required.

4.2.1 Concept Design Phase

Fire-related deliverables typically associated with concept design are listed below.

4.2.1.1 BCA Compliance Report

The report clarifies classifications of building, applicable BCA Performance Requirements and applicable Deemed-to-Satisfy Provisions. The BCA Report will identify where there are variations to Deemed-to-Satisfy (DtS) Provisions. The design will be subject to redesign to meet the NCC/BCA Performance Requirements via a DtS Solution or a Performance Solution by a Fire Safety Engineer.

The BCA Compliance Report will require architectural drawings for buildings and site layout to enable the assessment against the NCC/BCA. It is common for the BCA Report to contain a list of proposed essential fire safety measures that will form the basis of the fire safety measures to be detailed during detailed design stage. Likely fire safety measures include automatic fire detection, fire alarms, emergency lighting, exit signage, fire hydrants, etc.

4.2.1.2 Fire Engineering Concept Design Report

The Fire Engineering Concept Design Report (FECDR), prepared by the Fire Safety Engineer, establishes the fire engineering strategy at the concept design stage. It outlines the potential fire-engineered Performance Solutions, fire scenarios, acceptance criteria, evacuation concepts, fire system requirements, and the performance-based design methodology that will be used in the subsequent detailed fire engineering analyses.

4.2.1.3 Concept Fire Services Design Drawings

These are concept level drawings for all active and passive Fire Safety Systems and are prepared by the Fire Services Designer/Engineer. They translate the concept requirements from the NCC/BCA,

relevant standards and FECDR into buildable design documentation and align with architectural, structural, mechanical and hydraulic designs. These drawings may provide concept designs and specifications for the relevant fire services such as the fire hydrant systems, fire suppression systems, fire detection and alarm systems, smoke control systems, emergency lighting, exit signage, etc. The designer will also need to provide a design certificate declaring that their design is in line with the relevant codes and standards.

4.2.1.4 Fire Safety Study

A Fire Safety Study (FSS) identifies and evaluates site-specific fire hazards, particularly those with the potential for significant consequences to life, infrastructure, and the environment. It considers the nature of the facility's operations and its surrounding context, and provides recommendations for the fire protection measures, systems, and layouts necessary to effectively manage these risks.

It is important to note that the measures recommended in an FSS - and the extent of protection they prescribe - may differ from requirements set out in codes such as the NCC/BCA and applicable standards. This is because the FSS determines the level of protection based on the unique hazards and risk profile of the site. These hazards may include, but are not limited to, biogas storage and flare systems, biosolids storage, gas accumulation in confined spaces or dead zones, hazardous chemical interactions, and potential secondary fire events.

As part of the FSS, Hazard Identification (HAZID) and risk assessment are undertaken to identify hazards across the project's spatial and operational envelope, evaluate the severity and likelihood of each risk, and determine the controls required to reduce risks to acceptable levels. This process includes assessment of fire, structural, operational, environmental, and interface risks early in the concept design phase.

Depending on the complexity of the project, fire HAZID and risk assessment may be integrated into the plant/asset Safety in Design process/sessions. However, where fire risks are complex or significant, these assessments may be developed as a separate, standalone exercise.

4.2.1.5 Insurance Consultation

It is essential that Sydney Water's insurer is consulted for all capital works projects, including refurbishments, retrofits, extensions, new constructions, and relocations, to ensure that delivered assets are adequately insured against fire-related risks.

Project teams must engage the Sydney Water Insurance Team early in the planning and design phases to obtain advice and confirm applicable insurance requirements. In addition to compliance with relevant building codes and fire safety regulations, insurers may impose specific conditions, approval processes, or restrictions relating to the use of particular construction materials, systems, or design approaches.

Sydney Water's insurers conduct annual audits of selected sites to assess fire risk management and compliance. These audits may include reviews of fire protection system inspection, testing, and maintenance records; verification of fire safety management procedures, such as hot work permits and fire system impairment controls; and observation of fire hydrant flow testing and certification activities.

4.2.1.6 Construction Hazard Assessment and Implication Review (CHAIR) 1

CHAIR 1 is a Safety in Design deliverable (D0000653). It is a risk assessment workshop prompted by guidewords to assist stakeholders to identify and reduce construction, maintenance and operation safety risks. Section 9.2 includes CHAIR 1 additional fire safety guidewords to be used by the facilitator as required.

4.2.2 Detailed Design Phase

Fire-related deliverables typically associated with detailed design are listed below.

4.2.2.1 Performance Based Design Brief

The Performance Based Design Brief (PBDB) previously known as the Fire Engineering Brief Questionnaire (FEBQ) outlines the agreed methodology and parameters for delivering fire engineered Performance Solutions that vary from NCC/BCA Deemed-to-Satisfy (DtS) Provisions. Prepared by the Fire Safety Engineer, it outlines design objectives, the fire safety strategy, stakeholder consultation requirements, fire scenarios, modelling approaches and acceptance criteria in accordance with the Australian Fire Engineering Guidelines (AFEG). It is reviewed by key stakeholders, including the design team, Certifying Authority (Sydney Water), and FRNSW for acceptance of the fire safety strategy prior to the documentation of the Fire Engineering Report.

4.2.2.2 Fire Engineering Report

The Fire Engineering Report (FER) is the detailed technical analysis that implements the methodology defined in the PBDB. It includes the fire safety strategy behind the Performance Solution and how the Performance Solution meets the Performance Requirements of the NCC/BCA in lieu of complying with the NCC/BCA DtS Provisions. The Performance Solution assessment and acceptance criteria will include qualitative analysis through discussion and/or quantitative analysis via fire and smoke modelling, evacuation modelling, and fire testing in accordance with the Australian Fire Engineering Guidelines. The FER becomes the authoritative fire safety document guiding design coordination, construction requirements and commissioning tests for the fire safety measures and outcomes included in the FER.

4.2.2.3 Initial Fire Safety Report

The Initial Fire Safety Report (IFSR) is provided by FRNSW after the review of the Fire Engineering Report. The IFSR comments on firefighting compatibility, hydrant accessibility, fire-appliance interface

and operational considerations. Recommendations from the IFSR are expected to be considered and addressed by the relevant stakeholders and the Certifying Authority before issuing the relevant certification.

4.2.2.4 CHAIR 2, CHAIR 3 and HAZOP Workshops

CHAIR 2, a Safety in Design (D0000653) deliverable, is conducted near the end of the detailed design phase, prior to construction. Its primary focus is to eliminate or reduce construction and/or demolition hazards, including fire hazards. CHAIR 3 is usually performed around the same time as CHAIR 2 and focuses on reducing operation and maintenance related hazards including fire hazards.

HAZOP is specific to process plants, where each P&ID drawing is broken into nodes, and risks including fire risks, are identified and assessed. Additional fire safety guidewords for CHAIR 2, CHAIR 3 and HAZOP have been provided in Section 9.3 Appendix C – CHAIR 2 Guidewords for Fire Safety. These words can be used by the facilitator as required.

4.2.2.5 Fire Services Design Drawings

These drawings provide the fully coordinated design for all active and passive Fire Safety Systems and are prepared by the Fire Services Designer/Engineer. They are progressively updated during the various design stages. They translate the requirements from the NCC/BCA, relevant standards and FER into buildable design documentation and align with architectural, structural, mechanical and hydraulic designs. These drawings will provide details and specifications for the relevant fire services such as the fire hydrant systems, fire suppression systems, fire detection and alarm systems, smoke control systems, emergency lighting, exit signage, etc. The designer will also need to provide a design certificate declaring that their design is in line with the relevant codes and standards.

4.2.2.6 Operation, Maintenance and Management in Use Plans (MIUP)

A MIUP describes how a building, facility or asset will be operated and maintained once in use, with a focus on safety, compliance and asset life-cycle requirements. It details how the building will be utilised and maintained once occupied, with a specific focus on fire safety, system testing, emergency procedures and management principles, maintenance schedules, and the responsibilities of the building owner or manager.

The MIUP is not required for all buildings in Australia and is not mandated by the NCC as a universal requirement. Its necessity depends on the building type, approval conditions, and whether the fire safety design relies on performance solutions rather than purely Deemed-to-Satisfy Provisions. In practice, a MIUP is typically required where a Fire Engineering Report forms part of the approval, or where development consent conditions specify it, as it documents the operational and management controls needed to maintain the assumptions underpinning the approved fire safety design.

Although the MIUP is refined in the commissioning phase and managed and maintained in the operational and maintenance phase, the MIUP begins in the design phase so that operational input

can be integrated into the design. Once an active operational document, the MIUP is expected to be regularly reviewed, updated and enforced to reflect changes in the building including occupancy population and type, fire system upgrades, equipment type and layout, evacuation procedures, or alterations to building layout.

By keeping the MIUP current, the Building Owner ensures that the operational environment remains safe, compliant, and aligned with the building's design and performance expectations for the entirety of the asset's life cycle. Common measures in the MIUP can include prohibition of storage in certain areas, general housekeeping procedures, emergency and evacuation procedures and maintenance of systems that are critical to a fire engineered Performance Solution. A sample of a MIUP can be found in section 9.4 Appendix D – Sample Management in Use Plan.

This guideline proposes integrating MIUP requirements into existing Sydney Water maintenance systems and Standard Operating Procedures (SOPs). Sydney Water uses Maximo as its asset management system to store asset records, schedule maintenance, and generate work orders. Maximo work orders define inspection, testing, and compliance requirements supporting the Annual Fire Safety Statements, with task frequencies assigned based on asset-specific design requirements or legislative obligations. Typical fire-related assets recorded in Maximo include:

- Fire detection and alarm systems: smoke, flame, and heat detectors; fire indicator panels; aspirated smoke detection systems (e.g., VESDA); sirens; strobe lights.
- Emergency Warning and Intercommunication Systems (EWIS): internal intercoms, fire phones, brigade call-out panels.
- Fire Control Systems: sprinklers, pre-action systems, gas suppression systems, fire extinguishers, fire doors, smoke dampers, smoke curtains, smoke/fire shutters, penetration seals for compartmentation.
- Fire hydrant systems.
- Fire water pump systems: storage tanks, pumps, pump control panels, diesel fuel tanks (for diesel-driven pumps).

Where new Fire Safety Systems are proposed, designers are expected to request Maximo asset numbers early to avoid delays, and coordination with the Asset Information Management team is required to ensure all work instructions and SOPs related to fire safety maintenance are correctly captured. Fire Safety Systems work instructions may be incorporated into existing Maximo work orders or implemented through new work orders as required.

Where new or modified Fire Safety Systems, including systems installed under a performance-based solution, may affect existing plant operations or building usage, the design team is expected to consult with operators and building owners to determine which operational documents require updating. MIUP fire-related content may be incorporated into existing SOPs or addressed through the development of new SOPs where necessary. In addition to SOPs, Sydney Water also maintains Standard Incident Procedures (SIPs), Emergency and Pollution Incident Response Management Plans

(EPIRMPs), and Plant Operation and Maintenance (O&M) manuals, which may also be updated to include relevant MIUP requirements as appropriate.

4.2.2.7 Fire Safety Schedule

The Fire Safety Schedule (FSSc) is prepared by the Certifier acting on behalf of Sydney Water and forms the basis of the Annual Fire Safety Statement. The FSSc:

- Lists all essential and critical fire-safety measures required for the entire building/facility,
- Includes the minimum performance standards each measure must meet,
- Identifies which fire safety measures are existing, proposed, essential and critical as well as any fire safety Performance Solution Reports, and
- Must be documented in the NSW mandated standard template to ensure consistency and clarity across projects. The standard template can be found on the NSW Government website.

Fire-safety measures listed in the FSSc can include hydrants, sprinklers, alarms, smoke control systems, fire doors, exit signage and emergency lighting.

4.3 Construction Phase

Construction sites commonly present a range of fire hazards, including the use and storage of flammable substances and dangerous goods, constantly changing site conditions, altered egress routes, high personnel turnover, evolving building heights or site layout that affects evacuation procedures, and the accumulation of cleared vegetation or other combustible materials. During construction, fire safety risks are managed through a combination of temporary fire protection systems and administrative controls.

The NCC/BCA outlines requirements for managing fire risks during construction. Performance Requirement E1P5 specifies that suitable fire-fighting equipment should be installed in buildings under construction to support initial fire attack by site workers and enable the fire brigade to carry out firefighting operations. These systems should be appropriate for the hazards present and are expected to accommodate the changing height, configuration of the building and site layout. Hydrant systems and booster pumps become mandatory once a building exceeds specified height thresholds during construction in line with Clause E1D16.

Key fire-related deliverables that may be required during construction are listed below. Note that these can be combined or not required depending on project size, complexity and fire risk. Key stakeholders involved in this phase can be found in Section 4.6 Roles and Responsibilities.

4.3.1 Construction Fire Safety Management Plan

A Construction Fire Safety Management Plan is prepared by the Builder or Principal Contractor, sometimes with input from a Fire Safety Engineer, and outlines the practical fire-safety controls and

procedures required during construction. It ensures that fire risks associated with construction activities, such as temporary structures, altered access paths, incomplete Fire Safety Systems, hazardous materials, and site logistics, are properly managed. The plan must comply with Fire and Rescue NSW guidelines and include fire-safety roles and responsibilities, emergency procedures, site access for firefighters, hydrant and extinguisher provisions, and the integration of temporary and permanent fire-safety measures into the construction sequence.

4.3.2 Interim Fire Safety Strategy

An Interim Fire Safety Strategy (IFSS) is prepared by a Fire Safety Engineer when construction works interface with existing or partially occupied areas of a building. Its purpose is to maintain an acceptable level of fire and life safety during staged construction work, temporary conditions, or periods where permanent fire-safety systems are not yet operational. The Engineers Australia Society of Fire Safety Practice Note on Fire Safety in partially occupied buildings and the FRNSW document Fire Safety during Construction Work provide more information on IFSS.

The IFSS identifies construction-phase hazards, defines temporary fire-safety measures, addresses egress and compartmentation impacts, and outlines management procedures needed to protect occupants and workers. It is developed in consultation with stakeholders, including designers, builders, building managers and fire authorities, and follows the structured process recommended by Engineers Australia, including defining objectives, assessing hazards, implementing controls, monitoring compliance, and safely decommissioning temporary measures when no longer required.

4.3.3 Communication and Notification

Effective communication between stakeholders is essential to ensure onsite safety. The WHS Act requires construction teams to inform the design team of any newly identified risks associated with the design. This ensures hazards are addressed promptly and that design documentation remains aligned with evolving site conditions.

If construction requires isolating parts of an existing active fire system, a formal system impairment process must be logged to notify the insurer and FRNSW.

4.4 Commissioning Phase

The commissioning process is carried out in accordance with the Sydney Water Commissioning Specification (D0001440). Assuming that a new Fire Safety System is delivered as part of a major project or associated with a new process unit, e.g., COGEN or Carbonizer, the following commissioning approach will take place. The approach below does not apply to standalone Fire Safety Systems in buildings but it can still provide an insight into Sydney Water commissioning and handover methodology as well as key stakeholders involved.

The process begins with Pre-Commissioning, which includes the initial energisation of equipment such as process units, electrical switchgear, and Fire Safety Systems. This stage verifies correct installation, wiring, configuration, and basic field functionality, and is used to identify defects early. Fire Safety Systems delivered as part of an infrastructure project are expected to be energised at this stage. Project teams are expected to review the commissioning program to ensure fire and other safety systems are delivered early and activated in the correct sequence to protect buildings and process units.

Following pre-commissioning, Dry Commissioning is undertaken to initiate and test electrical and control systems, including those associated with fire and safety systems. Signal and communication interfaces to plant SCADA, IICATS, or the broader OT environment are energised and verified.

Sydney Water operates its assets using two primary control platforms:

- SCADA (Supervisory Control and Data Acquisition) – used for water and wastewater treatment plants, and
- IICATS (Integrated Instrumentation, Control, Automation & Telemetry System) – used for network-based pumping stations, reservoirs, and pipelines distributed across a wide geographic area.

Both platforms provide real-time monitoring and control. Fire Safety Systems connected to SCADA and/or IICATS send alarms to the Sydney Water Operations Centre (SOC). At the dry commissioning stage, only the system connection is activated but the alarm is disabled. A Disabled Alarm Register must be maintained during this stage to ensure that active fire events are not missed.

The next phase is Wet Commissioning where tanks, reservoirs, pumps, and pipelines are filled with clean water to confirm hydraulic performance. This stage may also include testing of new control rooms or switch rooms. During Wet Commissioning:

- Control systems and alarms are fine-tuned,
- Fire and gas detection systems are calibrated and tested,
- Operators receive training, and
- Equipment performance and reliability are validated.

All SOC alarms associated with Fire Safety Systems are expected to be fully tested and signed off by a Sydney Water acceptance engineer during wet commissioning. Once Wet Commissioning is complete, Cutover and Process Commissioning can commence. This is when buildings housing process units with fire risks become live. All SOC and fire alarms are activated. Callout lists and first responder details are updated accordingly.

The following sections outline key fire-related deliverables associated with this phase. Key stakeholders involved in this phase can be found in Section 4.6 Roles and Responsibilities.

4.4.1 Inspection and Testing Plans and Checklists (ITPs and ITCs)

Commissioning ITPs and ITCs confirm that Fire Safety Systems have been installed and tested in accordance with the approved designs, manufacturer's requirements, codes, and relevant standards. Refer to Sydney Water Commissioning Specification for acceptance details.

4.4.2 Baseline Data of Fire Safety Systems

Baseline data records the initial performance and test results of all fire safety services at the time of commissioning by the Installing Contractor. This data becomes the performance benchmark for future maintenance and annual assessments included in the Annual Fire Safety Statement.

4.4.3 Fire Services Work as Constructed Drawings

Work as constructed drawings document the installed configuration of all Fire Safety Systems, including sprinklers, hydrants, pipework, valves, fire panels, detectors, emergency lighting, EWIS cabling, smoke exhaust ducts, and control interfaces. These drawings can be documented by the Fire Services Designer or the Installing Contractor. The as-built fire services drawings should be provided in a format suitable for integration with Sydney Water's asset and document management systems to support operations and maintenance.

The as-built drawings should reflect the exact built condition, not the design intent, and are essential for maintenance, future upgrades, emergency response, and annual fire safety assessment. As-built drawings should align with the verified Performance Solutions in the Fire Engineering Report, the Fire Safety Schedule and the Fire Safety Certificate.

4.4.4 Fire Engineering Inspection Report

The Fire Engineering Inspection Report (FEIR) is prepared by the Fire Safety Engineer and documents inspection observations in relation to the outcomes in the Fire Engineering Report (FER) and holistic fire safety. The FEIR verifies that the outcomes in the FER have been correctly implemented during construction and commissioning. The FEIR is provided to the Certifying Authority (Sydney Water) as evidence that the building works have been completed and is consistent with the Performance Solutions in the Fire Engineering Report.

4.4.5 Fire Safety Certificates

A Fire Safety Certificate (FSC) is issued by Sydney Water (or their authorised representative e.g. project manager) and filed with the project records once all installed fire safety measures have been inspected, tested, verified and confirmed to perform in accordance with the Fire Safety Schedule. It confirms that essential and critical fire safety measures such as sprinklers, hydrants, detection systems, smoke control, exits, fire doors, and emergency lighting are fit for service and meet minimum

performance standards. The NSW Planning website provides the standardised template for FSCs. A copy of the FSC is to be submitted to FRNSW for their records.

Interim Fire Safety Certificates are issued when building works are divided into different stages (i.e. multiple Crown Certificates) and where the relevant part of the building's fire safety measures have been inspected, tested, verified and confirmed to perform in line with the Fire Safety Schedule. A Final Fire Safety Certificate will be issued once all installed fire safety measures have been confirmed to perform in accordance with the Fire Safety Schedule documented during the Detailed Design Phase.

4.4.6 Final Fire Safety Report

The Final Fire Safety Report (FFSR) is issued by FRNSW following a request by the Sydney Water (the certifying authority) where required for building work involving fire safety performance solutions. The FFSR provides FRNSW's assessment of whether the development meets fire brigade operational requirements such as hydrant accessibility, system compatibility, firefighting access paths, smoke movement assumptions, and evacuation conditions. Sydney Water is expected to consider and address the outstanding items in the FFSR before issuing the BCA Completion Certificate (equivalent to an Occupation Certificate in the private sector).

4.4.7 BCA Completion Certificate

A BCA Completion Certificate, typically issued by a building certifier, confirms that a constructed asset - like a pumping station or treatment facility - meets the relevant Performance Requirements of the NCC/BCA. Refer to Figure 1 for EP&A Act fire compliance certification requirement.

4.4.8 Communication and Notification

The WHS Act requires the commissioning team to inform the design team of any newly identified risks associated with the design. This ensures hazards are addressed promptly and that design documentation remains aligned with evolving site conditions. If commissioning requires isolating parts of an existing active fire system, a formal system impairment process must be logged to notify both Sydney Water's insurer and FRNSW.

4.5 Operation and Maintenance

Once a development/facility becomes occupied or fully operational, the asset transitions into its long-term operation and maintenance phase. The following sections outline key fire-related deliverables associated with this phase. Key stakeholders involved in this phase can be found in Section 4.6 Roles and Responsibilities.

4.5.1 Annual Fire Safety Statement

An Annual Fire Safety Statement (AFSS) is issued once every 12 months by the Asset Owner, Building Manager or their authorised representative. It confirms that all essential fire safety measures in the building have been inspected, tested, and verified by an Accredited Practitioner (Fire Safety), and that these measures continue to perform in line with the baseline data established during commissioning and in accordance with the current Fire Safety Schedule.

Under section 89 of the Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021, the owner of a building to which an essential fire safety measure applies, should provide the relevant local council with an AFSS for the building. While both local councils and Sydney Water fall within the definition of a "public authority" under the Environmental Planning and Assessment Act, section 89 of the Regulation expressly requires that the Annual Fire Safety Statement be given to a council. There is also no provision in the Sydney Water Act 1994 impacting the requirement to submit the annual statement to the relevant local council. Local council fire orders and audit powers still apply to Crown buildings in certain circumstances, particularly for occupied admin buildings.

4.5.2 Fire Emergency Plan

A Fire Emergency Plan that includes procedures for responding to fire emergencies, evacuating, notifying emergency services, and provision of medical assistance must be developed for each operational site and/or building. Refer to section 2.1.1 Fire Emergency Plan for regulatory details.

4.5.3 Maintenance of Essential Fire Safety Systems to AS 1851:2012

Maintenance of Essential Fire Safety Measures to AS 1851:2012 is now mandatory in the *Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation* under Clause 81A. Refer to Section 2.2.4 for more details.

4.5.4 Required Notifications

Under the Sydney Water Act and the Memorandum of Understanding between Sydney Water and FRNSW, Sydney Water is required to provide advance notice to FRNSW for any planned maintenance activities that may impact water flow or pressure needed for firefighting purposes. In addition to FRNSW notification requirements, insurance providers are expected to be informed of any fire system impairments or isolation.

4.5.5 Operation, Maintenance and Management in Use Plans (MIUP)

The operations team will be responsible for updating fire-related SOPs and Maximo work orders and any other MIUP documents developed during the design phase. Note that with some fire systems acceptance approvals, operational procedures can be nominated as a Performance Solution and if so, they will be included in the FSSc/AFSS as part of compliance.

4.6 Roles and Responsibilities

4.6.1 RACI Activity Matrix

The below summarises the roles and responsibilities of the various stakeholders in the project life cycle. A RACI (Responsible, Accountable, Consulted and Informed) Table is shown below for each stage.

Table 6: RACI meaning and description

Symbol	Meaning	Description
R	Responsible	The party who carries out the activity and holds responsibility for completing it.
A	Accountable	The party who is ultimately accountable for the process or task being completed appropriately. Responsible party is accountable to this party.
C	Consulted	Not directly involved but consulted for endorsement/sign-off (e.g., Hold points, FAT, ITPs).
I	Informed	Those who receive output or need to stay informed.

Table 7: Fire Safety Systems delivery RACI

Water Asset Life-cycle Phase	Fire Deliverable	Asset Owner/Certifying Authority	Design Manager	Operator Manager	Maintenance Manager	BCA Consultant	Dangerous Goods Consultant	Risk Engineer	Fire Safety Engineer	Bushfire Consultant	Constructors/Commissioning	FRNSW	Rural Fire Service	Comments
Planning	Preliminary Hazard Analysis	-	A	-	-	-	-	**R**	-	-	-	-	-	Required for potentially hazardous or offensive industry
	Dangerous Goods Assessment	-	A	-	-	-	**R**	-	-	-	-	-	-	Separation, storage, major hazard facility, fire & explosion risks, controls
	Bushfire Assessment Report	-	A	-	-	-	-	-	-	**R**	-	-	-	Bushfire-prone land
Concept Design	BCA Compliance Report	C	A	-	-	**R**	-	-	C	-	-	-	-	Required for Crown Certificate
	Fire Engineering Concept Design Report	-	-	-	-	-	-	-	**R**	-	-	-	-	Performance Solutions, fire scenarios, acceptance criteria, evacuation concepts, etc.
	Concept Fire Service Design Drawings	-	**R**	-	-	-	-	-	C	-	-	-	-	Hydrants, suppression, detection, alarm, smoke, emergency lighting, exit signage, etc as per FECDR.
	Fire Safety Study	-	I	-	-	-	-	**R**	A	-	-	-	-	site specific, HAZID, risk assessment, fire protection measures, systems, and layouts
	Insurance Consultation	-	**R**	-	-	-	-	-	-	-	-	-	-	Consult with Sydney Water Insurance
	CHAIR1	C	**R**	C	C	I	C	C	C	-	C	-	-	Construction, maintenance and operation safety risks reduction through design
Detailed Design	Performance Based Design Brief	I	A	-	-	-	-	-	**R**	-	-	I	-	Performance Solutions methodology, strategy, fire scenarios, etc. required for FER
	Fire Engineering Report	-	A	-	-	-	-	-	**R**	-	-	C	-	Qualitative analysis, quantitative analysis fire and smoke modelling, details PBDB
	Initial Fire Safety Report	-	-	-	-	-	-	-	A	-	-	**R**	-	Prepared by FRNSW after FER Review
	CHAIR 2, 3 & HAZOP	C	**R**	C	C	I	C	C	C	-	C	I	I	Risk Assessment Workshops covering Construction, Maintenance, Process and Operation
	Fire Services Design Drawings	-	**R**	-	-	-	-	-	A	-	-	-	-	

Water Asset Life-cycle Phase	Fire Deliverable	Asset Owner/Certifying Authority	Design Manager	Operator Manager	Maintenance Manager	BCA Consultant	Dangerous Goods Consultant	Risk Engineer	Fire Safety Engineer	Bushfire Consultant	Constructors/Commissioning	FRNSW	Rural Fire Service	Comments
	Management in Use Plan	A	**R**	C	-	-	-	-	C	-	-	-	-	MIUP included in MAXIMO/SOPs
	Fire Safety Schedule	**R**	A	-	-	-	-	-	-	-	-	-	-	List Fire Safety measures and performance standards. Basis for AFSS
Construction	Construction Fire Safety Management Plan	I	I	I	-	-	-	-	C	-	**R**	-	-	Practical fire-safety controls and procedures required during construction
	Interim Fire Safety Strategy	C	-	C	-	-	-	-	**R**	-	A	-	-	Required when construction interfaces with existing occupiable areas of a building
Commissioning	Fire Inspection and Test Plans/ (ITP's and ITC's)	-	-	-	-	-	-	-	C	-	**R**	-	-	Submitted to Sydney Water Acceptance Team
	Baseline Data of Fire Safety Systems	-	-	-	-	-	-	-	C	-	**R**	-	-	As commissioned Benchmark used in AFSS
	Fire Services as-built drawings	-	A	-	-	-	-	-	-	-	**R**	-	-	Fire Designer or installer is responsible
	Fire Engineering Inspection Report	I	-	-	-	-	-	-	**R**	-	A	-	-	Similar to commissioning Report
	Fire Safety Certificate	A	-	-	-	C	-	-	C	-	**R**	I	-	Required for occupation of building
	Final Fire Safety Report	I	-	-	-	A	-	-	C	-	I	**R**	C	Prepared by FRNSW as required after commissioning inspection.
	BCA Completion Certificate	-	-	-	-	**R**	-	-	C	-	A	-	C	Equivalent to Occupation Certificate for Private Developers
Operation and Maintenance	Annual Fire Safety Statement	A	-	-	**R**	-	-	-	-	-	-	-	-	Must submit to council
	Fire Emergency Plan	C	-	**R**	-	-	-	-	-	-	-	-	-	Emergencies response, evacuating, notifying emergency services, etc.
	Management in Use Plan	A	-	**R**	-	-	-	-	-	-	-	-	-	Internal Document, e.g. SOP/Maximo
	Maintenance of Fire Safety Systems to AS 1851:2012	A	-	-	**R**	-	-	-	-	-	-	-	-	Mandated under *Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation* under Clause 81A

Table 8: Fire Safety Systems delivery timeline

Documents	Description	Project Life Cycle				
		Planning	Design	Construction	Commissioning	Operation & Maintenance
Preliminary Hazard Assessment (PHA)	Offers an early, high-level evaluation of potential hazards linked to the project.					
Dangerous Goods Assessment (DGA)	Assessment for the dangerous goods that may be stored, handled or generated on site.					
Bushfire Assessment Report	Required for a site located on bushfire-prone land.					
BCA Compliance Report	Confirms BCA capability and advises the baseline regulatory requirements.		Concept			
Fire Engineering Concept Design Report (FECDR)	Defines the high-level fire safety strategy.		Concept			
Fire Services Design Drawings	Contains the fully coordinated design for all active and passive Fire Safety Systems as per FECDR.		Concept			
Fire Safety Study (FSS)	Optimises the overall design by evaluating fire hazards specific to the site, the nature of operations and the surrounding context.		Concept			
CHAIR 1	Identify and eliminate foreseeable hazards, or where elimination is not reasonably practicable, to mitigate through design decisions.		Concept			
Performance Based Design Brief (PBDB)	Outlines the agreed methodology and parameters for delivering fire engineered Performance Solutions.		Detailed			
Fire Engineering Report (FER)	Detailed technical analysis that implements the methodology defined in the PBDB.		Detailed			
Initial Fire Safety Report (IFSR)	Provided by FRNSW after the review of the Fire Engineering Report.		Detailed			
CHAIR 2 and CHAIR 3	Construction and Maintenance consultation, and design risk review		Detailed			
Fire Service Drawings	Detailed Fire Drawings issued for Construction		Detailed			
Management in Use Plan (MIUP)	How fire safety measures like access egress routes are to be monitored, maintained, and managed over time.		Detailed			
Fire Safety Schedule (FSSc)	Documents all essential and critical fire safety measures required and their standard of performance.		Detailed			

Documents	Description	Project Life Cycle				
		Planning	Design	Construction	Commissioning	Operation & Maintenance
Construction Fire Safety Management Plan	Prepared by the principal contractor and outlines the practical fire-safety controls and procedures during construction.					
Interim Fire Safety Strategy	Construction hazards, temporary fire safety measures, when construction interfaces with existing or partially occupied areas.					
Installation and Commissioning ITP's/ITC's	Confirm Fire Safety Systems installed in accordance with the approved designs, manufacturer's requirements, codes, and relevant standards.					
Fire Engineering Inspection Report (FEIR)	Documents inspection observations in relation to the outcomes in the Fire Engineering Report (FER) and holistic fire safety.					
Fire Safety Certificate	Confirms fire safety measures have been inspected, tested, verified to perform in accordance with the Fire Safety Schedule.					
Final Fire Safety Report (FFSR)	Issued by FRNSW following review of completed performance solutions and inspection of completed works and installed systems.					
Baseline Data of Fire Safety Systems	Records the initial performance and test results of all fire services at the time of commissioning by the installing contractor.					
Fire Services As-Built Drawings	Sprinklers, hydrants, pipework, valves, fire panels, detectors, emergency lighting, EWIS cabling, smoke exhaust ducts, control interfaces.					
BCA Completion Certificate	Confirms the as-built works comply with NCC/BCA.					
Annual Fire Safety Statement (AFSS)	Yearly legal certification of maintenance and performance.					
FRNSW & Insurance Notifications	Operational teams required to notify FRNSW of flow/pressure interruptions and Insurance team of Fire Safety Systems isolation					

5. Fire Safety Systems Risk Assessment and Design Principles

Risk assessments are carried out as part of the Safety in Design (SiD) framework applicable to all Sydney Water design tasks. The sections below highlight SiD procedure and present tools used for risk identification and assessment. An overview of fire safety design principles is presented in the end.

5.1 Safety in Design (SiD)

The Safety in Design (SiD) process (D0000653) is applied throughout all stages of design. It is an organised and collaborative approach that systematically identifies and eliminates foreseeable hazards, or - where elimination is not reasonably practicable - mitigates them through informed design decisions.

The process brings together designers, engineers, asset owners, operators, constructors, the certifying authority, fire engineers, emergency services (as applicable), and other relevant specialists. This multidisciplinary team analyses how the infrastructure will be built, used, operated, accessed, and ultimately maintained. The objective is to embed safety directly into the design rather than relying primarily on administrative or operational controls later in the asset life cycle.

SiD methodology and tools applied during the design stages include:

- Construction Hazard Assessment and Implication Reviews (CHAIR 1, 2 & 3),
- Hazard and Operability (HAZOP) Study,
- Control Systems Hazard and Operability (CHAZOP) Study, and
- Failure Mode, Effects, and Criticality Analysis (FMECA).

Risk assessments associated with SiD activities are conducted in accordance with the Sydney Water Hazard Identification and Risk Assessment (HIDRA) procedure. Additional fire-related CHAIR guidewords have been developed as part of this guideline and added to existing CHAIR tables. Refer to Appendix 9.2 and 9.3 for more details.

5.2 Fire Risk Identification

Many fire hazards are present across Sydney Water sites. These include a wide range of electrical components such as power capacitors, batteries, battery rooms, oil-filled transformers, electric vehicle chargers, arc flash–prone equipment, and various cables and plastic components within both high-voltage (HV) and low-voltage (LV) switchgear. Fire hazards also extend to chemicals used in treatment processes, including hydrogen peroxide, methanol, ethanol, and diesel fuel.

In addition, flammable gases - such as methane and hydrogen sulphide generated from anaerobic digestion and sludge stockpiles - pose significant fire risks. Liquefied petroleum gas (LPG) cylinders used for pilot flames in waste gas burners, boilers, and hot water systems also represent notable hazards.

Sydney Water projects utilise a broad range of construction materials that are expected to be considered when assessing fire hazards. These include pipeline and tank insulation systems, various pipe and tank construction materials, numerous lining products, gas storage membranes, and other specialised materials that may contribute to fuel loads or influence fire behaviour.

Other fire hazards include organic fuel sources, such as stockpiles of dried sewage products (biomass, cake or sludge) stored either indoors or outdoors, and external accumulations of natural materials like mulch and vegetation.

The storage and location of these hazards add additional complexity. These materials and equipment may be stored or installed indoors or outdoors, on manned or unmanned sites, and near critical infrastructure or neighbouring properties due to space constraints. Some hazards may only be present temporarily as part of construction, maintenance, or emergency response activities, further complicating fire risk management.

The table below lists various resources used to identify and assess fire-related hazards.

Table 9: Fire-related hazards identification resources

Fire Hazards	Identification Resource
Bushfire prone land	Bushfire Risk Assessment Bushfire Management Plan
Dangerous goods Large fuel sources Large gas storage	Preliminary Hazard Assessment (PHA) Dangerous goods reports/assessments Fire Safety Study (FSS) Hazard and Operability Study (HAZOP, HAZID) Construction Hazard Assessment and Implication Review (CHAIR 1: design, CHAIR 2: construction, and CHAIR 3: maintenance) Safety Data Sheets (SDS) Emergency and Pollution Incident Response Management Plan (EPIRMP) Design Reports
Construction fire loads (e.g. temporary storage of large combustible material)	Interim Fire Safety Strategy Construction Management Plan
Electrical equipment	Sydney Water Elec Spec CPDMS0022 Sydney Water High Voltage Installations DOC0270 Sydney Water High Voltage Switch rooms DOC0018

Fire Hazards	Identification Resource
Unusual environments (e.g. corrosive, flammable, enclosed spaces and at heights)	Relevant training and qualification Safe Work Method Statement (SWMS) Standard Operating Procedures (SOPs) Hazard and Operability Study (HAZOP, HAZID) Business Continuity Plan Site Risk Reports Site Safety Walk

5.3 Fire Risk Assessment

When assessing project or site-specific fire risks, Sydney Water applies the risk assessment framework adopted from AS/NZS ISO 31000. Further details can be found in Sydney Water risk documents listed in the reference section.

A robust risk assessment begins with ensuring that fire safety design options are developed and detailed to a level that can be risk assessed, e.g. drawings, equipment selection and concept design reports are available for assessment. Good risk assessments also require that the stakeholders participating in the workshop genuinely represent the range of personnel likely to be exposed to fire risk. A non-exhaustive list of relevant stakeholder groups can be found in Table 7: Fire Safety Systems delivery RACI .

It is recommended that the facilitator of the risk assessment be independent, and where fire risks or project complexity warrant it, the facilitator should be a qualified Fire Safety Engineer.

Fire risk assessment is proposed to be incorporated into existing HAZOP and CHAIR workshops. Fire risk focused guidewords have been added to CHAIR templates in 9.2 and 9.3. The same guidewords can be used for HAZOP workshops. The Sydney Water HIDRA process should be used for risk assessment scoring.

ISO 31000 requires ongoing monitoring and review of proposed risk mitigation measures to ensure they are effective. This monitoring, along with proper record-keeping of risk assessments, is to be incorporated into project and/or property record management plans. Effective communication and consultation are required throughout the entire process.

Sydney Water Risk Management framework (DOC800991) is summarised below.

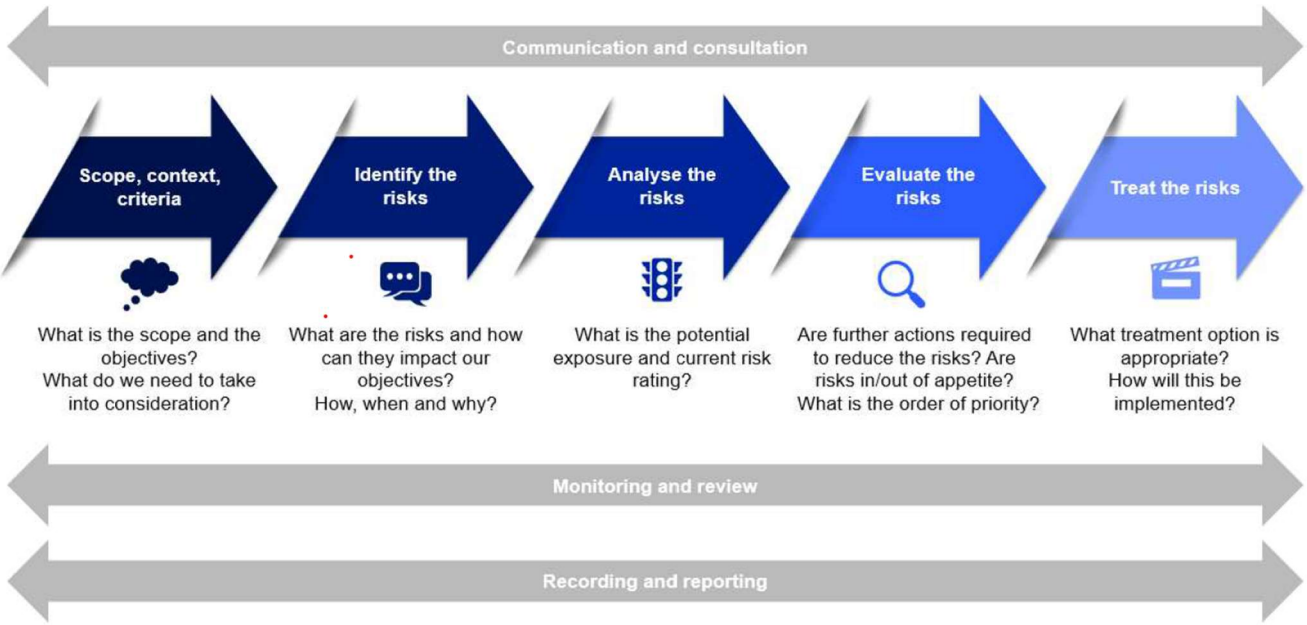


Figure 4: Risk Management Process (Sydney Water Risk Matrix Doc 800991)

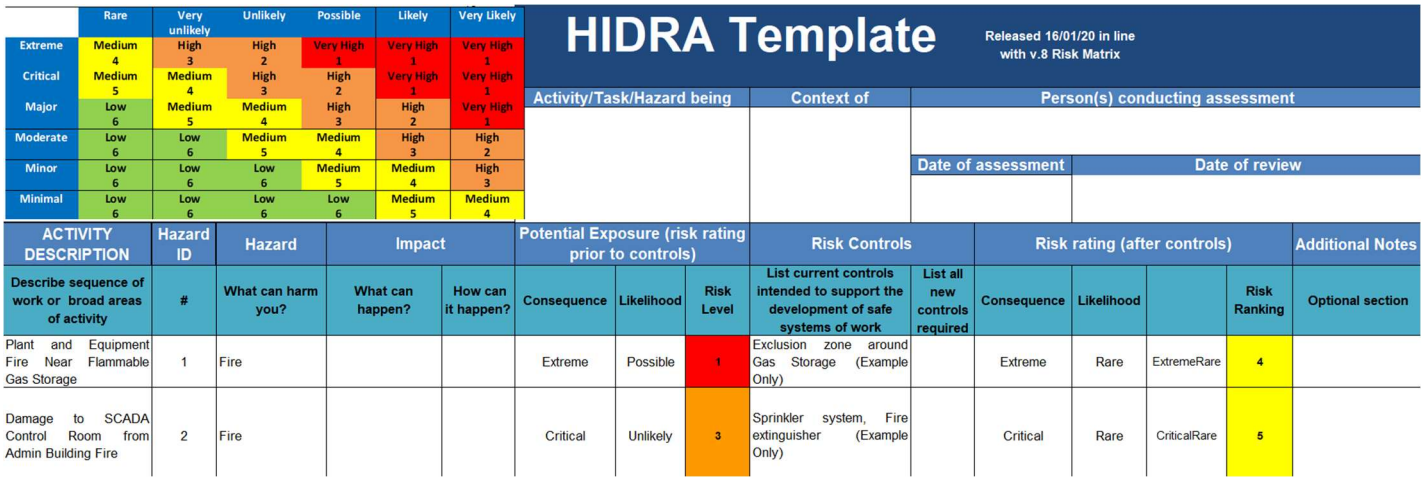
5.3.1 Hazard Identification and Risk Assessment (HIDRA)

Hazard Identification and Risk Assessment (HIDRA) is a semi-quantitative risk assessment and management tool used by Sydney Water. While HIDRA is routinely applied to operational and construction activities, it can also be used to assess fire risks throughout all stages of asset creation. Participation in HIDRA requires representation from teams and personnel who may be affected by the identified risks.

The HIDRA process involves identifying hazards and hazard events, assessing likelihood and consequences, and determining appropriate mitigation measures. Risk scores are assigned both before and after mitigation, using Sydney Water's prescribed scoring methodology. It is essential to apply Sydney Water's scoring system consistently, as different organisations use varying scoring frameworks, which may lead to confusion if mixed.

All risk mitigation measures should align with the hierarchy of control outlined in the WHS Regulations 2025. This hierarchy prioritises, in order: elimination, substitution, engineering controls, administrative controls, and finally personal protective equipment (PPE) as a last resort.

Any residual risk greater than "Low" requires escalation and sign off from the risk owner as per Sydney Water SiD procedure (D0000653). Risk owners can be found in Table 10: Sydney Water risk categories and the relevant risk owner.



	Rare	Very unlikely	Unlikely	Possible	Likely	Very Likely
Extreme	Medium 4	High 3	High 2	Very High 1	Very High 1	Very High 1
Critical	Medium 5	Medium 4	High 3	High 2	Very High 1	Very High 1
Major	Low 6	Medium 5	Medium 4	High 3	High 2	Very High 1
Moderate	Low 6	Low 6	Medium 5	Medium 4	High 3	High 2
Minor	Low 6	Low 6	Low 6	Medium 5	Medium 4	High 3
Minimal	Low 6	Low 6	Low 6	Low 6	Medium 5	Medium 4

ACTIVITY DESCRIPTION	Hazard ID	Hazard	Impact		Potential Exposure (risk rating prior to controls)			Risk Controls		Risk rating (after controls)				Additional Notes
Describe sequence of work or broad areas of activity	#	What can harm you?	What can happen?	How can it happen?	Consequence	Likelihood	Risk Level	List current controls intended to support the development of safe systems of work	List all new controls required	Consequence	Likelihood		Risk Ranking	Optional section
Plant and Equipment Fire Near Flammable Gas Storage	1	Fire			Extreme	Possible	1	Exclusion zone around Gas Storage (Example Only)		Extreme	Rare	ExtremeRare	4	
Damage to SCADA Control Room from Admin Building Fire	2	Fire			Critical	Unlikely	3	Sprinkler system, Fire extinguisher (Example Only)		Critical	Rare	CriticalRare	5	

Figure 5: Sydney Water HIDRA template

5.3.2 Sydney Water Risk Universe

Fire risk should also be assessed with respect to operational continuity, protection of critical assets, and financial burdens associated with asset replacement and ongoing insurance cost. Sydney Water risk assessment extends beyond personnel safety and property protection to include the wider corporate and legal compliance risks. The Risk Framework (Doc 819910) introduces the concept of Risk Universe where business risks as well as enterprise risks are defined and need to be included in fire risk assessments. Risks categories and their owners are listed below.

Table 10: Sydney Water risk categories and the relevant risk owner

Risk Category	Description	Risk Owner
Enterprise Risks	Risks that impact the ability to achieve Sydney Water objectives (from the Sydney Water Act). Examples include unacceptable public impact or customer dissatisfaction.	Managing Director / CEO
Business Risks	Risks that impact the ability to deliver objectives in line with Sydney Water Vision and Strategic Objectives. Examples include EPA licence non-compliance, Environmental Risks, Department of Health Critical Control Point (CCP) breach, financial loss, delays and high insurance premium.	EGM
Operational Risks	Hub/Team level risks that could materially impact Sydney Water's ability to deliver day-to-day operational requirements.	HoB, People Leaders

5.4 Common Fire Safety Principles

There are predominantly three different methods for incorporating fire protection systems into assets and facilities:

1. Prescriptive as dictated by Acts, Regulations, Codes and Standards,
2. Based on industry practices and guidance materials, and
3. Risk-based performance solutions via risk assessments.

Irrespective of the method used, fire protection systems must address the following objectives:

1. Protect the safety of workers, contractors and emergency responders,
2. Protect critical water and wastewater assets,
3. Support operational continuity and resilience,
4. Address, where they exist, specific Sydney Water fire risks,
5. Provide proportionate controls,
6. Integrate with Sydney Water asset life-cycle phases and operational systems, and
7. Establish early on compliance pathways, accountability and assurance systems.

Five main fire protection principles apply irrespective of the solution provided. These principles are outlined in the "Common Principles by the International Fire Safety Standards Coalition" international fire standard. This Coalition is a global, UN-backed group of international professional and not-for-profit organisations responsible for developing consistent, high-level fire safety standards for building design, construction and management and includes Engineers Australia and Fire Protection Association (FPA) Australia. These principles apply mainly to buildings but can be extended to apply to process units.

The five common underlying principles identified in the International Fire Safety Standards and applied in fire risk assessments are:

1. Prevention – Safeguarding against fire initiation and/or limiting its effects;
2. Detection and Communication – Identifying the presence of fire followed by informing occupants and fire services;
3. Occupant Protection – Facilitating occupant safety during evacuation from the effects of fire and its combustion products;
4. Containment – Limiting fire and its combustion products from spreading beyond an area; and
5. Extinguishment – Suppression of fire and protecting the surrounding areas.

The above fire design principles, methods and objectives are shown graphically below:

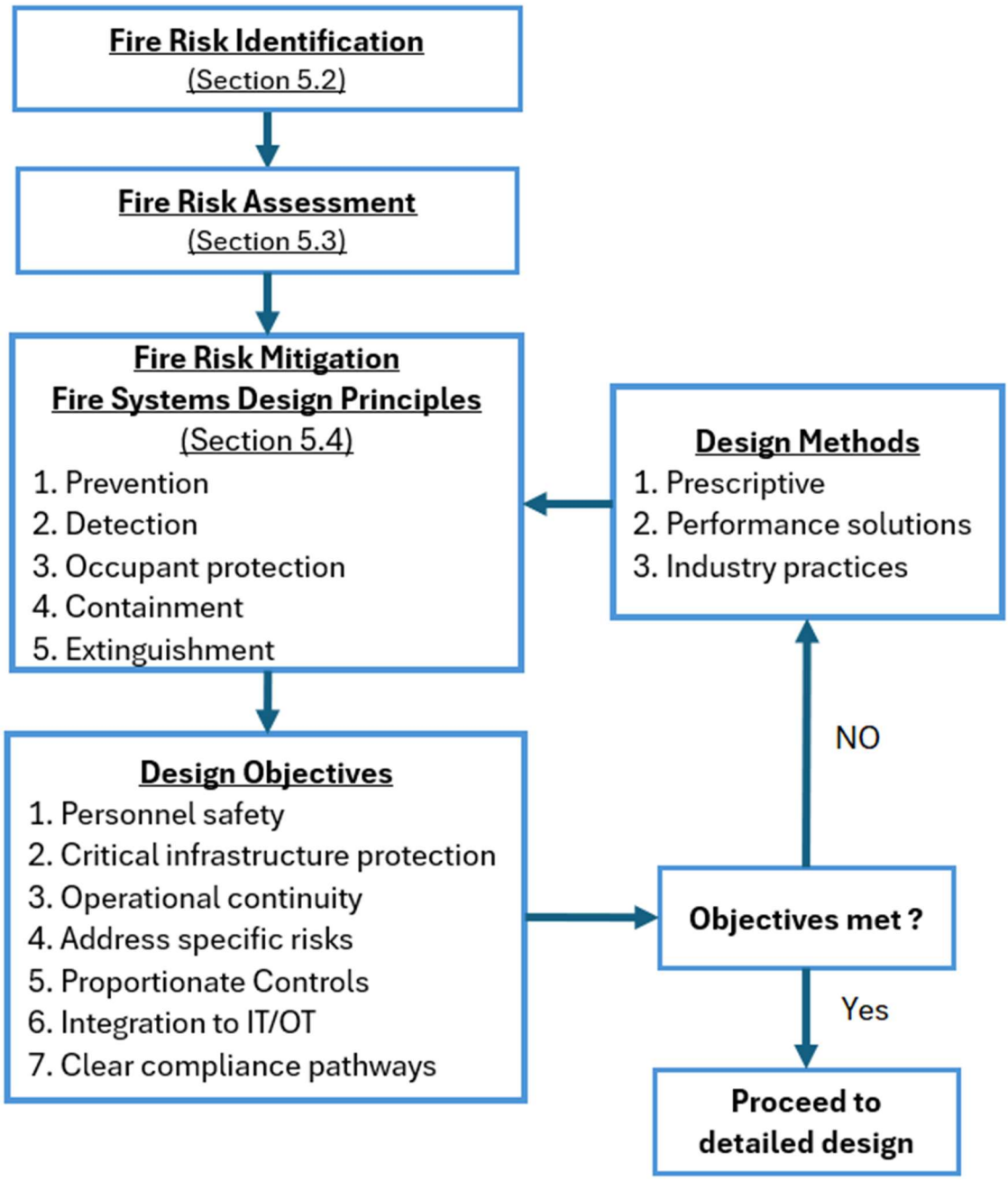


Figure 6: Fire Safety Systems design principles, methods and objectives

The following sections further expand fire systems design principles.

5.4.1 Prevention

The goals of the prevention principle are to provide life safety from fire, prevent building damage and protect the building's operational requirements. For effective building design, the prevention principle must be considered and applied at each stage of the project life cycle to eliminate fire initiation, so far as is reasonably practicable. This includes the control of ignition sources and management of potential fuel sources in line with NFPA 550's Fire Prevention Methodology as illustrated below.

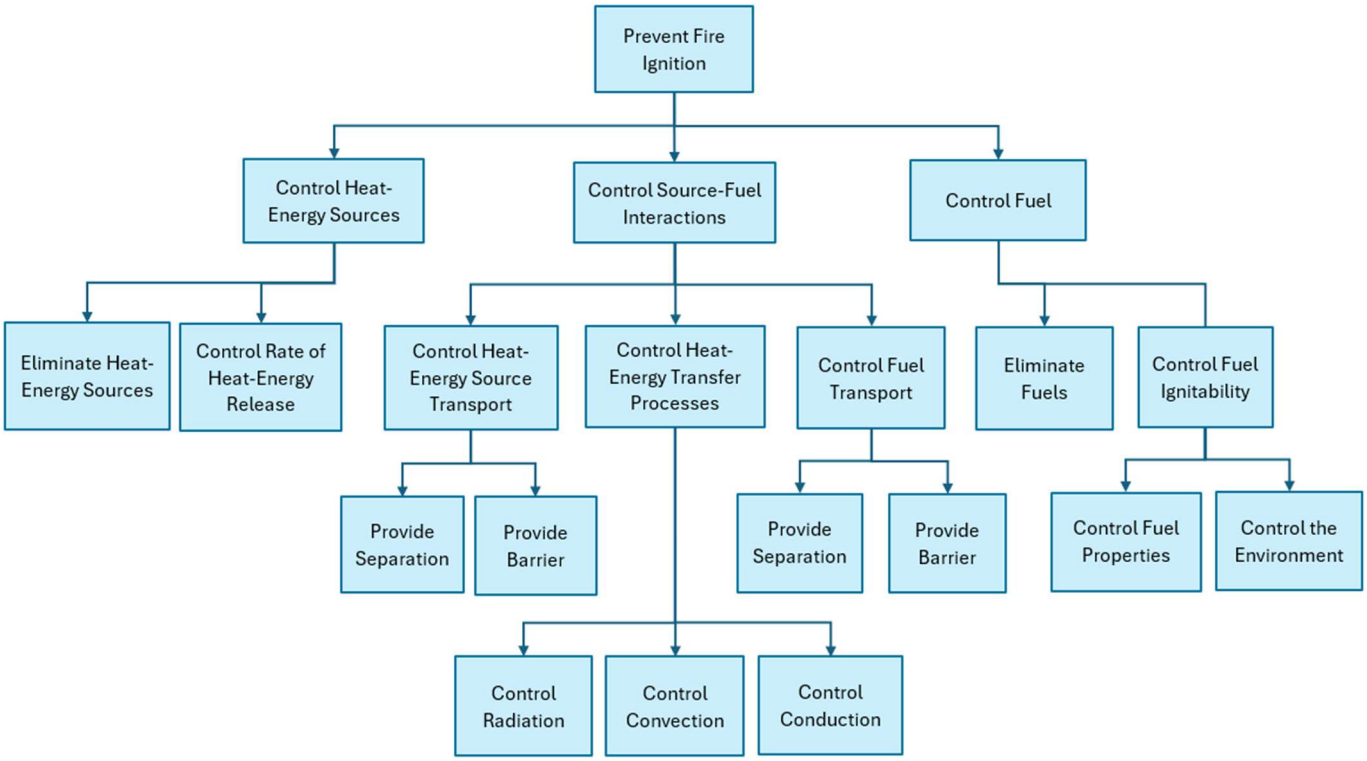


Figure 7: NFPA 550 Fire Prevention Methodology

When applying the prevention principle for fire safety, the initial phase of risk assessments generally involves identifying the causes of fire, which can include:

1. Arson;
2. Electrical fires;
3. Accidental fires (e.g. caused by cooking, smoking, open flames, candles, bonfires, chemical spills, hot work, etc.);
4. Explosions (e.g. dust and gas explosions, fireworks, etc.); and
5. Natural causes (e.g. lightning strikes, wildfires, etc.).

Once a hazard and its causes are identified, the appropriate fire safety strategies and measures can be proposed to prevent fire initiation.

5.4.2 Detection and Communication

The aim of detection and communication is to:

1. Notify occupants of a fire upon detection for first aid firefighting, building evacuation and fire brigade notification where direct connection is not provided; and
2. Notify fire brigades of a fire event where direct connection is provided and identify the location of the fire to carry out firefighting activities effectively.

Effective communication in a fire event reduces delay in decision-making, which can be critical for both occupants and fire brigade personnel in an emergency. Reducing the delay in both detection and

communication times often demonstrates a better fire safety strategy as occupant evacuation and fire brigade intervention can occur earlier and faster.

5.4.3 Occupant Protection

The occupant protection principle seeks to facilitate occupant evacuation by providing adequate shielding from the effects of fire, sufficient time and clear direction to reach an exit or safe location. Occupant protection is mostly achieved during the design stage based on building and exit configuration, fire safety measures that limit fire and smoke spread and the understanding of occupant characteristics.

5.4.4 Containment

Containment relates to limiting the spread of fire and its combustion products to mitigate the consequences of a fire event. This can be achieved through different strategies such as compartmentation, smoke control, active and passive Fire Safety Systems, fire-resistance level and fire hazard properties of materials.

5.4.5 Extinguishment

The aim for the extinguishment principle relates to suppressing a fire and protecting the surrounding environment. It is recognised that active fire safety measures like automatic sprinkler systems mainly contain fires within a compartment and extinguishment is undertaken by the fire brigade personnel. For smaller single fire events, building occupants are also able to extinguish fires via the use of fire hose reels, portable fire extinguishers and fire blankets. However, this approach is not recommended because it prolongs occupant exposure to fire and its combustion products which increases the risk of injury. Thus, buildings should contain fire safety measures designed and maintained adequately for fire brigade use to carry out firefighting operations efficiently.

Acknowledgement

Sydney Water would like to acknowledge Lote Consulting Pty Ltd, Fire Safety Engineers, co-authors of this guideline, as well as the following Sydney Water teams for their input: Legal, Property Group, Asset Management, Insurance, Operations, Engineering & Technical Services and project delivery teams.

6. References

Table 11: References

Document type	Title
Compliance obligations	• Work Health and Safety (WHS) Act 2011 (NSW) (New South Wales Government legislation) • Environmental Planning and Assessment (EP&A) Act 1979 (NSW). (New South Wales Government legislation) • State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 (NSW) • Security of Critical Infrastructure (SOCI) Act 2018 (SOCI) • Protection of Environmental Operations (POEO) Act 1997. (New South Wales Government legislation)
Policies and procedures	• Sydney Water. Safety in Design (D0000653) • Sydney Water. Environmental Impact Assessment and Approval Pathways (SWEMS0019) • Sydney Water. Commissioning Specification (D0001440) • Sydney Water. Risk Matrix (800991) • Sydney Water. Risk Framework (819910) • Sydney Water. Risk Management Procedure (1045159) • Sydney Water. WHS Risk Management (550964) • Sydney Water Building Design Specification (D0002084)
Other documents	• Australian Building Codes Board (ABCB). (2025). National Construction Code (NCC) 2022 Amendment 2 Volume One • National Fire Protection Association. (2016). NFPA 550: Guide to the Fire Safety Concepts Tree • International Organisation for Standardization. (2018). ISO 31000: Risk Management — Guidelines

7. Ownership

Role	Title
Group	Water & Environmental Services
Owner	Norbert Schaeper, Engineering Modernisation Manager
Author	Akheel Soltan, Technical Director - Process

8. Change History

Version	Issue Date	Prepared By	Reviewed By	Approved By	Brief description of change and consultation
1	15.07.26	A.Soltan	A.Smith	N. Schaeper	First Release

9. Appendices

9.1 Appendix A - EP&A Act Approval Pathways

9.1.1 Part 1, Section 1.6 - Exempt Developments

Exempt developments do not require development consent, provided they meet prescribed development standards and other requirements under environmental planning instruments including the TISEPP and *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008* (SEPP Codes). They cover work in connection with a sewerage system, stormwater management system or water supply system such as emergency works, emergency maintenance, and routine maintenance and associated landscaping works. They also include minor building works like adding an air conditioner, patios, carports, etc. Temporary structures required for any of the above can also be approved under this pathway so long as they are one storey high.

Where building work is involved, exempt development must comply with applicable development standards and other requirements, including building standards in the NCC/BCA, as required under the EP&A Act and relevant planning instruments. Exempt Development building works must comply with the NCC/BCA DtS Provisions. Performance Solutions are not permitted.

For projects under Exempt Development, Project-level compliance is overseen by the project manager. A BCA Compliance Report may be required depending on the scope, typically prepared by accredited consultants (Building Surveyor or Certifying Authorities or BCA Consultant).

In practice, many Sydney Water projects delivered under Exempt Development do not require a BCA report or fire system modifications; however, project teams should confirm this by consulting an Accredited Certifier or Building Surveyor – Unrestricted (formerly A1) or suitably qualified BCA consultant. Where a BCA Report is required, it must be retained in the project's document records.

9.1.2 Part 4, Division 4.3 - Development That Needs Consent

This represents the standard and most widely used development pathway in New South Wales. It is the primary approval route used by builders and developers for projects such as residential housing, shopping centres, and recreational facilities. Under this pathway, development consent from the local council or other consent authority is required.

A Statement of Environmental Effects (SEE) typically accompanies the Development Application (DA). It forms part of the required environmental assessment documentation for developments involving low to moderate environmental impacts. NSW requirements specify that a DA must include an environmental assessment - such as an SEE or Environmental Impact Statement (EIS) - depending on the scale of the proposal and environmental impacts.

Once a development consent is granted and before construction can begin, a Crown Certificate must be issued (Construction Certificates are used by the private sector). The Crown Certificate confirms that detailed building plans comply with the NCC/BCA - including requirements for Fire Safety Systems. Starting construction without a Crown Certificate is not permitted.

Upon completion of the works, a non-statutory BCA Completion Certificate is obtained (Occupation Certificates are used by the private sector) before occupation of the whole or part of the building. The BCA Completion Certificate verifies that the building has been constructed in accordance with the approved plans, Crown Certificate conditions, and relevant safety and regulatory standards, confirming that the premises are suitable for occupation.

This planning approval pathway is not commonly utilised by Sydney Water when delivering infrastructure projects as much of the development that it carries out is permissible without consent or exempt development under the TISEPP.

9.1.3 Part 4, Division 4.5 - Complying Development

Complying Development is for low impact development that, provided that it complies with applicable provisions of environmental planning instruments, development control plans and regulations, does not require development consent. Instead, it requires a Complying Development Certificate (CDC) which combines planning and building approval into a single streamlined process. A Complying Development application is submitted to the local council or an Accredited Certifier for assessment. Once the application is approved, the works proceed under a CDC.

While Performance Solutions can be incorporated into a CDC, they do require a supporting BCA Compliance Report as part of the application. All fire-related requirements and deliverables are captured within the CDC documentation. When work is completed, Crown Certificates will not be required. This approval pathway is rarely utilised by Sydney Water.

9.1.4 Part 4, Division 4.7 – State Significant Development

State Significant Development (SSD) is generally medium to high environmental impact activities that are declared to be SSD, usually in a SEPP, such as building a water recycling facility in a land use zone that is not a prescribed zone as listed in the TISEPP. Approval is required from the Minister for Planning. A development application is lodged with an EIS which addresses the Planning Secretary's Environmental Assessment Requirements (SEARs). Certain other approvals are not required to be obtained (such as an Aboriginal heritage impact permit) while others (such as an environment protection licence) cannot be refused and must be substantially consistent with the SSI approval.

Compliance with the NCC/BCA is similar to other Part 4 planning approval pathways, requiring both a Crown Certificate and BCA Completion Certificate (Construction and Occupation Certificates are

used by the private sector). As with other Part 4 pathways, this planning approval pathway is rarely used by Sydney Water when delivering infrastructure projects.

9.1.5 Part 5, Division 5.1 - Development Permitted Without Consent

This pathway is the one that is most commonly used by Sydney Water to deliver infrastructure projects. Environmental planning instruments, such as the TISEPP identify the types of activities that public authorities such as Sydney Water may undertake without needing development consent across a range of land zones. As a result, these activities do not require development consent under Part 4 of the EP&A Act and can instead be assessed and determined under Division 5.1, provided Sydney Water examines and takes into account matters affecting or likely to affect the environment by reason of that activity, in a manner that is proportionate to the nature and risk of the activity, in an REF or in an EIS.

Some Part 5 activities are State significant infrastructure (SSI) or critical SSI. These are infrastructure projects which are considered to be State significant because they are important to NSW for economic, environmental or social reasons. SSI applications require the preparation of an EIS and are determined by the Minister for Planning. Certain other approvals are not required to be obtained (such as an Aboriginal heritage impact permit) and others (such as an environment protection licence) cannot be refused and must be substantially consistent with the SSI approval.

The REF for Part 5 development that is not SSI should be prepared by a suitably competent person with relevant environmental planning and assessment experience and then reviewed and endorsed within Sydney Water. In certain cases, consultation with external stakeholders - such as local councils, airport authorities, or other state agencies - is required under the consultation provisions in the TI SEPP. If significant environmental impacts are identified, an Environmental Impact Statement (EIS) will be required.

9.2 Appendix B - CHAIR 1 Guidewords for Fire Safety

Fire-related guidewords and comments are added in blue to the existing CHAIR template. The same keywords can be used in HAZOP templates as required.

Table 12: CHAIR 1 with fire guidewords added

Guidewords	Sub-Prompts	Additional Fire-related Considerations / Comment
ENERGY	Low / high energy Tension / compression Potential / kinetic Inertia / moment	Electrical safety High or low temperature processes Hot works
EGRESS / ACCESS	Number of exit points Emergency egress, size (e.g. converging exits, head heights, reduced widths, etc) Obstructions, lighting Entry / exit points External impacts Maintenance People and equipment Movements	Evacuation procedures Simultaneous or phased evacuation Protected lobbies, safe havens, refuge areas or assembly points Building configuration and features Travel distances Egress routes and alternative routes Emergency lifts Occupant wayfinding (e.g. emergency lighting and exit signage) Merging population flows Good housekeeping related to evacuation
MATERIAL PROPERTIES	Internal linings External building construction Room contents Products stored	
OCCUPANT BEHAVIOUR / CHARACTERISTICS	Activities (e.g. smoking, cooking) Population, roles and security / access Awareness, familiarity and mobility Training (e.g. accreditation, site procedures) Crowd control and occupant behavioural response Evacuation time	Evacuation assistance for vulnerable occupants
EXTERNAL SAFETY INTERFACES	Members of the public Traffic Adjacent property Power / services External fire / plans Day / night / weekend	Distance to external hazards e.g. other buildings, structures, combustible storage or goods Consideration for interfacing or shared facilities

Guidewords	Sub-Prompts	Additional Fire-related Considerations / Comment
TOXICITY	Lead / asbestos Handling Storage Precautions Ventilation	Product safety
FIRE / EXPLOSION	Prevention / detection Suppression Occupant warning system Fire protection Emergency procedures	Visual alarm systems Fire brigade notification and intervention Direct connection to fire brigade Fire brigade panel Emergency Services Information Package (ESIP) Coordination with fire brigades e.g. training and preparation of occupants, familiarisation exercise, access in and around facility, provisions for firefighting operations Fire appliance requirements e.g. hard stand location, vehicle access Clear signage and block plans near and in the building e.g. at boosters, FDCIE, fire-isolated exits, hydrants Fire brigade personnel safety (e.g. building structural resilience, tenability) Fire and smoke containment Compartmentation Barriers Smoke control systems
ENVIRONMENTAL IMPACT	Vapour / dust Effluent / noise Seepage / waste	Impact of water run-off
NATURAL HAZARDS	Earthquake Flooding Thunderstorm (lightning protection) High winds Bushfire	
INSPECTION / TESTING	Eliminating Isolation Access	Inspections during construction Regular inspections, testing and maintenance of Fire Safety Systems for quality and safety during operation Confirm compatibility of new modules/materials with existing systems
DOCUMENTATION	Operations (e.g. SOPs) Maintenance Inspection / Testing	Hot work procedures

Guidewords	Sub-Prompts	Additional Fire-related Considerations / Comment
	Sequence Emergency Records / Reports	Training and preparations for evacuation (i.e. evacuation plans, procedures, fire drills, etc) Designating fire wardens Regular drills Training for occupants Avoiding works that compromise compartmentation Good housekeeping relating to prevention, procedures, containment and extinguishment Recognise Fire Safety Systems and avoid interference Electrical equipment safety Areas of hoarding or storage of easily ignited materials Emergency Services Information Package (ESIP) Temporary evacuation plans and procedures during construction to suit phased completion or temporary impairment Documentation of as-built conditions Sign-off by relevant stakeholders during construction Confirm compatibility of new modules/materials with existing systems Good housekeeping relating to extinguishment facilities, signage and fire brigade access Gap analysis between existing provisions and the requirements in the current standards
QUALITY CONTROL	Inspection / Testing Quality Assurance	Regular inspections for progress, quality and safety during construction and operation
CONSTRUCTION EQUIPMENT	Sequence Timing, Access	Control of combustible materials during construction: Waste control, storage and disposal Storage of construction materials and combustible materials Exposed combustible materials during construction
MAN-MADE DISASTERS	Arson Wilful damage	

9.3 Appendix C – CHAIR 2 Guidewords for Fire Safety

Table 13: CHAIR 2 with fire guidewords added

Guidewords	Sub-Prompts	Additional Fire Considerations / Comment

ELIMINATE	- Falls (of people)
	- Falling material / objects
	- Stepping on or striking against objects
	- Caught or trapped
	- Lifting and carrying – over exertion
	- Asphyxiation / drowning
	- Machinery
	- Electricity
	- Transport / mobile plant
	- Toxicity, fire and explosions
		- High-risk procedures
		  - Hot works
		  - Working at heights
		  - Enclosed spaces

AVOID	- Construction / lifting
	- Sequence
	- Timing / locations
	- Temporary instability
	- Access / egress
	- Delays / confined space
	- Erection / dismantling
	- Heat / cold / noise
		- Control of combustible materials during construction:
		  - Waste control, storage and disposal
		  - Storage of construction materials and combustible materials
		  - Exposed combustible materials during construction
		- High-risk procedures
		  - Hot works
		  - Working at heights
		  - Enclosed spaces

OTHER ISSUES?	- Modification
	- Isolation / engineering controls
	- Personnel protection equipment
	- Alter / rearrange
	- Increase / reduce
	- Simplify / improve
		- Workers' behaviour and characteristics
		  - Smoking
		  - Cooking
		  - Population, roles and security
		  - Awareness, familiarity and mobility
		  - Training (e.g. accreditation, site procedures)
		- Phased construction
		  - Phased implementation of permanent Fire Safety Systems for partial protection (e.g. installation of Fire Safety Systems shortly after the installation of combustible materials)
		  - Complete each fire compartment at a time
		  - Use temporary fire safety protection measures where appropriate (i.e. detection, mobile or semi-fixed firefighting systems)
		  - Regular inspections for progress, quality and safety

Guidewords	Sub-Prompts	Additional Fire Considerations / Comment
		- Documentation of as-built conditions - Sign-off by relevant stakeholders during construction - Temporary evacuation plans and procedures for phased completion or temporary impairment - Fire brigade intervention - Fire brigade notification and communication systems - Fire brigade access - Facilities for firefighting operations (e.g. water supply, manual firefighting equipment) - Site information (e.g. signage of facilities, stored hazardous materials)

9.4 Appendix D – Sample Management in Use Plan

Project:

Building Address:

Building Description:

EXISTING & NEW INSULATED PANELS (ISPs) IN THE OFFICE & WAREHOUSE

1) Signage indicating the installation of insulated sandwich panels for the subject building shall be maintained at the site entry points, fire hydrant booster and the Fire Indicator Panel (FIP) as per the FER.

EGRESS PROVISIONS IN THE OFFICE

1) Egress routes shall be shown on the Evacuation Block Diagrams and included in the Emergency Response Plan for the premises as per the FER.
2) Dedicated egress paths shown on Evacuation Block Diagrams shall be maintained clear of obstructions as per the FER.
3) All door hardware shall be maintained in accordance with BCA Clauses D3D24, D3D25 and D3D26 and the FER.
4) All doors shall maintain the clear width requirements in accordance with BCA Clause D2D8 and the FER.

EGRESS PROVISIONS IN THE WAREHOUSE

1) Egress routes shall be shown on the Evacuation Block Diagrams and included in the Emergency Response Plan for the premises as per the FER.
2) Egress paths shown on Evacuation Block Diagrams shall be maintained clear of obstructions as per the FER.
3) The permanent colour contrasting floor markings showing the dedicated 1 m wide egress pathways shall be maintained in the warehouse as per the FER.
4) All doors in the path of travel shall be maintained so that they are readily openable from the side that faces a person seeking egress in accordance with BCA Clauses D3D24, D3D25 and D3D26 and the FER.

EGRESS PROVISIONS UNDER THE AWNING

1) Egress routes shall be shown on the Evacuation Block Diagrams and included in the Emergency Response Plan for the premises as per the FER.
2) Egress paths shown on Evacuation Block Diagrams shall be maintained clear of obstructions as per the FER.

3) The permanent colour contrasting floor markings showing the dedicated 1 m wide egress pathways under the awning shall be maintained as per the FER.

THERMOGRAPHIC MONITORING IN OFFICE AND WAREHOUSE

1) All electrical wiring and switchboards shall be inspected, tested and maintained every year as per the FER. This includes checking of all equipment, contact terminations, and regular thermographic monitoring by a licensed electrician.

WAREHOUSE STORAGE

1) The storage in the Warehouse shall be maintained to be less than 4 m in height and 1,000 m^3 in volume as per the FER.
2) The signage enforcing the prohibition of storage over 4 m in the warehouse shall be maintained as per the FER.

AWNING STORAGE

1) The storage of combustible goods under the awning within 3 m of the existing adjoining building and the northernmost steel column shall be prohibited as per the FER.
2) The signage enforcing the storage prohibition under the awning shall be maintained as per the FER.
3) The permanent colour contrasting floor markings indicating the sterile area under the awning shall be maintained as per the FER.
4) The signage enforcing the storage prohibition and parking restrictions shall be maintained as per the FER.
5) The bollards shall be maintained as per the FER.

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