Controlled Document

Electricity Network Safety Management System (ENSMS) Description

Summary

Describes the framework of TransGrid's Electricity Network Safety Management System (ENSMS) to effectively manage network safety.

Document Control

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1. Purpose

The purpose of this document is to set out the elements of TransGrid's Electricity Network Safety Management System (ENSMS) to enable it to be adequately understood, communicated, and implemented.

2. Introduction

2.1 Network description

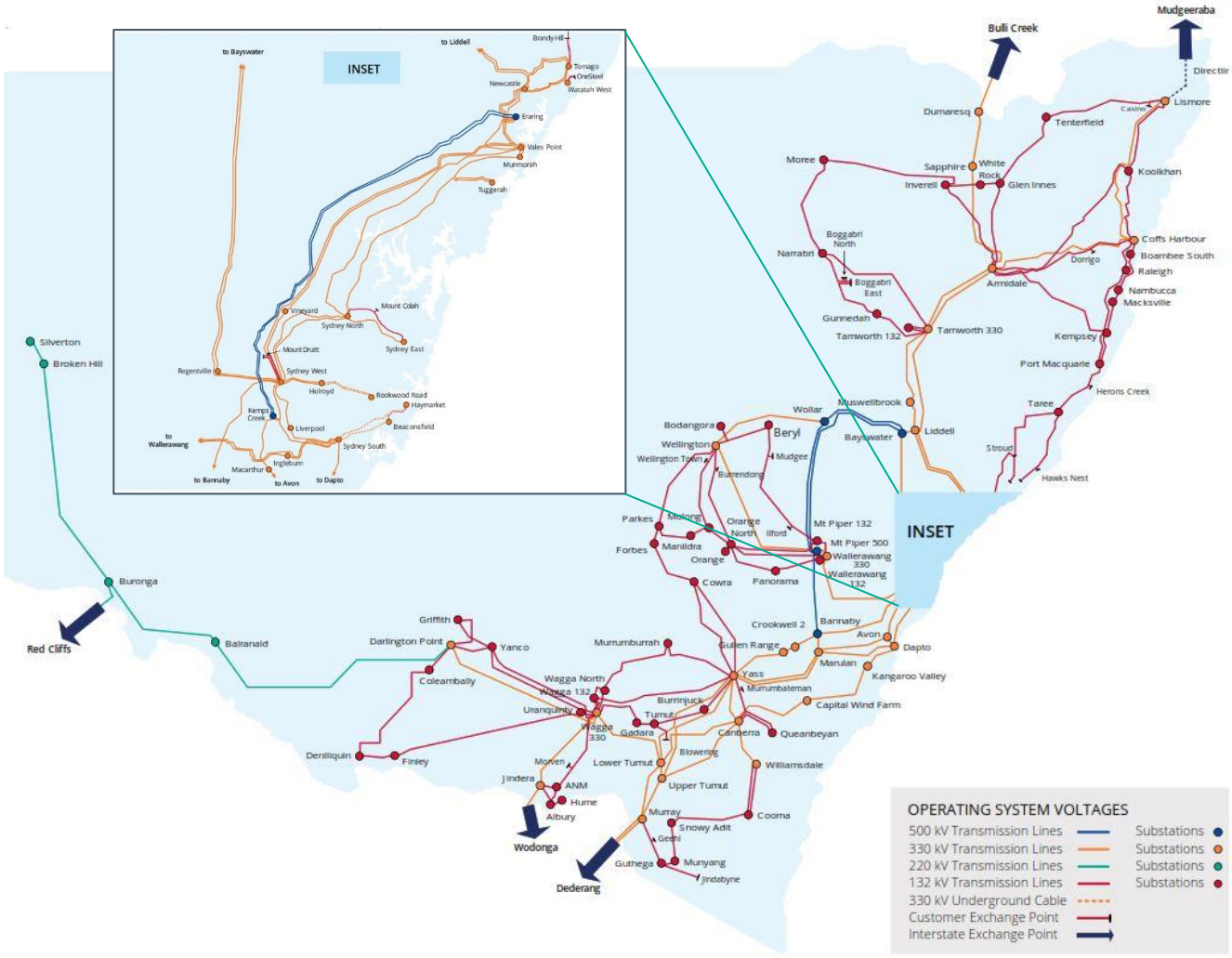
TransGrid operates and maintains the electricity transmission network in NSW and the ACT on a long term lease basis, this is one of the largest in Australia. It extends from the Queensland border to the Victorian border and connects the major energy sources with major load supply points throughout NSW and the ACT as well as transfer though the instate connectors. TransGrid's network forms the backbone of the National Electricity Market (NEM) facilitating interstate trading and transfer of electricity. TransGrid's prescribed electricity transmission network incorporates:

> Over 13,000 kilometres of high-voltage overhead transmission line and underground cable operating at voltages of up to 500kV
> 106 substations including switching stations
> Five inter-connectors to Victoria and Queensland

This network is controlled out of two independent control rooms located in Wallgrove and Newcastle. These control rooms are fully redundant with emergency protocols in place to manage unexpected events.

Figure 1 shows a graphical representation of TransGrid's NSW and ACT electricity transmission network. It does not show its non-prescribed electricity network assets outside of NSW. Appendix H provides a register of TransGrid's substation and transmission line assets.

Figure 1 - TransGrid's Network



2.2 Overview of this document

This document explains the elements of the ENSMS and its interactions with other management systems to achieve its primary objectives. It outlines how the network safety requirements of the overarching corporate policies for asset management, safety, environment and bushfire risks are managed by the ENSMS.

This description document enables TransGrid to implement its ENSMS and make it known and readily accessible to stakeholders endorsing, approving, managing, informing and undertaking ENSMS functions. The intended audience of this document includes, but is not limited to:

> TransGrid's management, employees and contractors, particularly those directly involved in the safe and reliable operation of its network throughout its life cycle.
> NSW and ACT DNSPs
> The communities and consumers near TransGrid's electricity network.
> NSW and ACT government authorities, including the Independent Pricing and Regulatory Tribunal (IPART), Utilities Technical Regulator (UTR), Rural Fire Service (RFS), Forestry Corporation, local government councils, public infrastructure utilities etc.

For ease of navigation this document follows the structure of AS5577 structure. It also provides descriptions in relation to specific requirements of the Regulation outside of AS 5577.

2.3 Scope

The scope of ENSMS includes TransGrid's NSW and ACT electricity transmission network consisting of prescribed and non-prescribed asset portfolios as shown in Table 1. The ENSMS encompasses the following asset lifecycle activities for these network asset portfolios from planning through to disposal.

TransGrid also operates electricity network assets outside of NSW and ACT. These network assets are excluded from the scope of this ENSMS.

For Victorian Assets a specific Electricity Safety Management Scheme has been developed that may make reference to this document, as such there is some reference to these. This is information only and does not support ENSMS compliance for NSW/ACT.

TransGrid also owns and maintains significant portfolio of non-network assets such as office facilities, properties, fleets etc. in NSW and ACT. These non-network assets are excluded from the scope of this ENSMS.

Table 1 – Assets within the scope of the ENSMS

Asset Portfolio	Within the scope of this ENSMS [Aligned to AS5577]	Outside the scope of this ENSMS
Network Assets	NSW and ACT prescribed electricity transmission network assets that make up the transmission system (i.e. all assets included in the RAB). *[This constitutes the core business of TransGrid and majority of its asset portfolio]*	----
	NSW and ACT non-prescribed electricity transmission network assets and directly associated telecommunication systems. *[This includes connection assets and negotiated assets.]*	Other non-prescribed assets that do not form part of the electricity transmission network such as third part telecommunications services.
Non-Network Assets	----	> Property portfolio (where not directly related to the network) > Facilities (head office, three regional depots and three area centres) > Fleet (motor vehicles, mobile plants), test tools and equipment > IT hardware and software (not directly related to the network such as operational technology) > Non-network solution initiatives (where not directly connected to the network)

3. Context

3.1 Obligation

TransGrid complies with the NSW Electricity Supply (Safety and Network Management) Regulation 2014 (the Regulation) that requires it to have an Electricity Network Safety Management System (ENSMS) whose primary objective is to ensure that design, construction, commissioning, operation and decommissioning of its network (or any part of its network) is safe, and in particular, to support:

> The safety of members of the public.
> The safety of persons working on networks.
> The protection of property (whether or not belonging to a network operator).
> The management of safety risks arising from the protection of the environment (for example, preventing bush fires that may be ignited by network assets).
> The management of safety risks arising from loss of electricity supply.

The content of TransGrid's ENSMS is in accordance with AS 5577 and deals with the following matters:

- The safety and reliability of its network.
- Advice to the public about the hazards associated with electricity in relation to its network.
- Management of bush fire risk relating to its network assets that are capable of initiating bush fire.

3.2 Policy and Commitment

The safe and responsible operation of the electricity transmission network is TransGrid's highest priority and must comply with the Regulation with regards to ENSMS. This priority and the regulatory obligation drives the following overarching corporate policies and statement:

- **Asset Management Policy**

  This policy commits to manage TransGrid's network '…Provide safe and reliable power… '. This component of the policy is focussed on safety and reliability during the entire network asset life cycle and requires compliance with legislative, regulatory and licence conditions.
- **Health and Safety Policy**

  This policy operates in conjunction with the Asset Management Policy focusing on safety of staff, contractors, visitors and the public. This policy also obliges compliance to other jurisdictional and legislative requirements.
- **Environment Policy**

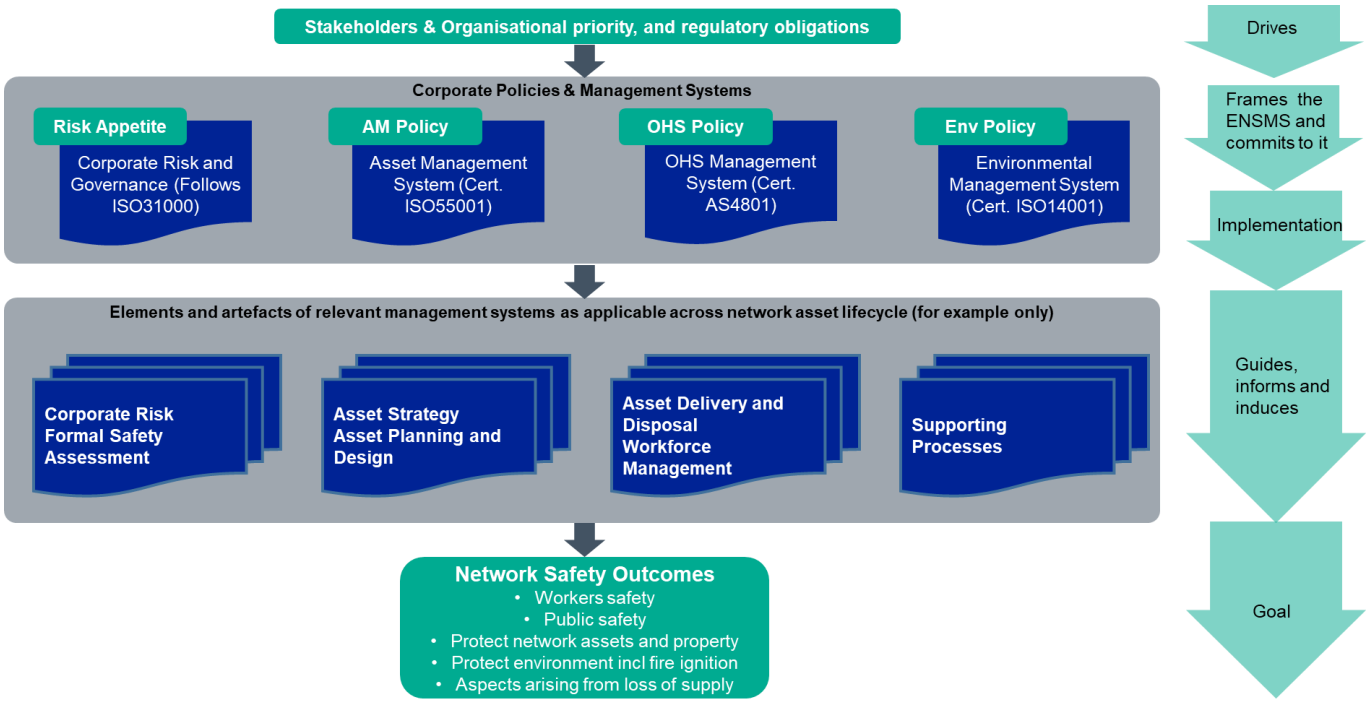
  This policy operates in conjunction with the Asset Management Policy focusing on protecting the environment. This policy also obliges compliance to other jurisdictional and legislative requirements.
- **Risk Appetite Statement (RAS)**

  TransGrid's RAS defines the degree of risk that the business is willing to accept for its stakeholders to fulfil its strategic and operational ambitions. This statement is endorsed by the Board and informs the management of the risk tolerance levels the business must operate to at all times. It specifies the tolerance levels for safety, environment and bushfires, amongst other risks.

Together these overarching corporate policies and statements frame the ENSMS within TransGrid and provides the organisational commitment. The respective management systems invoke these overarching corporate policies in TransGrid's day-to-day business undertakings. The management systems contain the supporting elements and artefacts that apply across the network asset lifecycle which guide, inform and induce the business to achieve the desired safety outcomes.

This contextual relationship between organisational priority, regulatory obligations, corporate policies and commitments, implementation of those commitments via relevant management systems to achieve the desired safety objectives is illustrated in Figure 2.

Figure 2 – Contextual view of ENSMS



The relevant management systems are described in the following Section 3.3. They are integrated to interact with each other and leverage each other's processes to efficiently achieve the primary objectives of the ENSMS.

3.3 Relevant Management Systems

An overview of TransGrid's management systems is provided in the Business Management System Description available on *The* Wire. The scope and boundaries of these management systems in relation to the ENSMS are outlined below.

> **Asset Management System**

The Asset Management System (AMS) supports and operationalises the intent of the Asset Management Policy. It is certified to ISO 55001 and is aimed at strategically managing TransGrid's assets to ensure they satisfy the corporate objectives (including safety) for the assets to deliver value to the business across the entire asset lifecycle. Examples of relevant elements of the AMS that support the ENSMS includes asset strategy, standards and specifications, safety-in-design, asset specific inspection and maintenance plans, performance monitoring and investigating, asset management committee etc.

> **Health and Safety Management System**

The Health and Safety Management System (HSMS) supports and operationalises the intent of the Health and Safety Policy. It is certified to AS 4801 and aims to ensure the safety of all staff, contractor and the public. Controls from HSMS are mostly used during the operational field level activities such as construction, commissioning, inspection, maintenance and decommissioning. Examples of relevant elements of the HSMS that support the ENSMS include Power System Safety Rules, SWMS library, health and safety committee etc.

> **Environmental Management System**

The Environmental Management System (EMS) supports and operationalises the intent of the Environment Policy. It is certified to ISO 14001 and aims to ensure the environmental risks are assessed and appropriately managed. Controls from EMS are used during the entire stages of the network asset lifecycle. Examples of relevant elements of the EMS that support the ENSMS include environmental impact assessments, review of environmental factors, vegetation management etc.

> **Risk Management Framework**

The Risk Management Framework (RMF) supports and operationalises the intent of TransGrid's RAS by providing the methodologies and tools to translate and compare the business risks to the set tolerance limits. TransGrid's RMF follows ISO 31000 principles. The RMF requires all relevant management systems to lower their respective risks at least to the determined tolerance limits. Examples of relevant elements of the RMF that support the ENSMS include Network Risk Assessment Methodology, strategic risk register, formal safety assessments, CREMP etc.

In addition to the above management systems, the ENSMS also leverages processes from Business Management System (BMS) that is certified to ISO 9001. The BMS coordinates all the actions the organisation undertakes (planning, processes, documentation, monitoring, measurement, audits, preventive and corrective actions, improvements, governance, organisational change management etc.) to meet the corporate goals.

Further, the ENSMS also utilises the organisational human resource processes and procedures that oversee the skills and competencies of TransGrid's workforce which underpins and forms the enabling part of all management systems.

Collectively these management systems and their respective artefacts enable TransGrid's ENSMS to satisfy the requirements of AS5577 to meet the requirement of the Regulation.

4. Definitions

Key terms and definitions relating to the ENSMS are explained in Table 2:

Table 2 – Abbreviations and definitions

Term	Definition
AS 4801:2001	Australian standard for Occupational Health and Safety Management System
AS 5577:2013	Australian standard for Electricity Network Safety Management Systems
ACT	Australian Capital Territory
AEMO	Australian Energy Market Operator
ALARP	As Low As Reasonably Practicable
AMS	Asset Management System
CAMMS	Compliance, Audit, Risk and Safety Management System
CASA	Civil Aviation Safety Authority
CFA	Country Fire Authority
Control	A measure (either preventive or to mitigating) that is modifying risk.
Emerging risks	Foreseeable risks raised in industry that have the potential to impact us in managing risks.
EMS	Environmental Management System
ENSMS	Electricity Network Safety Management System (As applied to TransGrid's NSW and ACT assets.)
EPA	Environment Protection Authority
ESMS	Electricity Safety Management Scheme (The AS5577 compliant ENSMS as applied to TransGrid's Victorian network assets).
ESC	Essential Services Commission (Victoria)

ESV	Energy Safe Victoria
ESSNM (or 'the Regulation')	Electricity Supply (Safety and Network Management) Regulation 2014 (the Regulation)
FSA	Formal Safety Assessment
Good Industry Practice	The baseline suite of precautions for generic industries. This is codified in international and Australian standards, industry codes and guidelines, and informal but accepted means of addressing common issues.
HSMS	Health and Safety Management System
ICRC	Independent Competition and Regulatory Commission
IPART	Independent Pricing and Regulatory Tribunal
ISO 14001	International standard for Environmental Management Systems
ISO 31000:2018	International standard for Risk management – Guidelines
ISO 55001: 2014	International standard for Asset management – Management systems - Requirements
IEC 31010:2009	International standard for Risk management – Risk assessment techniques
NSW	New South Wales
RAS	Risk Appetite Statement
RFS	Rural Fire Service
Risk	Effect of uncertainty on objectives
RMF	Risk Management Framework
RMS	Roads and Maritime Services
Safety Case	A Formal Safety Assessment for a Victorian network asset. Note: > For the purpose of this document a reference to an FSA is also a reference to a Safety Case unless indicated otherwise. > As the Victorian legislative requirements for electrical safety are related to safety arising from the network', the Worker Health and Safety FSA related requirements are only inclusive in Safety Cases where the hazard arising from the network
SES	State Emergency Service
SWMS	Safe Work Method Statement
UTR	Utilities Technical Regulation

5. Electricity Network Safety Management System (ENSMS)

5.1 High level overview of the ENSMS

The ENSMS is intricately linked with other management systems as noted in Section 3.3. The ENSMS is a whole of organisational approach to achieve the desired safety outcomes aligned to TransGrid's highest priority and to meet the regulatory obligation. Such whole of organisational approach therefore comprises of multifaceted business practices that holistically work together to implement risk controls to deliver the safety outcomes. The integration of process within the ENSMS is illustrated in Figure 3

The integrated features of TransGrid's ENSMS can be apply in any of the following cogent descriptions:

- Logical Plan-Do-Check-Act cycle where each stage in this cycle are interdependent and are of equal importance. The AS 5577 structure approximately follow is model and specify relevant requirements for every stage.
- Logical lifecycle stages of the network assets following business processes associated with expenditure decisions.
- Relevant elements of the various TransGrid's management systems that are interlinked with each other and together constitute and support the ENSMS objectives.

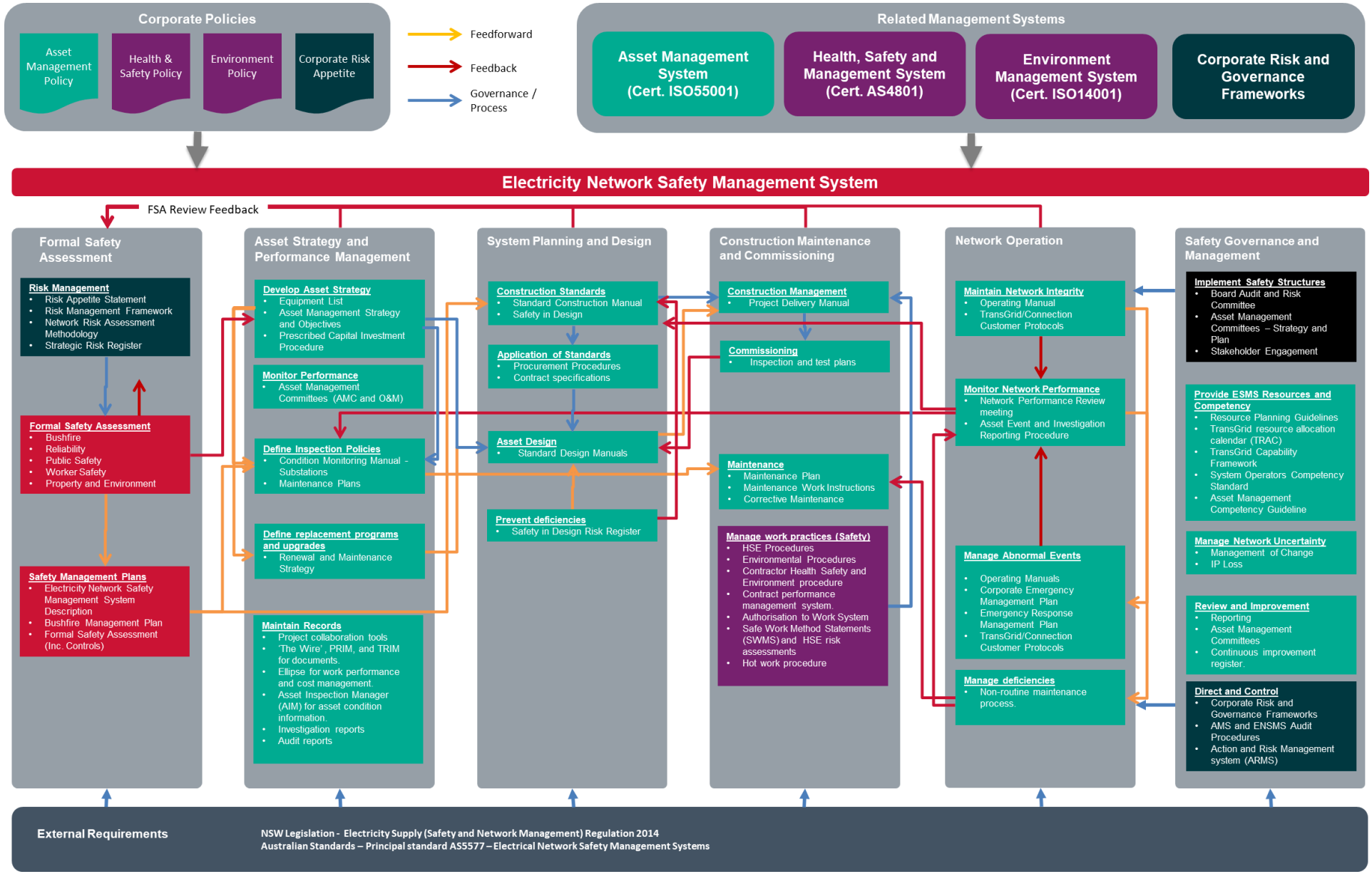
This description document describe TransGrid's ENSMS by aligning to the structure of AS 5577, i.e. Planning, Implementation, Measurement & Evaluation, and Management Review & Change Management.

5.2 Planning

5.2.1 Overview of TransGrid's Risk Management Framework

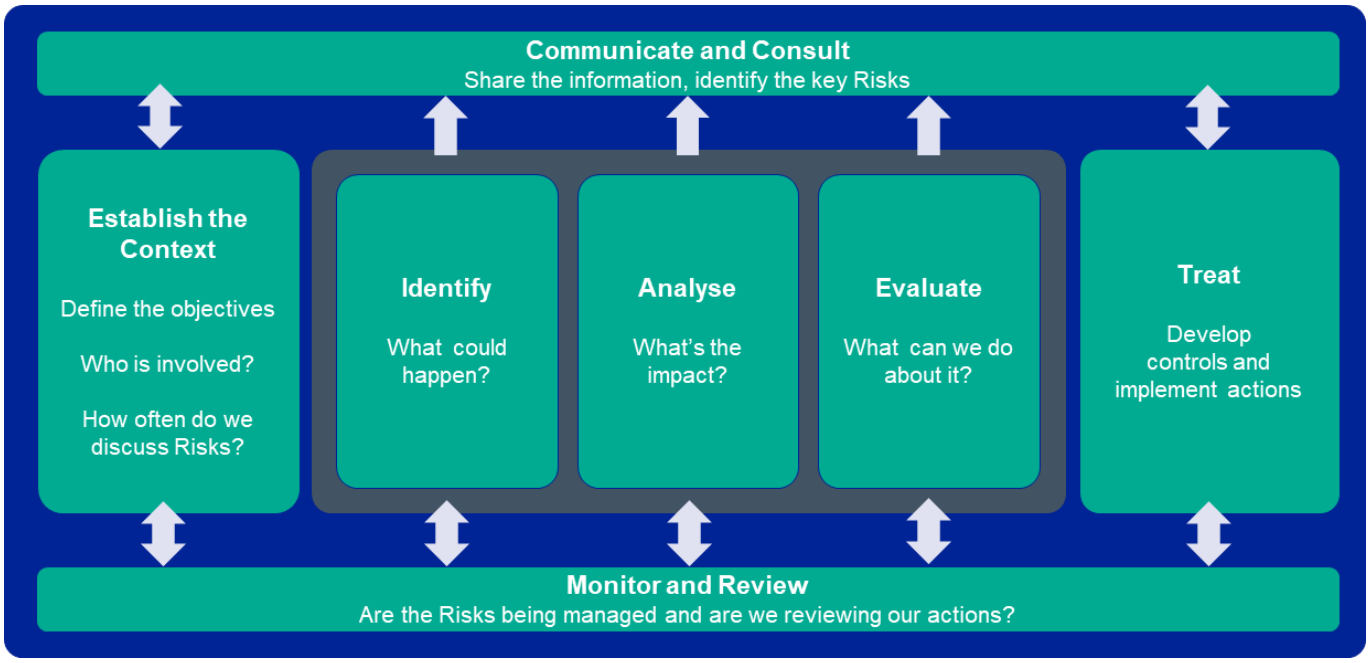
TransGrid's Risk Management Framework sets out the process and criteria for undertaking risk assessments across the organisation. This framework follows the AS/NZS ISO 31000 principles and is illustrated in Figure 4.

Figure 3 - TransGrid's ENSMS overview



A printed copy of this document may not be the current version. Please refer to the Wire to verify the current version.

Figure 4 - TransGrid's RMF overview



This framework is informed by TransGrid's RAS as described in Section 3.2, where each strategic risk theme (including safety, environment, bushfire, amongst other risk themes) has an appetite or is prescribed with a risk acceptance criteria or a risk tolerance level (Very low, or Low, or Medium, or High). TransGrid's risk appetite for safety related themes are shown below.

Safety

"TransGrid has no appetite for any activity that places the health, safety and well-being of its staff, contractors, or the community at significant risk. The Board recognises that it is not possible to eliminate all safety risk when operating in hazardous / dangerous working conditions, however it is expected that management keep the safety risk to as low as reasonably practical."

Asset Management

"Operational risk is inherent in all of TransGrid's activities specifically in building, maintaining and operating the network and assets. Total elimination of this risk is not considered possible or sought after, from a cost/benefit perspective. However, a low level of operational risk is expected. TransGrid expects management to reduce the level of operational risk to a level as low as reasonably practicable."

Bushfire Risk

"Bushfire risk is inherent in the maintenance and operation of TransGrid's network and assets. The Board has a very low risk appetite and expects management to meet the obligations and guidelines provided by regulatory authorities and reduce the level of network initiated bushfire risk to a level as low as reasonably practicable."

This overarching risk direction endorsed by the Board sets the scene for TransGrid to reduce its safety related risks ALARP, this is consistent with the requirements of AS5577. This cascades down to every steps of its business process.

The following Sections describe the elements of TransGrid's RMF in relation to conducting the Formal Safety Assessments (FSA). TransGrid's FSAs consider hazards that might be associated with activities on or near the electricity network infrastructure. The FSAs follow TransGrid's RMF methodologies and therefore comply with the principles of AS/NZS ISO 31000. TransGrid's FSAs use a specific, formal, structured and documented risk assessment tool (bow-ties in accordance with HB 89:2013 based on ISO 31000 principles and guidelines) that are fit for purpose and appropriate to the electricity network industry.

TransGrid identified relevant internal and external stakeholders and involved or consulted with them in relevant stages of the FSA. The description of this stakeholder consultation is provided in Section 5.3.5.

TransGrid's FSAs are documented in a series of separate documents that detail the underlying risk assessment methodology and outcomes. The FSA categories following are aligned with the Regulation's primary objectives and together they underpins the planning component of TransGrid's ENSMS:

> Bushfire
> Reliability
> Public Safety
> Worker Safety
> Property and Environment

5.2.2 Establishing the context

Identifying and understanding the external and internal circumstances in which TransGrid seeks to achieve its networks safety objectives is important. TransGrid has acknowledged the context such as legislative requirements, hazards in the electricity network industry, workforce culture and competency, proximity of network infrastructure to public and its access, safety focus of internal and external stakeholders, along with its RAS and RMF while assessing the risk in safely operating its network.

TransGrid's RAS and RMF inform the key stakeholders such as safety managers, asset managers, project managers, operational manager, designers etc. of decision criteria for risk assessment and risk reduction to ALARP level. TransGrid's RMF stipulates:

> TransGrid has a uniform risk tolerance set at 'Medium', meaning that it is mandatory to identify treatments for any risk that is rated 'High' or 'Extreme'.
> Inherent risks rated 'High' or 'Extreme' must have their associated treatments approved by the Executive Manager of the Business Unit.
> 'Extreme' and 'High' risks are only acceptable where mitigation plans are in place and ALARP can be demonstrated.
> It is expected that for residual risks, where ratings level are assessed as 'High' or 'Extreme', that the treatments are escalated to the CEO for approval.

The risk acceptance criteria, as shown in Table 3, is set as ALARP in accordance with the requirements of AS 5577. TransGrid's RMF allows the business to the accept residual risk if it is below or equal to the prescribed tolerance level, or to reduce it to As Low As Reasonably Practicable (ALARP) by considering and implementing all reasonably practicable effective controls.

Table 3 – Risk tolerance or risk acceptance criteria

RMF Residual Risk Rating	Risk Tolerance	Requirement
Extreme	Intolerable	Risk must be reduced to an acceptable level.
High	As Low As Reasonably Practicable (ALARP)	Risk acceptable when eliminated, or where elimination is not reasonably practicable reduced ALARP and all additional safety improvements or recognised good practice precautions have been assessed for inclusion and only discounted when the cost is disproportionate.
Medium		
Low	Acceptable	Additional safety improvements or recognised good practice precautions have been assessed for inclusion.

TransGrid consider that ALARP is demonstrated for each significant hazard if:

a. Where reasonably practicable the hazard has been eliminated, or where this is not reasonably practicable.
b. All risk treatment options have been considered.

c. A risk treatment option has not been implemented only if the cost of doing so is grossly disproportionate to the benefit gained.
d. Opportunity for further safety improvement has been assessed.

In this regard, TransGrid's Asset Management Committee has endorsed a set of criteria for demonstrating ALARP where quantified risk is available based on the calculation of network safety risk reduction and disproportionality multipliers for cost. Details of the applied ALARP criteria are documented in TransGrid's Network Risk Assessment Methodology (RAM). The RAM also outlines the actions, escalation and approval requirements for each level of residual risk.

The assessment of risk treatment options which have been excluded under ALARP but are considered to be 'recognised good practice' are described in the FSA.

The depth of analysis for such assessment is proportional to a level required to comprehensively identify, analyse and evaluate risks, consider risk treatment options to achieve the risk criteria, and monitor/review the appropriateness, reasonableness and effectiveness of risk treatment options to manage network related safety risks.

5.2.3 Planning for safe operation

TransGrid utilises Formal Safety Assessments (FSA) to understand the risks its business faces, the available controls and their impact, and the residual risks. This involves mapping out known hazards associated with planning, owning, operating, maintaining and renewing the electricity network infrastructure, and nominating control measures to prevent the hazard from eventuating and/or to mitigate the consequences from the hazardous event following a formal bow-tie diagram technique. Relevant internal and external stakeholders are involved and consulted with during this process. The FSAs activities are informed by TransGrid's RMF as explained in Section 5.2.1 and utilises the established context as explained in Section 5.2.2 for decision making.

TransGrid's FSAs are aligned with the Regulation's primary objectives, the scope of each is summarised in Table 4.

Table 4 - TransGrid's Detailed Formal Safety Assessments

FSAs	Scope overview
Public Electricity Safety [per Clause 6(a) of the Regulation]	Considers network related safety risks to the general public resulting from TransGrid's operations, including people working near TransGrid's network assets. This includes public safety aspects arising from the protection of the environment (excluding bushfire risk which is addressed in a separate FSA). [Trim D2018/00113]
Worker Health and Safety [per Clause 6(b) of the Regulation]	Considers network related safety risks to employees and contractors working on or near TransGrid's network. This includes worker health and safety aspects arising from the protection of the environment (excluding bushfire risk which is addressed in a separate FSA). [Trim D2017/13789]
Environment and Property [per Clauses 6(c) and (d) of the Regulation]	Considers network related risks to damaging the environment and property from TransGrid operating the network where they are not captured in other FSAs. [Trim D2018/02273]
Bushfire Risk Management [per Clause 6(d) of the Regulation]	Considers network related bushfire risks. This includes the management of safety risks associated with bushfires in proximity to TransGrid's assets, as well as bushfires that may be ignited by TransGrid's activities and/or assets. [Trim D2017/01907]

FSAs	Scope overview
Network Reliability [per Clause 6(e) of the Regulation]	Considers network related safety risks arising from the loss of electricity supply, including network planning, continuity of electricity supply and physical security of assets. [Trim D2017/00127]

Copies of the detailed Formal Safety Assessments are available on *The Wire*. These FSAs all consider the electricity network asset life cycle activities such as:

> Network planning.
> Site safety management.
> Network safety management incorporating network structural integrity, external interference management, fault condition monitoring and response, and change of operating conditions and remaining asset life review.
> Substation operation and maintenance.
> Emergency response.

The FSAs are used to communicate to internal and external stakeholders an evidence-based safety assessment that demonstrates TransGrid's ability to manage the risks from key hazards to ALARP. The intended audience of the FSAs include but is not limited to:

> TransGrid's Board and the respective risk owners (executive management).
> TransGrid's employees, contractors and outsourced service partners particularly those directly involved in the safe operation of the network asset throughout its lifecycle.
> The local community near the network asset.
> Relevant jurisdictional authorities (i.e. NSW RFS, NSW SES, SafeWork NSW, LGAs, City Councils, Shire Councils, NSW IPART, ACT UTR, and the interconnected electricity networks)

The following sub-sections describes the steps involved in developing the FSA for planning for safe operation of TransGrid's electricity network assets and consists of risk identification, risk analysis, risk evaluation, and risk treatment.

5.2.3.1 Risk identification

TransGrid identifies risks by analysing the loss of control of hazards (energies) that it must manage in the network. Each FSA identifies the hazards events within the defined scope and identifies any uncertainties and assumptions associated with those hazards.[1] Hazards are considered to be those sources of energy for which loss of control will prevent TransGrid from achieving the primary objectives of the ENSMS.

To support risk identification and aid performance review TransGrid has systematically identified the Key Hazardous Events in each of the FSA for its entire network and across the asset life cycle stages. It is an objective of the ENSMS to prevent these Key Hazardous Events that are also used to monitor its ongoing performance. This continual improvement is based on its interaction with its employee, suppliers, industry peers and forums (i.e. internal and external stakeholders). The following Table 5 summarises the key hazards identified in each FSA.

TransGrid demonstrates Good Industry Practice with regards to risk identification through consideration of the industry information (Appendix D) and demonstrated commitment to continual improvement. This provides confidence that TransGrid is identifying reasonably foreseeable network related safety hazards.

[1] This process has only been applied to the Bushfire Formal Safety Assessment at the time of this revision. Other FSAs will be updated as each completes its review cycle.

Table 5 – Key hazards identified in FSAs

FSAs (Last Update)	Identified key hazards
Public Electricity Safety (6/2018)	> Asset failure > Unauthorised access to network assets > Uncontrolled discharge of electricity or contact with electricity > Asset lifecycle activities
Worker Health and Safety (6/2018)	> Confined spaces > Driving > Electricity > Falling or moving objects > Hazardous substances and dangerous goods > Heavy lifting operations > Mobile powered plant > Traffic management > Working at heights (including falls and falling objects)
Environment and Property (6/2018)	> Asset functional failure > Release of pollutant > Inappropriate disposal of hazardous waste > Activities not undertaken as per EMS processes
Bushfire Risk Management (1/2020)	> Conductor Drop > Vegetation Encroachment > Explosive Failure > Earthing / Induced Voltage > Hot work > External Fire Threat to Assets > External Fire Threat to Workers
Network Reliability (6/2018)	> Asset failure > Forced outage (external issue) > Forced outage (capacity constraint) > Operational error > Sabotage > Third party activities near assets

Every key hazard has been analysed through bow-tie analysis in each respective FSA that involves identifying causes and contributing factors and, as a minimum, consider the following:

> Safety related aspects of the loss of supply.
> Electrical work on or near network assets.
> Other activities that may involve electrical hazards, including work being carried out in the vicinity of electrical assets.
> Single and multiple failure modes, including knock-on effects as appropriate.
> The design of network assets and the condition and operating methodologies for electricity network assets.
> External hazards and natural disasters.
> Intentional and unintentional human activities.

5.2.3.2 Risk analysis

TransGrid analyses each hazard identified in the FSAs through a combination of both quantitative and qualitative methods.

Quantitative methods are considered where substantive data is available and is suitable for such risk analysis to be performed. Quantitative analysis is undertaken in accordance with the TransGrid's RAM and through consideration of TransGrid's Network Asset Health Framework (NAHF) and Network Asset Criticality Framework (NACF). The values for likelihood and consequence are reconciled with RMF by:

> Comparing the numerical probability of failure at a network/asset class level against the likelihood ranges provided for 'Probability' in the RMF for each likelihood rating.
> A monetary valuation for consequence is calculated and assessed against the 'Financial' consequence category in the RMF.

For risk analysis where no suitable quantitative methods are possible, qualitative methods are applied through the following approaches:

> The 'Qualitative' likelihood descriptions in the RMF are assessed in consultation with the appropriate stakeholders (risk workshop attendees) including subject matter experts and the appropriate rating selected.
> The most appropriate consequence category, or in the case of multiple applicable categories, the worst case consequence category per the qualitative descriptions in the RMF are assessed in consultation with the appropriate stakeholders including subject matter experts and the appropriate rating selected.

Once the likelihood and consequence ratings are determined using either quantitative or qualitative means, the risk rating is determined in accordance with the risk matrix in the RMF.

The application of each type of risk analysis is defined for each identified hazards in all FSAs.

5.2.3.3 Risk evaluation

Both qualitative and quantitative risk assessments are determined or categorised using the guidance outlined in the risk matrix contained in RMF. The resulting risk rating is then compared with the risk acceptance criteria as described in Section 5.2.2.

According to Table 3 risks evaluated as 'Extreme' are intolerable and must be reduced to an acceptable level, risks evaluated as 'High' or 'Medium' are to have reasonably practicable effective controls applied and hence the risks are acceptable once reduced to ALARP, and risks evaluated as 'Low' are acceptable.

In demonstrating ALARP, formal tests are applied to investment options as outlined in the RAM. The outcomes of these tests are captured in the Option Feasibility Studies (OFS) and Options Evaluation Reports (OER) produced as part of the Prescribed Network Capital Investment Process.

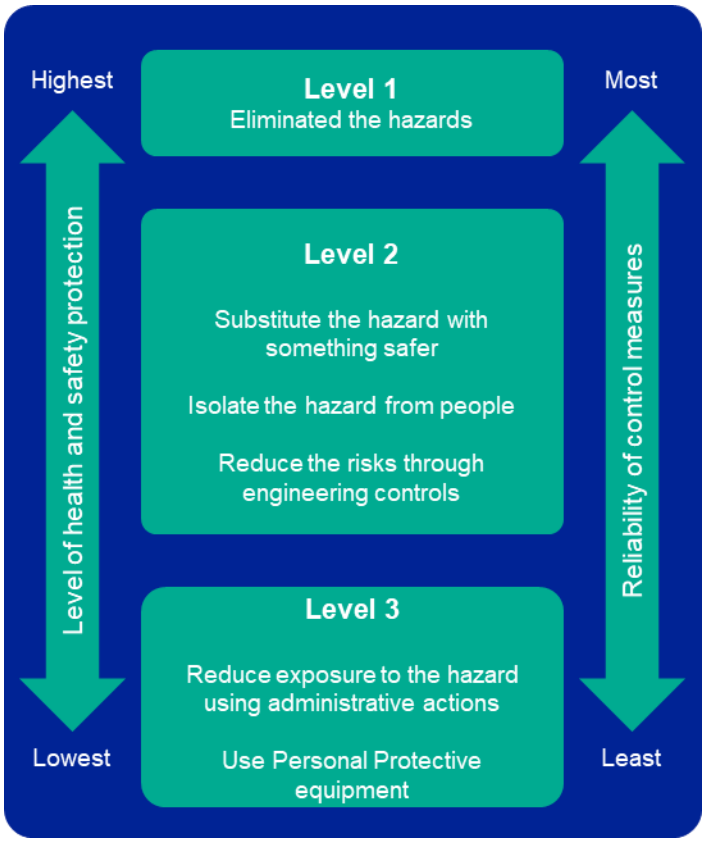
For non-capital investments, the test of reasonable practicability for the implementation of risk treatment options is performed on the suite of operating risk treatments and focuses on ensuring that all recognised good practice risk treatments are in place.

5.2.3.4 Risk treatment

Risk treatment options are selected for all identified key hazardous events in the FSA and documented or presented in the bow-tie diagram. Risk treatment options are generally classified as preventive controls (preventing identified failure modes from causing a key hazardous event) or mitigating controls (mitigating potential consequences following the occurrence of a key hazardous event).

TransGrid applies the hierarchy of controls when considering risk treatment options for managing network related safety risk as per Figure 5. Each identified risk treatment or suite of risk treatments is assessed for the ALARP criteria as outlined in the RAM in each FSA. Where a risk treatment does not fulfil the ALARP criteria, it is still selected for implementation where it is considered reasonable good practice. Risk treatments from all related management systems (i.e. AMS, HSMS and EMS) are brought together in the FSA so that the residual risk can be assessed.

Figure 5 - Hierarchy of Controls



Source: TransGrid's Health and Safety Risk Assessment Procedure

The use of bow tie diagrams captures TransGrid's holistic approach for applying risk treatments, incorporating options available through all of TransGrid's management systems to manage network related safety risks.

When identifying controls it is accepted that there is a level of uncertainty as to the effectiveness of each item. This uncertainty is managed through:

- Identifying the critical controls, this being where failure of a control has a reasonable probability of causing the hazardous event to occur to ensure these have appropriate control assurance.
- Assessing control effectiveness as detailed in this section.
- Ensuring sufficient layers of preventative and mitigative controls are in place to reduce the risk to ALARP.

In assessing risk treatment options in order to achieve ALARP, TransGrid consider:

- The level of risk that is involved with the hazard, as stated in Table 3, any inherent risk above 'Low' must have control measures implemented to mitigate to ALARP.
  - The level of inherent risk is determined using the risk assessment principles described in Appendix A.
- The effectiveness of the control.
  - The process for determining the effectiveness of controls is defined in Table 6.
- Criticality of the control. Controls are considered to be critical where a failure of it will result in the occurrence of key hazardous event(s).
- Whether the control is considered good industry practice (state of knowledge).
  - TransGrid has a long history with HV transmission systems and has developed a series of standard design manuals as listed in Appendix B.
  - In addition TransGrid is a member of ITOMS and ENA and has design staff attend various conferences and forums that discuss contemporary technology and what is providing the safest and most reliable technology solutions. Appendix D lists TransGrid's research into good industry practice of control measures and how they are applied within its various management systems. These are reviewed in detail in each FSA.

- The cost of implementing the control (cost of mitigating the risk) is performed through the following processes.
  - TransGrid's RAM requires the calculation of a risk cost specifies disproportionality factors for safety and environment inputs when assessing the risk of various investment options.
- The entire phases of the asset life cycle and the control opportunities present in each phase. For example, in the procurement phase equipment selection considers safety. In design phase, safety-in-design steps are adopted. Similarly, for the operation and maintenance decisions the cost of controls is generally insignificant to the overall asset ownership or project cost and therefore where a good industry practice is available, it is implemented.

The effectiveness of risk treatment option is assessed qualitatively using the principals of HB 158-2010 – Delivering assurance based on ISO 31000:2009 Risk management – Principles and guidelines and aligned to the categories available in the CAMMS risk module. The qualitative assessment detailed in for each risk treatment option is performed as part of the FSA using the criteria in Table 6.

Table 6 – Risk treatment effectiveness measures

Risk treatment effectiveness	Qualitative description
Effective (include previous Fully and substantially effective)	Controls are well designed for the risk, address the root causes and Management believes that they are effective and reliable at all times.
Partially effective	While the design of controls may be largely correct in that they treat most of the root causes of the risk, they are not currently very effective; or Some of the controls do not seem correctly designed in that they do not treat root causes, those that are correctly designed are operating effectively.
Ineffective (include previous largely and totally ineffective)	Significant control gaps either due to design or issues discovered at implementation. Either controls do not treat root causes or they do not operate at all effectively.

Risk treatment options that are not selected for implementation on the basis of the ALARP criteria are documented as part of the 'Risk Evaluation' stage of the FSA process. This includes assessment of possible safety improvements or recognised good practice controls.

Responsibility and accountabilities for the implementation of selected risk treatments align with the responsibilities and accountabilities described in Appendix E.

TransGrid demonstrates Good Industry Practice with regards to identifying network related safety risk treatment options through consideration of information available from industry bodies and forums as detailed in Appendix D, active engagement in associated forums and demonstrated commitment to continual improvement. This provides confidence that TransGrid is adequately identifying the available risk treatment options to meet the risk criteria set out in AS5577.

Selected risk treatments are incorporated into standard operational procedures and forms part of TransGrid's business-as-usual practices.

5.2.3.5 Residual risk assessment

Following the application of risk treatments, residual risks of the key hazards are assessed as per the RMF. Where residual risk levels are above 'Medium', compliance to ALARP is demonstrated by showing that all reasonably practicable risk treatments are escalated to the CEO and/or Executive for approval and implementation.

5.2.4 Planning for foreseeable abnormal operations and emergencies

TransGrid's electricity transmission network can be operating in one of the following three operating conditions:

Table 7 – Criteria for Normal, Foreseeable Abnormal and Emergency conditions

Operating conditions	Criteria
Normal	The network or part thereof is able to operate with all critical controls operating and there are no imminent threats to the TransGrid's ENSMS safety objectives.
Foreseeable Abnormal	The network or part thereof is able to operate at or near the requirements specified by the National Electricity Rules but with impairment to critical control/s or is under potential threat (for e.g. a significant bushfire is proximate to TransGrid assets). Such foreseeable abnormal condition will usually only rate as a level 1 incident under the emergency response procedure and is managed using business-as-usual procedures.
Emergency	A significant event has occurred at the network or part thereof, or it is in imminent danger from an external threat such as approaching bushfire. Such emergency condition is considered level 2 and above in the Power System Emergency Response Plan and requires actions under the suite of TransGrid's Emergency Management Plans and its supporting operational manuals.

TransGrid has established contingency and emergency procedures to ensure the effective operation of the network assets in foreseeable abnormal or during emergency circumstances. Such procedures are included in the management plans and operating manuals listed below. These procedures are developed in alignment with AS5577 Section 4.3.3.

Foreseeable abnormal condition is defined as a Level 1 incident in TransGrid's Power System Emergency Response Plan (PSERP). Emergency condition is defined as a Level 2 incident or higher within the CREMP. Each FSA specifically applies these criteria to define the abnormal and emergency conditions considered.

As part of mitigating risk TransGrid consider the hazards that will result in a facility not reducing risk to ALARP or that will result in it not achieving its ENSMS safety objectives. Key to this are the following preventative and mitigative processes that are used to either control or minimise risk in a foreseeable abnormal condition:

> Operating connected to emergency power sources:
  – TransGrid maintains battery banks and chargers (includes diesel generators where appropriate) to supply its secondary systems in its substations as contingency to losing its auxiliary LV power supply.
> Operating without normal supply assets such as powerlines or transformers:
  – The design of TransGrid's network infrastructure provides various levels of redundancy in its systems depending on the bulk supply point categories for single system element failure in accordance to the NSW Electricity Transmission Reliability and Performance Standard 2017 criteria.
> Operating at other than normal voltage levels:
  – Use of protection systems, for example protection relays.
  – Robust design that ensures equipment can withstand the maximum possible range of variation, for example, overvoltage. All equipment is rated, in terms of insulation and current ratings. Procurement specifications and Factory Acceptance Tests incorporate such requirements.
> Operating under communications outages:
  – TransGrid uses redundancy to achieve high reliability on its communications network, including redundant power supplies, duplicated systems and diverse paths.
  – TransGrid uses multiple public and internal telephony services as well as its own VHF radio network of last resort for voice communications

- TransGrid's sites are not reliant on the communications network to operate, depending upon network conditions.

> Operating under changed conditions to avoid further damage to the network:
  - Specific operating procedures are in place to cover operating in foreseeable abnormal conditions:
    - OM520 Operation of Main Grid under normal conditions
    - OM800 Communication Procedures
    - OM681 Contingency Planning
    - OM530 System Voltage Control
    - OM669 Operational Failure of SCADA
    - OM695 Management of External Hazards
    - OM 667 Operational Failure of a Control Centre.
  - Identification of foreseeable abnormal and emergency conditions in consultation with relevant stakeholders during the development of the FSA.
  - Implementation of emergency management plans and procedures including:
    - 'Continuity of Transmission Supply Plan' that outlines the general approach to continuity of electricity supply following the loss of a significant network asset.
    - 'Corporate Response and Emergency Management Plan' which aims to anticipate, respond, and manage any type of emergency which impacts on safety, reliability, the environment, or TransGrid's business as quickly and safely as possible.
    - 'Power System Emergency Response Plan' which support the CREMP for power system emergencies.
    - Site Specific Emergency and Evacuation Plans.
    - Substation Emergency Response Plans.
    - Operating Manuals.
    - 'IT Disaster Recovery Procedure' which provides a guideline for the orderly restoration of technology services in the event of a disruption (e.g. natural, man-made, or technological failure).

Documentation associated with the Business Continuity Management Framework and other plans and procedures for foreseeable abnormal and emergency conditions are available on *The* Wire.

5.2.4.1 Continuity of Transmission Supply Plan

TransGrid has established a Continuity of Transmission Supply Plan which outlines the general approach for continuity of electricity transmission supply within the Transmission System for loss of a significant asset (or a substantial part thereof) which may lead to the inability of a bulk supply point to supply customers or may impact on the optimal operation of the transmission system. These significant assets may include substations, switching stations, transmission lines, high voltage cables, cable transition points, communication sites, SCADA systems, or System Operations control rooms.

5.2.4.2 Corporate Response and Emergency Management Plan

The Corporate Response and Emergency Management Plan (CREMP) sets out TransGrid's approach to respond to, and manage as quickly as possible, a Business Disruption Event (Event) that occurs to any aspect of TransGrid's business operations that may have an impact on:

> Safety and/or environment.
> Network security or reliability.
> TransGrid's reputation.
> Any other event that has the potential to, or has led to, a major consequence event as defined by TransGrid's Enterprise Risk Management Framework.

This plan requires the formation of a Crisis Management Team and Crisis response Team for events (crisis) that can result in significant disruption to TransGrid's operations. As appropriate this plan will call in specific response plans. Those directly related to the ENSMS are:

> Power System Emergency Response Plan

> HSE Incident Management Procedure

5.2.4.3 Power System Emergency Response Plan (PSERP)

Emergency management procedures are specified in the PSERP and are used to co-ordinate the management measures necessary to ensure a state of preparedness for emergencies which may impact upon reliability of supply, the safety of staff, members of the public, or the environment. The PSERP is also required to respond to emergencies declared under the NSW State Emergency Management Plan and AEMO's Power System Emergency Management Plan (PSEMP).

The PSERP categorises various levels of emergency and details the specific command structures and responsibilities associated with each. A risk management process supports the PSERP by identifying and evaluating key risks, and promoting a formal approach to management of those risks.

Whilst TransGrid's assets are exposed to the elements and are therefore impacted by natural events such as bushfires, cyclones and earthquakes, the PSERP also applies to failures of major system components and abnormal events such as vandalism and sabotage. The PSERP categorises emergency levels and details specific roles and responsibilities for each emergency level.

TransGrid's response to an incident is dependent on the severity of the impact and level of control TransGrid has over the incident. The severity of the impact is classified into five levels as shown in the following Table.

Table 8 – CEMP Incident Level Definitions

Incident Level	Managed by	Definition
Level 1 Operational Incident (management is not within scope of PSERP)	Relevant team leader, site controller or maintenance manager	An event that can be managed by a team leader or maintenance manager without additional assistance. Low risk of adverse publicity, environmental impact, or customer impact. Typical examples include: > Forced and emergency outages; > Call outs and alarm responses; > Near miss and lost time injuries; > Minor environmental incidents substantially contained within TransGrid property and which are non-reportable; > Minor injuries to staff > Loss of supply events below 0.05 system minutes.
Level 2 Local Emergency	Asset Monitoring Centre (network incidents) Group Emergency Management Team (incidents not related to the network)	An event in which the onsite response requires support from the relevant groups in the organisation to deal with local adverse media publicity, where there is a low likelihood of significant human, environmental, financial or asset damage. Trigger points for Level 2 incidents: > Prolonged (greater than half an hour) loss of supply greater than 20MW > Serious injuries involving staff, contractors or members of the public > Reportable environmental incident involving significant impact on eco-systems including local and off site effects with medium term impact > Other situations involving moderate financial or reputational impacts.
Level 3 Widespread Emergency	Corporate Crisis Management Team	An event which requires significant operational and executive support to manage wider potential impact,

Incident Level	Managed by	Definition
		adverse publicity, operational, financial, human or environmental impact. Trigger points for Level 3 incidents: > Significant public disruption due to loss of load > 8 hours duration > Widespread loss of load event > 200 MW for more than 1 hour > Significant risk to system stability and operations > Major bushfire event; > Terrorist attack to people, assets or operations > Fatality or ongoing risk of fatality due to emergency situation > Environmental incident with significant harm to World Heritage areas > Data breaches.
Level 4 AEMO Co-ordinated Response	Industry controlled incident led by AEMO	The impact of this incident goes well beyond TransGrid's area of operations. The overall system safety and integrity is in jeopardy and/or the impact is such that it requires a co-ordinated response from multiple industry participants or jurisdictional representatives. Incidents of this sort are expected to be reliability driven with widespread system impacts or risk of impact.
Level 5 Jurisdiction Direction	Government controlled incident	The real or potential impact of this incident has escalated to a point that the Government reasonably believes that it needs to intervene. Government may invoke its power to employ mandatory energy rationing or the State Counter Disaster Plan. Under the State Counter Disaster Plan, the Police, or State Disaster Co-ordinator mobilises to provide the co-ordination required.

5.2.4.4 Site Emergency and Evacuation Plan

A Site Emergency and Evacuation Plan for incidents such as fire or bomb threats are available at each operational centre (depots and offices). These plans are located prominently on notice boards throughout the offices and buildings. These plans comply with AS 3745-2010 Planning for Emergencies in Facilities.

These plans detail the site emergency control personnel, evacuation measures including annual training exercises, debrief sessions, and the testing of alarms.

All visitors to sites are advised of the existence of these procedures as part of their site induction.

First aid equipment and trained first aid personal are available at each site and work location. In the event of a critical incident, the employee assistance program (EAP) is available to all employees for debrief and support.

Following any major incident and after emergency response drills a review ('lessons learnt') is undertaken that review the response and ensure that personnel have follow emergency management processes. Substation Emergency Response Plans

TransGrid has established a comprehensive set of emergency response plans for use by first responders to an emergency at each of its substation assets. The emergency response plans aim to bring together the immediate actions that may be required to be undertaken during an emergency from the various 'abnormal operation' related procedural documents.

The emergency response plans for each substation site are available on *The Wire* for access by relevant personnel and contractors, and are regularly reviewed, tested and updated. These plans include procedures and responsibilities for dealing with:

- Fire emergency, covering both small and large fires.
- Site evacuation.
- Security threat, including evidence of a security breach.
- Oil spill or other hazardous material.

5.2.4.5 Operating Manuals

TransGrid's network operation centres are staffed on a 24 hour basis. Operating staff at these centres are trained to operate the system in a safe manner in response to emergency conditions of all types, including:

- Supply disruptions.
- Asset damage.
- Fire, explosion, impact.
- Natural disaster.
- Civil disturbances.

In response to natural disasters and disturbances, the operator is required to contact the appropriate emergency service organisation. Operating staff escalate and coordinate responses with field staff, who access other resources as required, to address these emergencies in accordance with the PSERP or CREMP.

TransGrid has in place a comprehensive and proven set of procedures for network operations, including outage management, covering both planning for safe operations and planning, and preparation for abnormal operations. The scope of the topics covered by the operating manuals includes:

- Access permits
- Communications
- Contingencies
- Emergencies
- HV safety rules
- Interruptions to supply
- Notification of system incidents
- Operational failure of a control centre
- Operational communication facilities
- Operations
- Outages
- Restart of the NSW transmission system

The operating manuals are regularly reviewed and updated by the business group or team within TransGrid. They are available to relevant staff on *The Wire*.

5.2.4.6 Information Technology (IT) and Operational Technology (OT) disaster recovery

The IT Disaster Recovery Procedure provides a guideline for the orderly restoration of ICT services in the event of a disruption (e.g. natural, man-made, or technological failure). The procedure describes fundamental elements and the methodology to be used by the business for recovery and testing or ICT services.

The OT disaster recovery plan identifies the process to respond to cyber-incident in the TransGrid SCADA environment. The plan describes the fundamental elements listed below:

- Incident Level.
- Incident Lifecycle.
- Incident Recovery.
- Post Incident Analysis and Forensics.
- Roles and responsibilities.

5.2.5 Standards and Codes

Relevant Australian Standards and Codes of Practices are used throughout the asset lifecycle, where applicable. Relevant standards and codes are applied in the following order of precedence:

> The standard is mandated by legislation (for e.g. Compliance to AS5577 under the ESSNM Regulations).
> The standard represents good practice as indicated by a code of practice and is applicable to mitigating an identified hazard.
> The standard is considered good industry practice and is recognised as a reasonable level of control to meet the ALARP requirements.

In a case where a standard or code is mandated but the risk control is not considered appropriate or would not be effective then a higher standard may be adopted. Where applicable, TransGrid's FSAs list specific exclusions to the standards included in legislation or codes of practice requirement[2]. Such exception are formally signed off with the approval of the FSA.

Where a standard may specify a control then any decision to not include it should be assessed to show that it does not meet the ALARP criteria. The core standards, codes, and guidelines appropriate to managing the risks of key hazardous events included in the FSAs that forms part of TransGrid's ENSMS are listed in Appendix C.

In order to ensure that TransGrid is operating to the latest standards and industry good practice TransGrid undertakes various consultations with industry peers. Specifically TransGrid is a member of ITOMS, ITAMS, Asset Management Council (AMS), Engineers Australia and ENA and has design, asset management, and field delivery staff attend various conferences and forums that discuss contemporary technology and what is providing the safest and most reliable technology solutions. These forums also allow the identification of emerging technologies or other control options. The participation of key staff in these forums then allows these learnings to be incorporated in the FSAs and other management system processes to manage the safety risks. Appendix D lists TransGrid's research and interaction into good industry practice and how they are applied within its management systems. Specific individuals have been identified to be leads on the CIGRÉ panels. The individuals are identified in Appendix D.

TransGrid has Subject Matter Experts (SMEs) for each of its network asset class and network operations through identifying functional positions at each of the key life cycle stages as shown in Table 9.

The competency for these discipline is managed through roles and responsibilities requirement identified in the Position Descriptions and as appropriate supported by the Asset Management Competency Guideline.

Table 9 – SMEs for TransGrid's network asset class and functional areas

Network Asset Class / Functional Areas	Discipline	Position
Transmission overhead lines and underground cables	Design	> Transmission Lines and Cable Design Manager
	Asset management	> Transmission Lines and Cable Asset Manager
	Maintenance	> Transmission Lines and Cable Manager
Substation primary systems	Design	> Substations Design Manager
	Asset management	> Substation Asset Manager
	Maintenance	> Substations Manager
Digital infrastructure	Design	> Digital Infrastructure Design Manager
	Asset management	> Digital Infrastructure Asset Manager

[2] As at this revision there are no specific exclusions to compliance with mandated standards and code of practice. Every year TransGrid reports such exception and its justification in its annual ENSMS performance report to the IPART.

Network Asset Class / Functional Areas	Discipline	Position
	Maintenance	> Digital Infrastructure Manager
Network operations	Network operations	> Control Centre Manager
	Operations monitoring	> Asset Monitoring Centre Manager > Control Centre Manager
OHS	Safety	> Safety Manager > Power System Safety Rules Manager
Environment	Environmental Management	> Environment Manager

The SME collectively ensures that the Engineering (including Network Planning) and Design are reasonable and practicable from a safety outcomes perspective. The SMEs ensure that the various work on the network asset life cycle is done in accordance with Australian and other relevant standards which are incorporated into the TransGrid Standard Design Manuals (these are listed in Appendix B). These have been refined over a number of decades and updated to reflect on-going industry technological advancements. This ensures that designs are developed which are safe and will have repeatable performance.

Relevant standards and codes that are referenced by TransGrid are included in Appendix B. The specific procedures, manuals, and functional specifications are identified in the relevant FSA.

The following sub-section describes the application of these standards in relation to ensuring safety outcomes as per the EMSMS and in respective stages of network asset life cycle.

5.2.5.1 Application of Standards

TransGrid implement the standards explained in this section through the following processes:

- Standards related to design are included in the Standard Design and Construction manuals for use in the design phase.
- The ‘Procurement Procedure’ sets out the requirements for approval of tender selections meet the necessary technical requirements in regards to safety. Key components of this procedure include the requirement for:
  - Safety standards for contractors to be included in contracts.
  - Evaluation committee to have relevant experience.
  - Risk management and technical criteria to consider safety and environment systems.
- The ‘Procurement Procedure’ is supported by the ‘Contractor Health Safety and Environment Management’ that requires specific management processes for contracted services dependent on the size and type of contract.
- The ‘Project Delivery Manual’ procedure includes the requirement for witnessing and inspection of plant procurement to ensure that the required quality standards are met.

The ‘Procurement Procedure’ and Contractor Health Safety and Environment Management’ procedure are available on *The Wire*.

5.2.5.2 Design standards

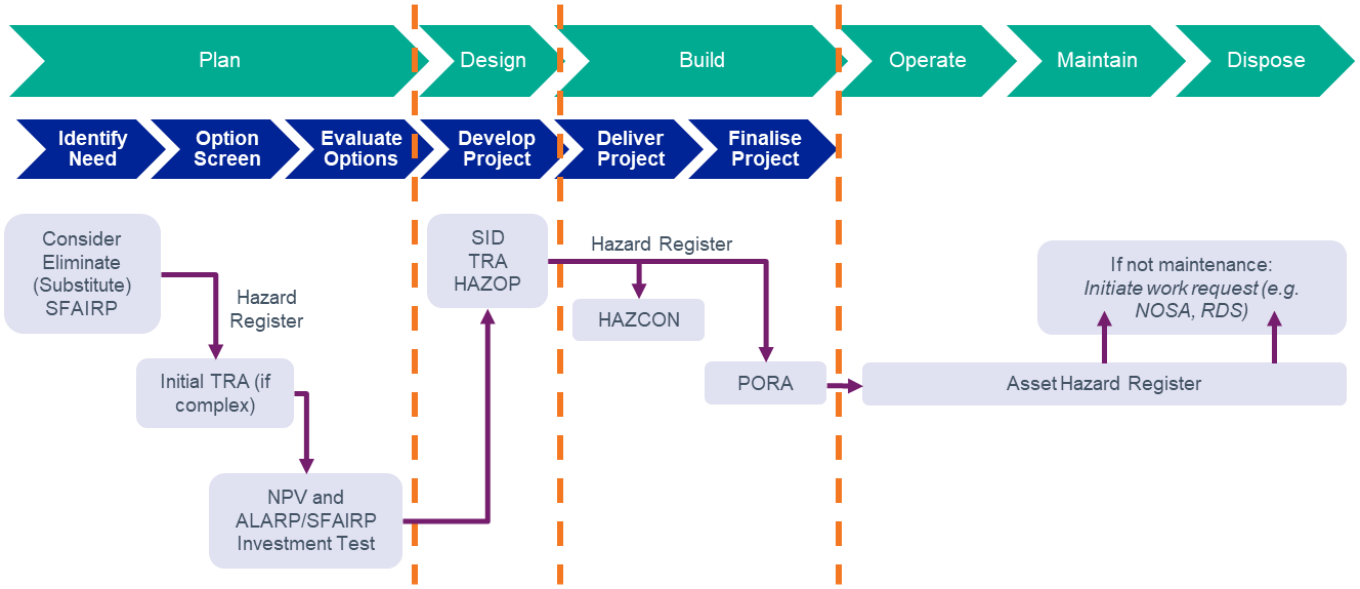
TransGrid’s network assets are designed in accordance with the Standard Design and Construction Manuals for each asset stream. These Manuals are based on relevant Australian and International Standards, and incorporate additional TransGrid requirements developed from experience in operating the transmission network.

All designs are assessed using a Safety-in-Design process as where potential hazards across the life cycle of the asset are identified and controls to manage the risks are considered. TransGrid ensure safety is minimised to ALARP through the following process:

- All designs are initially based on the requirements set out in the relevant Standard Design Manual. The default starting position is compliance with the standards included in these manuals.
- Designs are reviewed to identify cases of departure from a published technical standard, Australian or International Standard and the use of an alternative standard in order to ensure that all identified hazard are adequately controlled.
- The Safety in Design procedure results in a 'Safety in Design Report'. This report references an optimised version of the Standard SID Risk Register that deletes non-applicable items and adds project specific risks. The SID process is implemented via a workshop of skilled and experienced practitioners.
- The Safety in Design Procedure in its guidance references the Safe Work Australia Code of Practice 'Safe design of structure code of practice' and AS5577 'Electricity Network Safety Management Systems'. This COP provides guidance on the need to consider the adequacy of controls from specified standards and AS5577 drives requirements to consider network safety requirements.

The relevant Australian Standards and Codes of Practices are identified in the Standard Design and Construction Manuals located on *The Wire.*

Figure 6 Safety Assessment through Project Lifecycle



5.2.5.3 Construction standards

In order to ensure the quality and performance TransGrid build assets according to the standard design and construction manuals. Construction is undertaken using the processes set out in the 'Project Delivery Manual'. This manual is readily accessible on *The Wire*.

This Project Delivery Manual details the methodology for delivering construction projects from the perspective of project management and construction staff. It specifically covers establishing project, executing project, and finalising project activities. It also provides some limited advice on the process for making the initial investment decision by which the project scope is specified and project funding is provided. The methodology is based on the PMBoK (Project Management Body of Knowledge) international standard.

Key components related to support of the ENSMS in the Project Delivery Manual are:

- **Stakeholder Engagement:** The Project Delivery Manual includes the following procedures/documents for identifying and co-ordinating with the relevant authorities.
- **Project Responsibilities:** Project responsibilities and authorities are included in the development of a Project Management Plan (PMP) by the Project Manager. Supporting this plan is a Responsibilities, Accountability, Consulted, and Informed (RACI) matrix. The procedures for monitoring compliance with the PMP are included in the 'Quality Management Plan'.
- **Project Risk Management:** The risk management of a construction project consists of the following controls.

- Construction hazard assessment (HAZCON)
- Work Health and Safety Management Plan (WHSMP)
- Safe Work Method Statements
- Pre work risk assessments
- Mobile Plant Framework
- Environmental Impact Assessment or exemption certificate
- Hot Work Permits and Fire Risk Assessment and Control Measures.

> **Project Change Management:** Project change management and variations are covered under the following processes:
  - 'Project Development Framework' captures the procedure for varying an intended design during construction using a 'Request for Design Services' this includes approval to implement company/industry construction standards.
  - 'Project Delivery Manual' document covers the process for minor deviations from Approved 'For Construction' designs.
  - The 'Project Delivery Manual' and the 'Project Development Framework' in Section 4.5 detail the responsibility for keeping As-Built records. This includes the use of a close out checklist to record compliance. Asset variations that occur during construction are captured on red-line mark-ups that are communicated to the designers for update of drawings in the Electronic Drawing Management System (EDMS).
> **Managing Defects:** The Project Delivery Manual provides a process whereby non-conformance reports (NCR) are issued to manage equipment or work, where specified requirements have not been met or complied with. This can be as a result of unacceptable results from the Factory Acceptance Tests (FAT) or from inspections on site or results from Site Acceptance Tests (SAT).
> **Managing Non-Standard Equipment:** TransGrid requires type-tests to be undertaken for non-standard/new items to be undertaken/produced by the supplier and requires the designs (in particular the interfaces of the design) to be issued for TransGrid's review and approval prior to the commencement of the production process, this is covered in the 'Project Delivery Manual', section '070 Plant Procurement'. The risks of implementation of non-standard designs are covered through the 'Safety in Design' process.

5.2.5.4 Commissioning standards

The Project Delivery Manual includes a section Project Quality Management. The purpose of Project Quality Management is to ensure the project will satisfy the needs for which it was undertaken. Quality management is achieved through work instructions that satisfy TransGrid quality requirements with continuous improvement activities conducted throughout, as appropriate. The project quality requirements require:

> Project Quality Plan
> Contractors Quality Management Plan

Out of these input documents the following items are prepared:

> Check sheets (Inspection and Test Plans or Inspection and Test Checklists)
  - The Project Delivery Manual is supported by a number of standard templates that cover the majority of standard equipment utilised in TransGrid's network assets.
> Commissioning Plan
  - A commissioning plan is prepared in accordance with the commissioning work instruction prior to the commencement of commissioning. A copy of this plan is provided to System Operations to assist with preparation of High Voltage switching arrangements. Each work team on site has a copy of the commissioning plan provided to them and will need to confirm the completion of their specific tasks as detailed within the plan. A copy of the commissioning plan shall also be available in the *Project Pack*.

The Project Delivery Manual contains inspection and testing requirements that are followed in order to demonstrate regulatory compliance including:

- Inspections & testing in accordance with AS 3000 for TransGrid and the principle contractors joint testing and commissioning plan.
- First Energisation & Practical Completion checklist.
- Earth Grid Test Results.
- Factory Acceptance & Site Acceptance Tests.

These demonstrate that the network asset is safe to energise and would not have any adverse safety impacts.

5.2.5.5 Maintenance standards

All maintenance work is carried out in accordance with the relevant Maintenance Plan for the following asset classes:

- Transmission overhead lines
- Underground cable
- Substation primary systems
- Digital infrastructure
- Easements and Access Track
- Substation Security
- Network Property

These Maintenance Plans comply with relevant industry standards, codes and guidelines, and take into consideration TransGrid's Standard Design and Construction Manuals.

These are reviewed annually in response to the risk review undertaken in the Renewal and Maintenance Strategy development, which considers emerging issues associated with the key hazardous events. The Maintenance Plans are located on *The Wire*.

5.2.5.6 Operations and work procedures

TransGrid's work procedures are based on a formal process of task analysis and risk assessment, supported by the accumulated experience of the organisation and good practice work methods. All work carried out within TransGrid, whether by TransGrid employees or contractors, is carried out in accordance with these procedures. TransGrid's procedures comply with all relevant legislation, the ENA National Electricity Network Safety Code, and other Codes of Practice and Guidelines including those issued by SafeWork NSW and SafeWork Australia.

The Health and Safety group maintains a register of the standards and codes consulted by health, safety, and environment work procedures that various elements of the Health and Safety Management System and Environment Management System comply with.

Operation and work procedures are contained in the following:

- TransGrid's Power System Safety Rules which details the rules for safe work on the transmission system.
- Operating Manuals which provide operation parameters for specific sites and operating practices and requirements to facilitate safe switching operations.
- Safe Work Method Statements (SWMS) which provide a prescriptive description of how work is to be carried out based on the organisations risk management principles.
- Work procedures includes, but not limited, to substations, lines, protection, metering, communications, Safety, and environment.
- Network Operating procedures are contained in Operating Manuals. These cover aspects of operating the network such as equipment ratings, switching procedures, operation during outages, response to incidents, load shedding, system restart, synchronising, logging, and statistics recording. These procedures comply with the requirements under the National Electricity Rules, the Australian Energy Market Commissions Reliability Panel standards and guidelines, and the Australian Energy Market Operators standards and guidelines.

The operating manuals are located in secure LAN folders and where appropriate on the Wire. Work instructions and Power System Safety Rules are located on *the Wire*.

5.3 Implementation

5.3.1 Resourcing

TransGrid has approximately 1,000 staff members with a mixture of qualifications and skillsets (trade, technical and non-technical tertiary education). Staff are strategically based at locations throughout NSW, ACT, and Victoria in order to meet day to day operation and maintenance requirements, as well as being able to provide emergency response. Field staff are co-ordinated from major depots located in Western Sydney, Newcastle, Tamworth, Orange, Wagga Wagga, and Yass.

TransGrid's workforce planning process is designed to ensure that the organisation can meet the challenges facing it through the effective use of existing strategies, development of future key strategies and initiatives based on best practice and understanding how TransGrid's current and predicted organisational demographics will impact on future resourcing. Workforce planning establishes an integrated process for identifying, securing, and developing the employee competency and skill required to support and achieve TransGrid's current and future strategic themes, including its safety priority. The workforce planning recognises that human and financial resources, as well as facilities and equipment, are needed to implement the ENSMS to enable the transmission network to be operated in a safe manner. This includes:

> Carrying out of hazard controls and mitigation identified in the FSA.
> Developing, implementing, monitoring and reviewing the EMSMS.
> Undertaking planned and unplanned operations and maintenance.

To support the implementation of the ENSMS, TransGrid deploys the field and operational resources as shown described in Table 11. TransGrid manage resource availability through an internal allocation calendar (TRAC) that is visible through a web interface or via a mobile phone application for TransGrid staff. This system allows an interactive allocation of staff to work orders, management of resource loading, confirmation of the competence required, and the capability of the assigned resource. The TRAC system integrates with the ATW system that will not allow work to be performed if the allocated resources do not have the required competencies.

Table 11 – Field Resource Availability

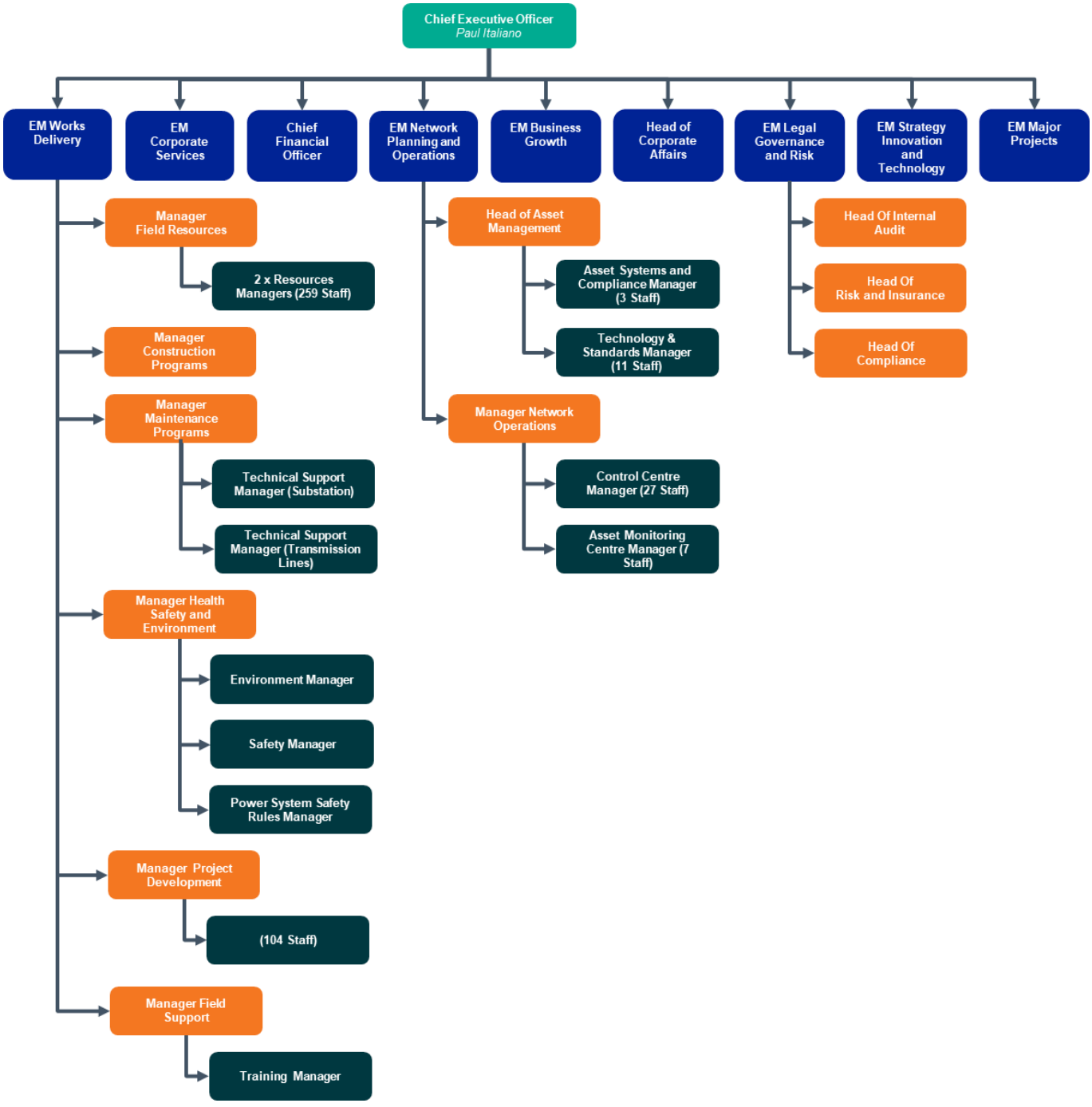
Business Area	Quantity and Shift	Responsibility
Operational		
Control Room	18 Staff (24 Hour Coverage)	Normal Operation and Abnormal Operations Control Commence Emergency Management Activities
Asset Monitoring Centre	6 Staff (1 Staff at least on 24 hour coverage)	Identifying asset related defects from online systems. Managing the creation non-routine maintenance work orders (corrective maintenance)
Maintenance		
TransGrid Field Technicians	Approx. 258 Staff (Shift and Day Work as required)	Managed as a resource pool with personnel with the relevant competencies assigned to works

Outsources Service Providers (Generic requirements) (Where contracted)	24 hour first response service with 60 minute callout response.	First response services Switching services Provision of site emergency response coordinator.

5.3.2 Management structure

TransGrid's management structure is shown in Figure 7. Up-to-date organisation charts that outline the management structure are also available from TransGrid's intranet site, The Wire. The personnel responsible for the management, including the operation and maintenance of the transmission network that in turns supports the ENSMS objectives are identified in the TransGrid's organisation charts.

Figure 7 – Organisation chart with management structure and key roles pertaining to the ENSMS



The Health Safety and Environment Group has a team of suitably qualified members who provide specialist advice and support to the Board, Executive, managers, team leaders, employees, and contractors. This team helps managers implement health and safety systems, safety management plans, and business unit health and safety plans. The budget for the Health Safety and Environment team provides support and resources as required to assist in the implementation of the annual corporate health and safety programs.

The EM/Network Planning and Operations has a team of suitably qualified and experienced asset managers and compliance specialists who facilitate the development of the FSAs for each asset class, develop the asset management strategies, asset management plans, and monitor the performance of the network and the achievement of the asset management plans. The ENSMS is monitored by the Asset Management Committee to ensure its appropriateness and effectiveness in managing network safety.

To help communicate and promote health and safety throughout the relevant business unit, each health and safety committee has its own budget. Adequate time and resources are provided to committee representatives for:

- Health and safety training.
- Inspections.
- Committee meeting attendance and document review.
- Health and safety issue investigation.

5.3.3 Responsibilities, Accountabilities and Authorities

The responsibilities, accountabilities and authorities of TransGrid's managers for the key elements of TransGrid's ENSMS are set out in the Business Unit Framework document that contains a RACI matrix related to each process listed in Figure 8 TransGrid Operating Model Processes.

In order to support the Business Unit Framework TransGrid has detailed the functional and resourcing responsibilities, accountabilities and authorities for the processes shown in Figure 8 , and with respect to the ENSMS a summary of the key roles is summarised in this section. The key frameworks related to the life cycle of the assets and this ENSMS are:

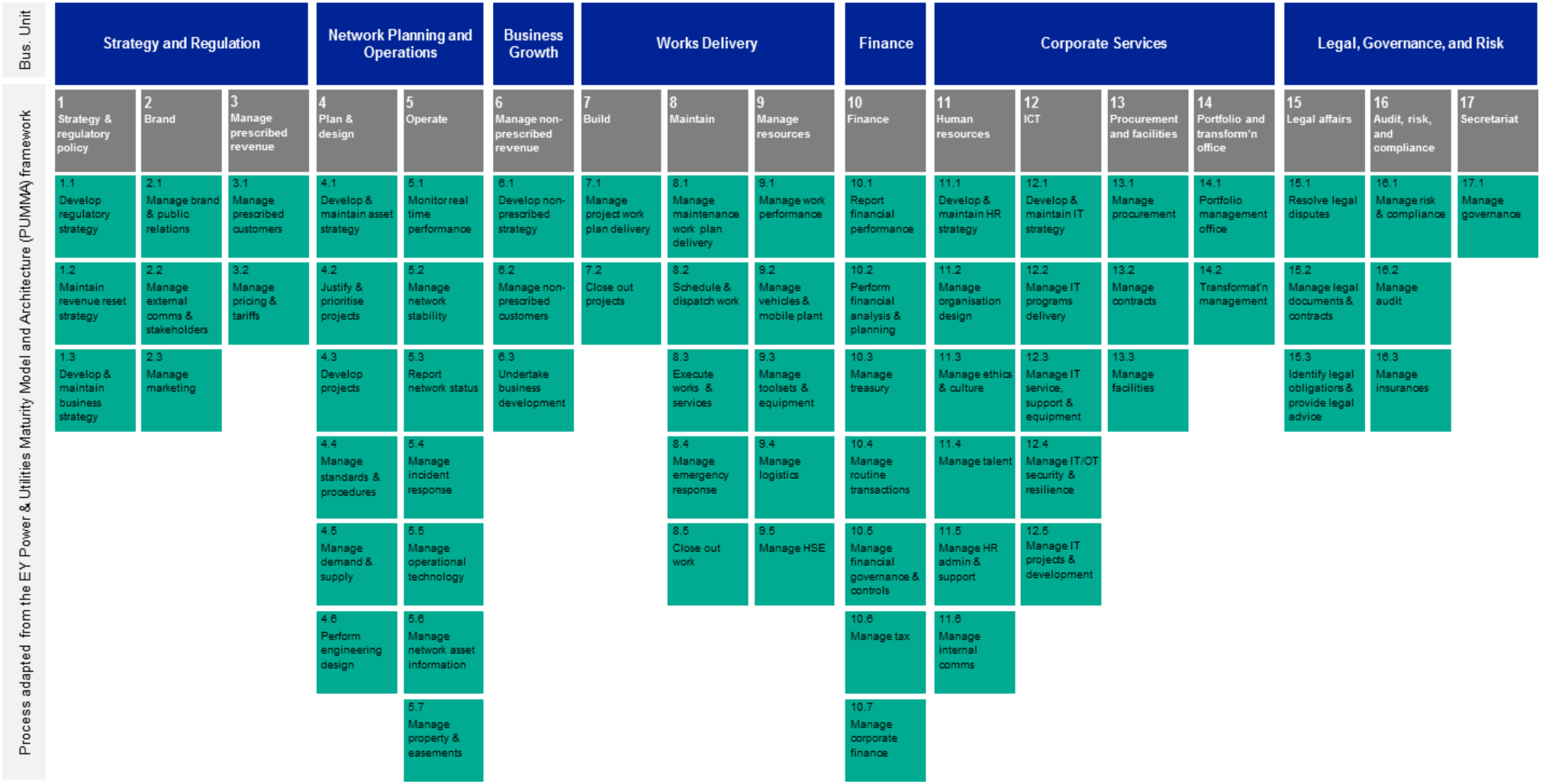
- Asset Management Framework
- Health and Safety Management System Framework
- Network Planning Framework
- Project Development Framework
- Works Program Framework
- Network Operations Framework
- Field Resources Scheduling Framework
- Managing People Framework (Field Resources)

The RACI matric embedded within the TransGrid's organisation chart in Section 5.3.2 and the business processes illustrated in Figure 7 identifies the positions or roles responsible for the following:

- Approve policies and procedures;
- Initiate action to, so far as reasonably practicable:
  - Prevent safety issues arising from a loss of supply;
  - Prevent environmental impact;
  - Mitigate the impact of such events to the public; and
  - Correct electricity network safety issues;
- Identify, record and report on any existing or potential deficiencies within the ENSMS or the network's design, construction, commissioning, operation, maintenance and decommissioning;
- Initiate, recommend, approve and monitor corrective and preventive actions in relation to identified existing or potential deficiencies within the ENSMS or the network's design, construction, commissioning, operation, maintenance and decommissioning;
- Evaluate and verify the effectiveness of any corrective or preventive action implemented;
- Satisfy the mandatory approval requirements of AS5577 for specific items to the approved.

The responsibility, accountability and authority with respect to TransGrid's ENSMS is set out in the brief description of the following roles and their relation with the ENSMS.

Figure 8 TransGrid Operating Model Processes



Chief Executive Officer

The Chief Executive Officer with the support and guidance of the Board of Directors is ultimately accountable for the management of TransGrid. The Chief Executive Officer oversees the strategies, policies, and performance of TransGrid and sets the values and standards. Governance arrangements are established in a charter which describes the functions of the Board and those functions delegated to management.

The Chief Executive Officer is responsible for approving all management system policies.

Executive Manager / Network Planning and Operations

The Executive Manager/Network Planning and Operations is responsible for the stewardship of TransGrid's electricity network, including:

- Electricity Network Safety Management System.
- Asset Management System.
- Allocation of sufficient resources to ensure appropriate governance of the ENSMS and AMS.
- Strategic asset management, including:
  - Asset management strategies
  - Asset management plans
  - Approval of FSAs as applicable
  - Network development strategies to ensure compliance of the electricity network with relevant technical and commercial regulation
- Network operations including developing switching plans.
- Investment strategy and solutions.
- Asset engineering standards.
- Research, development, and application of appropriate technical standards.
- Safe operation of the network, including network operating and incident management services.

Executive Manager / Works Delivery

The Executive Manager / Works Delivery is responsible for:

- Delivery of all asset related works as defined in the asset management strategies and plans, including:
  - Project Construction
  - Project Commissioning
  - Network maintenance
  - Customer connections and services
- Health and Safety Management System
- Environment Management System.
- Approval of FSAs as applicable.
- Project and program management.
- Engagement and management of service providers.
- Emergency response.
- Field operations and field switching.
- Commissioning and handover of assets.

Asset Systems and Compliance Manager

The Asset Systems and Compliance Manager is responsible for managing the ENSMS and ensuring that it remains fully implemented within the organisation and that it requirements are communicated to internal and external stakeholders as defined in this document. Dedicated personnel report to this position providing the ability to implement the following responsibilities:

- identifying interface issues and facilitating and monitoring of any actions required to address these (the 'Interface champion').
- managing the audit program (second line of defence).
- assuring the quality of the ENSMS through the review processes described in this document.

Safety Manager

The Safety Manager is responsible for health and safety aspects related to the ENSMS.

Environment Manager

The Environment Manager is responsible for environment aspects related to the ENSMS.

Power System Safety Rules Manager

The Power System Safety Rules Manager is responsible for management of the Power System Safety Rules and the ongoing compliance with these.

Training Manager

The Training Manager is responsible for ensuring that the consistent application of knowledge (competence) and the standard of performance required in the workplace (skill) are actively maintained for field staff within TransGrid.

Head of Internal Audit

The Head of Internal Audit maintains an internal auditing function that ensure compliance to certified management systems and other regulated requirements of TransGrid is maintained. This is a second or third line of defence function.

Head of Risk and Insurance

The Head of Risk is responsible for:

- maintaining the corporate Risk Management Framework
- developing the Risk Appetite Statement for Board approval
- performing reviews of strategic risks on an annual basis and presenting these to the BARC

Head of Compliance

The Head of Compliance is responsible for maintaining the corporate Compliance Management Framework

Manager Construction Programs

Ensures that appropriate governance and compliance is applied to construction programs including:

- Construction project management
- Construction commissioning
- Construction contract management

Manager Field Resources

The Manager Field Resources is responsible for managing TransGrid's internal resource pool and ensuring that the program of works is sufficiently resourced.

The brief description of responsibility, accountability and authority of these roles with respect to TransGrid's ENSMS is summarised and illustrated in Table 10.

Table 10 – Responsibilities and Accountabilities

ENSMS Requirement	Responsibility and Accountability	Key Document / Procedure
Approve policies	Chief Executive Officer	> Health and Safety Policy > Asset Management Policy > Environment Policy > Quality Policy
Approve procedures	The Board and Chief Executive Officer	> Risk Management Framework
	Chief Executive Officer Audit and Risk Committee	> Corporate Governance Framework
	Executive Manager / Network Performance and Operations	> Electricity Network Safety Management System (ENSMS) Description (NSW) > Electricity Safety Management Scheme document (Victoria) > Network Vision 2056 > Prescribed Capital Investment Framework > Prescribed Capital Investment Process
	Head of Asset Management	> Asset Management Strategy and Objectives > Asset Management System Description > AMS and Electricity Network Safety Management System (ENSMS) Audit Procedure
	Executive Manager / Works Delivery	> Power System Safety Rules > Environmental Management System Framework > Project delivery manual > Project risk management
	Manager / Health Safety and Environment	> Health and Safety Management System Framework
	Executive Manager / Corporate Services	> Procurement procedure (Confidentiality, Supplier Performance Contract Management)
	Executive Manager / Network Performance and Operations	> Design management > Safety in design > Corporate and emergency management plan (CEMP) > Continuity of transmission supply plan > Substation emergency response plans > Operating manuals (multiple documents)
Prevent safety issues arising from a loss of supply	Executive Manager / Network Performance and Operations	> Ensure personnel follow emergency response procedures and personnel follow supply restoration procedures. – Corporate and emergency management plan (CEMP) – Continuity of transmission supply plan

ENSMS Requirement	Responsibility and Accountability	Key Document / Procedure
		– Substation emergency response plans – Operating manuals (multiple documents)
	Executive Manager / Works Delivery	> Site emergency and response plan/s > Work place instructions and procedures > Safe work methods
	Executive Manager / Corporate Services IT Operations Manager	> Information technology disaster recovery > Service Recovery and Failover to secondary site procedure,
	Executive Manager / Works Delivery	> Work place instructions and procedures
Prevent environmental impact	Head of Asset Management	> Bushfire Mitigation Plan > Maintenance Plans
	Executive Manager / Network Performance and Operations	> Public Electrical Safety Awareness Plan
	Executive Manager / Works Delivery	> Health, Safety and Environmental Audit Process
Correct electricity network safety issues	Executive Manager / Works Delivery	> Work place instructions and procedures > Safety committees and communication > Safety training > Safety Equipment
	Executive Manager / Network Performance and Operations	> Operating manuals (Multiple) > Power System Safety Rules
	Executive Manager / Legal Governance and Risk	> Compliance monitoring and control testing > Internal audit reporting guide
Identify, record, and report on any existing or potential deficiencies with the ENSMS	Executive Manager / Network Performance and Operations	> AMS and Electricity Network Safety Management System (ENSMS) Audit Procedure
	Executive Manager / Legal Governance and Risk	> Compliance monitoring and control testing > CAMMS > Internal audits
	Executive Manager / Works Delivery	> Safety audits > Site Conformance Inspections
	Executive Manager / Network Performance and Operations	> AMS audits > Technical performance assessments
Initiate, recommend, approve, and monitor corrective and preventive actions in relation to existing or	Executive Manager / Works Delivery	> Incident notification system > Safety audits > Site Conformance Inspections
	Executive Manager / Legal Governance and Risk	> Compliance monitoring and control testing > Internal audits > CAMMS

ENSMS Requirement	Responsibility and Accountability	Key Document / Procedure
potential deficiencies within the ENSMS	Executive Manager / Network Performance and Operations	> AMS and Electricity Network Safety Management System (ENSMS) Audit Procedure > Control Assurance Review > AMS review committee
Evaluate and verify the effectiveness of any corrective actions	Executive Manager / Works Delivery	> Safety audits > Site Conformance Inspections
	Executive Manager / Legal Governance and Risk	> Compliance monitoring and control testing > Internal audits > CAMMS
	Executive Manager / Network Performance and Operations	> Asset management committee
Monitoring Asset Performance Events	Asset Monitoring Centre Manager	> Operating manuals (multiple documents) > Substation emergency response plans
Monitoring Operational Events	Control Centre Manager	> Operating manuals (multiple documents) > Substation emergency response plans
Addressing Network Safety Events	Safety Manager	> Safety audits > Site Conformance Inspections

5.3.4 Training and competency

5.3.4.1 Talent management processes

TransGrid has well established human resource and people management processes in place for management of the training and development of its personnel, including:

> The Performance Development Process (PDP) which is used to record, monitor and manage the performance of TransGrid's employees. This process covers:
  – Performance planning, performance monitoring and performance reviews.
  – Assessment of the competencies required for the present role.
  – Career development and readiness to undertake future roles.
> A staff training and development matrix which is maintained in Ellipse.
> A nominated Training Co-ordinator / HR Business Partner for each business unit.

As part of the PDP an employee's capabilities are assessed by their team leader or manager against the relevant required capabilities required for their role. Capability assessment areas include:

> Leadership and management competencies (are outside the scope of the asset management system).
> Behavioural competencies, such as core values and behaviours, leadership competencies.
> Asset management (technical) capabilities.
> Job-specific operational competencies such as safety management, working at heights, asbestos awareness, working in confined spaces, bush-fire awareness, etc.

TransGrid manages capability and job specific competencies through the following procedures:

> TransGrid Capability Framework
> Asset Management System Capability Guideline
> System Operator Competency Standard
> Field Resources - Technical Capabilities Framework MHR-FRM-MAN-271

> ‘Authorisation to Work’ procedure.

Job descriptions outline, when necessary, health or safety competencies. These competencies, as well as any medical restrictions, must be taken into account as part of the pre-work risk assessment before starting the task.

5.3.4.2 Skills development

Managers/team leaders identify the training requirements for employees under their control and develop annual training plans. It is the responsibility of each individual employee in consultation with their manager/team leader to ensure training is completed. Progress against training requirements is monitored through the PDP process.

Managers and team leaders receive training in health and safety principals, behaviours, and responsibilities appropriate to their role. Employee, contractor, agency employees, and visitors receive induction training based on their likely risk exposure.

Health and safety committee representatives are trained in accordance with SafeWork NSW - OHS Committee Training.

TransGrid conducts a range of training and education programs in addition to those for employees who undertake the operation and maintenance of the network. This training and education includes:

> Systems operations
> Asset management
> Risk management
> Systems planning and analysis
> Project management
> Substation design

All training courses should be arranged through their Local Training Coordinator to ensure the training is appropriate for their position and the work they are required to undertake, approved and the employee’s training records are updated.

5.3.4.3 Competency Management

In cases where a competency deficiency is identified this is addressed by:

> Training for field resources is managed under the Training Procedure and all personnel undergo training that is required for their role, being Compliance, Compulsory or Employee development under that procedure. If an employee is ‘not yet competent’ they either do not do the activity or work as part of team (if learning the activity). If it is decided that an employee needs retraining we assess and retrain and where necessary they may have their authorisations reduced until competence is attained.
> For non-compliances with the ENSMS, generally related to intentional non-compliance, then disciplinary action may be taken in accordance with the TransGrid Disciplinary process. Employees have a fundamental obligation to work in accordance with the relevant Industrial Instrument, Code of Ethics and Conduct, Policies, Procedures and Standards. The TransGrid Disciplinary Procedure applies to all employees of TransGrid and describes the process to be followed in the case of disciplinary investigations or actions.

5.3.4.4 Training and education – Management Resources

TransGrid supports the development of leadership, management, and interpersonal skills for all our employees. The organisation supports this development through a number of activities, which are available to all employees, including:

> Leadership Development Framework
> Mentoring
> Succession Planning
> Workforce Planning
> High Potential Leaders Program

- Management Programs
- Senior Leaders Workshops

TransGrid ensure that it has competency for the development and maintenance of its ENSMS through ensuring that personnel have the requisite skills to undertake a FSA in accordance with AS 5577 and ISO 31000:

- Requiring the requisite skills in risk management and management systems are identified in the position descriptions for roles. These key roles include Environment Manager, Safety Manager, Asset Systems and Compliance Manager, and Asset Strategy Specialist.
- The skills for risk assessment and management system development are identified in the Asset Management System Capability Guideline. This includes the following capabilities in which the Asset Systems and Compliance Manager and Asset Strategy Specialist are designated to have Advanced skills:
  - Assess and manage risks in accordance with ISO 31000. This includes a specific skill to be able to facilitate FSA in accordance with AS 5577 to achieve an intermediate level of competence.
  - Develop ENSMS
  - Assure the quality of asset management system processes.
  - Monitor and review progress and performance.
  - Review and auditing compliance with legal, regulatory, ethical, and social requirements.
- Where additional skills are required or independent review is required external consulting resources are engaged.
  - For all FSA developed and revised to date external consulting resources have been engaged to either facilitate or provide objective input to the risk assessment process.
- Ongoing monitoring as part of the performance development process to determine competency gaps and identify training requirements for people involved with the ENSMS.
- Ongoing communication at group meetings to raise awareness of TransGrid's ENSMS.

5.3.4.5 Training and education – Field Resources

TransGrid is a Registered Training Organisation and has a strong tradition of providing valuable training and education programs for its electricity transmission workforce. These programs include comprehensive training and support for apprentices, trainees, and fully qualified staff (SDP). The range of training and education programs that TransGrid provides includes:

- Apprenticeships and Traineeships:
  - Transmission Lines Apprenticeships:
  - The Transmission Lines Apprentices' Program is a four-year program combining work experience and study in the Certificate III in ESI - Transmission. Apprentice training is provided by a combination of in-house learning programs and off-site or external provider courses.
  - Electrical Fitters (Substations) Apprenticeships:
  - The Electrical Fitters (Substations) Apprentices' Program is a four-year program combining work experience and study in the Certificate III in Electrotechnology (Electrician). Apprentice training is provided by TAFE NSW and work experience is provided by TransGrid.
- Mandatory Training:

  TransGrid's mandatory training requirements ensure safety training and certification at levels appropriate to each position and to the work being carried out. Records of mandatory training are maintained to ensure staff have the appropriate qualifications and alert staff when renewal is due. This training encompasses (Relevant to ENSMS):
  - Asbestos Awareness
  - Bushfire Awareness
  - Confined Spaces.
  - CPR.

- Fire Awareness (F1).
- Hazardous Substances and Dangerous Goods.
- Herbicide Application.
- Hearing Conservation.
- Manual Handling.
- Work Safely in the Construction industry (Induction).
- OHS Induction.
- Risk Assessment.
- Safety Rules.
- Substation Fire Training (F2).
- Working at Heights
- Code of Ethics and Conduct.
- Environmental Rules.
- Fatigue Management.
- Driver Awareness.
- Incident Investigation for Team Leaders and Managers.
- Contractor H&S Management.

5.3.4.6 Training requirements for other electricity utilities personnel entering TransGrid's network sites

Access to TransGrid's network assets is restricted to staff authorised under TransGrid's Power System Safety Rules. As a minimum staff accessing the site are required to obtain Category 1 (Safe Access to Substations) authorisation under TransGrid's PSSR.

Following completion of TransGrid's Category 1 PSSR training and an associated site orientation to reinforce learnings from the online module, staff will be granted access to site via a valid security card and keys.

The site orientation is provided by TransGrid's representative and includes:

> Substation entry / exit / emergency procedures
> PPE requirements
> Accessing information on hazards applicable to the location and applying the reporting process for identified hazards
> Incident reporting procedures
> The organisations safe system of work (risk assessment, training, competency and authorisation processes) are of an adequate standard having regard to TransGrid's PSSR and associated procedures.

For staff involved in High Voltage Switching Operations at a site additional familiarisation training will be provided on the operation of the electrical apparatus and associated operating equipment under the external providers operational control including:

> Use of local HMI
> Operation and locking of disconnectors
> Operation and locking of earth switches
> Usage and application of earthing equipment and locks on equipment under the external providers operational control

5.3.4.7 Training requirements for contractors performing outsourced services

Contractor's workers are required to become authorised under the relevant categories of the TransGrid's PSSR and Environmental Authorisations prior to working at TransGrid's sites. To become authorised, workers will be required to undertake training as prescribed in Table 12.

All such worker's which are authorised under the TransGrid's PSSR and Environmental Authorisations will be required to undertake 'Refresher Training' at regular intervals to maintain their authorisation. This training normally comprises of an assessment and/or learning. It is typically two-yearly or annually and the method of delivery is through e-Learning. TransGrid will notify the Contractor prior to 'Refresher Training' to identify training needs and provide a training estimate.

Where TransGrid's staff, the so called, insourced service, are required to work on the site, competence is managed through:

> TransGrid's PSSR
> TransGrid's internal training and competency frameworks

Table 12 – PSSR and Environmental Authorisations - Qualifications and Training Requirements

PSSR or Environmental Category	Examples of work requiring this category
Category 5.5 – Operate HV Air Insulated Switchgear	Switching and isolation services for planned, Unplanned, and Emergency work.
Category 5.4 – Issue HV Access Authority	Issuing an Access Authority for planned, unplanned, or Emergency work.
Category 5.2 & 5.3 – Receipt of a HV Access Authority and HV Testing	Receive an Access Authority for work on or near HV conductors and act as the Authorised Person in Charge for works under an Access Authority. Supervise instructed persons for work in the switchyard.
Category 4.1, 4.2 & 4.3 – Work Under a Low Voltage/Mechanical Access Authority, Issue a Low Voltage/Mechanical Access Authority & Operate Low Voltage/Mechanical Apparatus including Produce/Check LVMPRI.	Operate Low Voltage and Mechanical Apparatus, Produce and Check LVMPRI's, Receive Low Voltage Access Authorities.
Cat 3.3 - Work in Substation General	Any Work within the Substation.
E2 – Carry out Work	Any Work within the Substation.

5.3.4.8 Access and work authorisation

TransGrid has an integrated on-line system which performs the traditional approval to work function whilst ensuring access to areas is only granted to authorised and competent persons, the ATW. The ATW system has the following functionality within it:

> Standardising/improving authorisation processes and alignment with the security cards/keys including a unified view of the status of authorisations and security access. This results in effective management of authorisations and security cards and improved safety and security.
> Integrates with external organisations (ESI companies, direct customers, and contractor organisations) by implementing a secured portal to capture authorisation, training recognition and security card/keys applications online.
> Has integration with the TransGrid ERP system (Ellipse) to ensure competencies managed through ATW are up to date.

For outsourced service, these are covered by inclusion of relevant clauses into the engagement contract. Authorised contractors are supplied with an access card to ensure that only authorised personnel have access to the site.

All such worker's that are authorised under the TransGrid's PSSR and Environmental Authorisations will be required to undertake 'Refresher Training' at regular intervals to maintain their authorisation. This training normally comprises of an assessment and/or learning. It is typically two-yearly or annually and the method of

delivery is through eLearning and/or face to face training. TransGrid will notify the contractor prior to 'Refresher Training' to identify training needs and provide a training estimate.

Training for Categories 3.3, 4.1 and 5.3 will be as per the standard TransGrid training for contractors. Training for Categories 4.2, 4.3, 5.4 and 5.5 is a gap training which is intended to cover differences between the PSSR and the safe access to High Voltage management system, which current contractors currently works by.

TransGrid ensure persons who carry out work are competent by having individuals nominated in a contract. TransGrid check the accreditations and specifically verify that these persons have completed the TransGrid PSSR training by interrogating the on-line ATW system before providing access to the site for performance of the works under the contract.

Mandatory safety training and annual refresher training is required to maintain Authorisation to Work. A list of the various training requirements for each Authorisation category including contact details for booking training courses are provided in the Attachment 8 of PSSR and Environmental Authorisation. PSSR authorisation and access to TransGrid sites is terminated should staff competency not be maintained.

The PSSR elements are audited via the on-line ATW and all aspects of the works under the contract are subject to an annual internal audit. Non-conformances reports (NCRs) of the work are to be reported by the contractor and PSSR authorisation and access to TransGrid sites shall be terminated should staff competency not be maintained.

The PSSR and Environmental Rules require specific Qualifications and Training requirements depending on which section of the works fall under the appropriate section of the PSSR. These requirements apply to TransGrid staff and contractors.

5.3.5 Consultation, Communication and Reporting

This section provides guidance on applying a structured procedure on how TransGrid engages with internal and external stakeholders in order to meet the requirements of AS5577-2013: Electricity Network Safety Management Systems (ENSMS). This requires the identification and engagement or relevant internal and external stakeholders for the development, implementation, and operation of the relevant ENSMS or ESMS.

Figure 8 shows the process for stakeholder engagement during development of the ENSMS and following sub-sections describes this process in further details.

Figure 8 - Stakeholder Consultation and Communication Process

5.3.5.1 Internal Stakeholder Engagement

TransGrid has internal stakeholder engagement forums. The key forums are:

> Asset Management Committee
> Work Health and Safety Committees
> Operations and Maintenance Committee.
> Power Systems Safety Rules Committee
> Design Review Committee
> Network Performance Review Committee
> Asset Management Working Groups

The Charter and Membership details of the above forums are outlined in the following documents available on *The Wire*:

> Asset Management Committees – Strategy and Plan
> Work Health, Safety, and Environmental Committees in TransGrid (intranet page with associated links)

The internal stakeholder obligation(s) pertaining to the ENSMS are identified in Table 13 based on the understanding of their business function.

The Asset Systems and Compliance section of the Asset Management group has a delegated responsibility to monitor that the ENSMS is efficient and effective in satisfying the regulatory requirements. It performs this by participating or reviewing engagement activities for the all FSAs.

Table 13 Internal stakeholder obligations

Business Unit	Business Group	Interests
Corporate Services	Information Security	Reduce the impact of cyber security threat on reliability to ALARP.
Legal Governance and Risk	Audit	Provide assurance on key components of the ENSMS linked with the Strategic Risk Register. [Refer to FY19 Internal Strategy and Audit Plan] Interested in the outcomes of independent audits.
	Risk and Compliance	Ensure corporate risks that are related to the risks identified in the ENSMS/ESMS are managed to ALARP.
Network Planning & Operations	Asset Management	Accountable for developing and implementing the ENSMS. Manage risks attributed from asset failure to ALARP. Provide assurance to TransGrid owners that their controls are complete and effective in managing the relevant risks.
	Executive	Endorse relevant risk management activities identified in FSAs and ENSMS.
	Network Operations	Manage risks attributed from their operation of the network under normal, foreseeable abnormal and emergency conditions to ALARP. Provide assurance to TransGrid owners that their controls are complete and effective in managing these risks. Efficiently and effectively implement relevant controls owned by other stakeholders.
	Network Planning	Manage risks attributed from their planning of the network under normal conditions. Provide assurance to TransGrid owners that their controls are complete and effective in managing these risks. Efficiently and effectively implement relevant controls owned by other stakeholders.

Business Unit	Business Group	Interests
	Technology and Standards	Manage risks attributed from the design of assets under normal, foreseeable abnormal and emergency conditions to ALARP. Provide assurance to TransGrid owners that their controls are complete and effective in managing these risks.
Works Delivery	Project Delivery	Efficiently and effectively implement relevant controls owned by other stakeholders. Raise awareness with the relevant stakeholders on of emerging issues that may impact the effectiveness of controls.
	Construction Programs	Manage risks attributed from the construction, commission, and decommission of assets under normal, foreseeable abnormal and emergency conditions to ALARP. Provide assurance to TransGrid owners that their controls are complete and effective in managing these risks. Efficiently and effectively implement relevant controls owned by other stakeholders. Raise awareness with the relevant stakeholders on of emerging issues that may impact the effectiveness of controls.
	Executive	Endorse risk management activities identified in FSAs.
	Field Resources	Efficiently and effectively implement relevant controls owned by other stakeholders. Raise awareness with the relevant stakeholders on of emerging issues that may impact the effectiveness of controls.
	Field Support	Provide assurance to TransGrid owners that their controls are complete and effective in managing relevant risks. Efficiently and effectively implement relevant controls owned by other stakeholders.
	Health Safety & Environment	Provide assurance to TransGrid owners that their controls are complete and effective in managing the relevant risks. Raise awareness with the relevant stakeholders of emerging issues that may impact the effectiveness of controls.
	Maintenance Programs	Manage risks attributed from the maintenance of assets under normal, foreseeable

Business Unit	Business Group	Interests
		abnormal, and emergency conditions to ALARP. Provide assurance to TransGrid owners that their controls are complete and effective in managing these risks. Efficiently and effectively implement relevant controls owned by other stakeholders. Raise awareness with the relevant stakeholders on of emerging issues that may impact the effectiveness of controls.

Guidance for engagement with relevant internal stakeholders is provided in Appendix E.

5.3.5.2 External Stakeholder Engagement

This section details the requirement for identifying and engaging with relevant external stakeholders through the preparation of the FSAs and/or Safety Case.

TransGrid has in-place a Stakeholder Management Framework that guides how the organisation manages its relationship with stakeholders. The primary objective of stakeholder management is to create and maintain a positive perception of TransGrid and its people, so as to support the achievement of business success now and into the future. TransGrid is committed to:

> meaningful, open, and honest stakeholder engagement
> listening to our stakeholders' feedback
> incorporating and addressing stakeholder views
> responding to and acting upon stakeholder feedback

Appendix 1A of the Stakeholder Management Framework document available on *The Wire* provides a comprehensive list of TransGrid's external stakeholders. Further information on TransGrid's Stakeholder Engagement activities, outcomes and plans is available in the document 'Connecting with you: TransGrid Stakeholder Engagement' available on the TransGrid public internet site.

The messaging with external stakeholders is focused around the following themes:

> Demonstrate that TransGrid's controls are appropriate and effective in addressing stakeholders' concerns related to TransGrid's risks and identify which of TransGrid's controls are relied upon by the stakeholder.
> Highlight to the relevant stakeholders that their controls contribute to the management of TransGrid's risks.
> Highlight to the relevant stakeholders that they are key to protecting TransGrid's assets as they are critical to maintaining the safety of the electricity network.

Table 16 provides a breakdown of the concerns relevant to each external stakeholder and how they relate to the 3 themes. This assists with focusing engagement activities with the external stakeholders.

This procedure does not apply to the Environment and Property FSA as it is covered in the 'Needs and expectations of interested parties Procedure'.

The relevant external stakeholders in NSW, ACT and VIC are identified as the ENSMS and ESMS cover assets in NSW, ACT and VIC.

Table 16: External stakeholder interest

Stakeholders	Jurisdiction	Relevant FSA	Key Concern
Contractors	Where relevant	Public Safety, Worker Health and Safety, Bushfire	Protect the safety of the public and their staff. Limit damage to environment, public lives and private property from bushfire caused by TransGrid.
Distribution Network Service Providers- ActewAGL (ACT), Ausgrid (NSW), Endeavour Energy (NSW) , Essential Energy (NSW and ACT), Evoenergy (ACT), Powercor (VIC)	Where relevant	Public Safety, Worker Safety, Bushfire, Network Reliability Safety	Ensure no gaps in the controls used by TransGrid and DNSPs in managing network safety risk.
Electricity Consumers	Where relevant	Network Reliability Safety	Obtain value in network safety risk management for prices paid by consumers.
TransGrid Customers (including generators)	Where relevant	Public Safety	Protect their safety.
AEMO	All	Network Reliability Safety	Limit TransGrid's disturbance to reliability of the NEM.
Civil Aviation Safety Authority	All	Public Safety	Protect the safety of the public.
Landowners	All	Public Safety, Bushfire	Protect their safety. Limit damage to environment, public lives and private property from bushfire caused by TransGrid.
Access Canberra	ACT	Public Safety	Protect their safety.
ACT Ambulance	ACT	Public Safety, Worker Health and Safety	Protect their safety. Limit damage to TransGrid property from their operation. Reliance on them to promptly respond TransGrid staff emergencies at remote locations.
ACT Fire & Rescue	ACT	Public Safety	Protect their safety.
ACT Police Force	ACT	Public Safety, Network Reliability Safety	Protect the safety of the public and their staff.

Stakeholders	Jurisdiction	Relevant FSA	Key Concern
ACT Rural Fire Service	ACT	Public Safety, Bushfire	Protect their safety. Limit damage to environment, public lives and private property from bushfire caused by TransGrid.
ACT State Emergency Service	ACT	Public Safety, Bushfire	Protect their safety. Limit damage to environment, public lives and private property from bushfire caused by TransGrid.
Environment, Planning and Sustainable Development Directorate - Environment (including Parks and Conservation)	ACT	Bushfire, Network Reliability Safety	Limit damage to environment, public lives and private property from bushfire caused by TransGrid. Limit TransGrid's disturbance to reliability of the NEM.
Independent Competition and Regulatory Commission	ACT	Public Safety, Worker Safety, Bushfire, Network Reliability Safety	Demonstrate that TransGrid is satisfactorily meeting regulatory requirements, and given them opportunity to scrutinise our approach.
Utilities Technical Regulator	ACT	Public Safety, Worker Safety, Bushfire, Network Reliability Safety	Demonstrate that TransGrid is satisfactorily meeting regulatory requirements, and given them opportunity to scrutinise our approach.
WorkSafe ACT	ACT	Public Safety, Worker Safety, Bushfire	Demonstrate that TransGrid is satisfactorily managing safety.
Department of Planning and Environment	NSW	Network Reliability Safety	Limit TransGrid's disturbance to reliability of the NEM.
Energy and Water Ombudsman		Public Safety, Bushfire	Protect the public safety and property.
Forestry Corporation of NSW	NSW	Bushfire	Limit damage to environment, public lives and private property from bushfire caused by TransGrid.
Independent Pricing and Regulatory Tribunal	NSW	Public Safety, Worker Safety, Bushfire, Network Reliability Safety	Demonstrate that TransGrid is satisfactorily meeting regulatory requirements, and given them opportunity to scrutinise our approach.
NSW Ambulance	NSW	Public Safety, Worker Health and Safety	Protect the safety of the public and their staff. Limit damage to TransGrid property from their operation. Reliance on them to promptly respond TransGrid staff emergencies at remote locations.
NSW Fire & Rescue	NSW	Public Safety	Protect the safety of their staff.

Stakeholders	Jurisdiction	Relevant FSA	Key Concern
NSW National Parks and Wildlife Service	NSW	Bushfire	Limit damage to environment, public lives and private property from bushfire caused by TransGrid.
NSW Police Force	NSW	Public Safety, Network Reliability Safety	Protect the safety of the public and their staff. Assist in minimising reliability impacts from incidents.
NSW Rural Fire Service	NSW	Public Safety, Bushfire	Protect the safety of their staff. Limit damage to environment, public lives and private property from bushfire caused by TransGrid.
NSW State Emergency Service	NSW	Public Safety, Bushfire	Protect the safety of their staff. Limit damage to environment, public lives and private property from bushfire caused by TransGrid.
Roads and Maritime Services	NSW	Public Safety	Protect the safety of their staff.
Safe Work NSW	NSW	Public Safety, Worker Safety, Bushfire	Demonstrate that TransGrid is satisfactorily managing safety.

The current communication methods available when engaging with the external stakeholders are:

> TransGrid Advisory Council and Revenue Proposal Working Group (consumer focus groups convened by TransGrid).
> Fact Sheets (on TransGrid website).
> Q&As (on TransGrid website).
> Material to be distributed to community (flyers, local newspapers or doorknocking).
> Media Releases.
> Pre-emptive media.
> Powering NSW *enews* newsletter via its relevant subscriber distribution list. The distribution of this newsletter includes the following stakeholders:
  – AEMO.
  – Department of Planning and Environment (NSW).
  – TransGrid Customers (including generators and directly-connected customers) (only customers that express interest to receive the newsletter).
  – DNSPs (only DNSPs that express interest to receive the newsletter).
  – Electricity Customers.
  – IPART.
  – Landowner and community representatives (including local council).
  – RMS.
> Social media (LinkedIn for the broader business community).
> Organised meeting / workshop.
> Direct communication via email.

Guidelines for the engagement of external stakeholders in the development and implantation of ENSMS related activities is provided in Appendix F.

5.3.5.3 Regulatory Communications

The monitoring activities listed below are key to ensuring the controls remain effective in managing TransGrid's risks. The stakeholders and TransGrid's procedures, which ensure the engagement activities are completed in a timely manner, are identified against each activity.

(a) Regulatory incident reporting, as per stakeholders' requirements.
  (i) TransGrid procedures:
    - Regulatory Incident Reporting Procedure
  (ii) Relevant stakeholder procedures:
    - Electricity Networks Reporting Manual - Incident Reporting (October 2017, NSW)
    - Electrical Incident and Safety Performance Reporting Guidelines (VIC)
    - Electricity Transmission Supply Code 2016 (ACT)

(b) Regulatory incident notification. Notification of incident issued to relevant stakeholder as required.
  (i) TransGrid procedures:
    - Health and Safety Incident Management
    - Health, Safety, Environment and Network Safety Communication and Reporting

(c) Compliance reporting and reporting on performance of ENSMS, Asset Management System, Health and Safety Management System, and/or Environment Management System.
  (i) TransGrid procedures:
    - Bushfire Preparedness Report Procedure
    - ENSMS Annual Performance Reporting Procedure
    - Health, Safety, Environment and Network Safety Communication and Reporting
  (ii) Relevant stakeholder procedures:

- Electricity Networks Reporting Manual - Safety Management Systems Reporting (April 2018, NSW)
- Electricity Networks Reporting Manual - Bushfire Risk Management Reporting (April 2018, NSW)
- Electricity Networks Reporting Manual - Annual Compliance Reporting (April 2018, NSW)
- Electricity Networks Reporting Manual - Transmission Reliability Standard (April 2018, NSW)
- Electricity Networks Reporting Manual - NSW Code of Practice for Authorised Network Operators (April 2018, NSW)
- Electrical Incident and Safety Performance Reporting Guidelines (VIC)
- Electricity Transmission Supply Code 2016 (ACT)

5.3.6 Communication and Awareness of Safety Risks and Controls

TransGrid performs stakeholder engagement through the lifecycle of the asset including:

> During the FSAs as described in Section 5.2.3 and Section 5.2.4.
> During the design phase as part of the Safety in Design assessments.
> During construction key contractors are engaged to perform a HAZCON as required in the project delivery manual.
> During operation readiness activities through negotiation of contractual requirements for any outsourced work contracts, operating protocols with direct suppliers, and if required with stakeholders that may be engaged during normal operations or in the event of emergencies (typically near neighbours and fire authorities.)

TransGrid has in place a range of mechanisms to make its workforce for the operations and maintenance of the network aware of the key safety related risks and associated controls. These mechanisms include:

> Internal communications and newsletters, such as articles on *The Wire*, Safety alerts, Health and safety updates.
> The work health and safety committees, including the distribution of the minutes of these meetings.
> Mandatory training and education courses.
> Site and project induction sessions for both staff and contractors.
> Site and team meetings.
> Hierarchy of training and accreditation levels required to access equipment as mandated under the Safety Rules.
> Workplace pre-work hazard assessments.
> Site conformance inspections.
> Safety audits.

The following relevant documents are available on *The Wire:*

> Training Procedure
> Induction Procedure
> Performance Development Process
> Strategic Workforce Planning Report
> PSSR

5.3.7 Exchange of Health and Safety Information

TransGrid provides a process for complaints and a medium for an ongoing exchange of health and safety information with relevant parties which may include:

> Regulators (IPART, UTR, SafeWork NSW)
> Suppliers
> Contractors
> Other relevant stakeholders

> General public

The following relevant documents are available on *The Wire:*

> Issues Management Process
> Health and Safety Incident Management
> Health and Safety Committee Consultation Statement
> General Responsibilities and Selection of Procurement Method
> Contractor HS Management
> Email Communication Framework

5.3.8 Communications Plans

A communication plan is to be prepared as part of the management of change applied whenever a change is made to the ENSMS, a FSA, or a critical control such as a maintenance plan. This communications plan shall consider what stakeholders, and the type of communication required. Refer to Asset Management System Change Procedure for details on how to create a communications plan.

> The ENSMS life cycle stage and FSA process steps the stakeholders are engaged in.
> Timeframe for delivery of engagement activities. 2018 and 2019 calendar year quarters are used.
> The activities relevant to the ENSMS life cycle stages.

5.3.9 Reporting

To monitor, review, continually improve, and to meet regulatory requirements, TransGrid prepares a number of reports. It also records incidents, hazards, “near misses”, and corrective actions and maintains a database of Work Activity Risk Assessments, Workplace Risk Assessments, and Safe Work Method Statements on *The Wire* (Health and Safety Risk Management).

Health and Safety (Worker safety and environment)

Health and safety performance is reported to the Executive and Board.

Requirements for environment, health, and safety reporting are detailed in ‘Health, Safety, Environment and Network Safety Communication and Reporting’ procedure.

Asset Management (Network safety related)

The monthly Network Performance Review tracks the outages in the network that is used for internal and external reporting.

External Reporting

TransGrid holds a licence to operate its prescribed transmission networks and assets in New South Wales and the Australian Capital Territory (ACT). TransGrid needs to notify the relevant regulatory authorities on incidents that occur within the respective jurisdictions in accordance with the relevant Acts and Regulations. The requirements for regulatory incident reporting are detailed in the ‘Regulatory Incident Reporting Procedure’.

Table 10 lists the standard reports that are produced to provide regulatory governance and oversight in the NSW and ACT jurisdictions. This table is based on the requirements identified in the IPART website (in December 2019) and for the ACT the requirements listed in ‘Electricity Transmission Supply Code 2016 (**Code**)’.

Table 10 – External Reporting Requirements

Compliance area – reporting manual	Report due to IPART	Reporting period	Is an audit report required?

Incident reporting	Ongoing –more information in the reporting manual	Report on individual significant incidents	No
Electricity network safety management systems (Including bushfire preparedness)	31 October	12 months to 30 September	No, except at IPART's discretion.
Compliance with critical infrastructure licence conditions	30 September	The preceding financial year	Yes
Transmission reliability standard	31 August	Report on compliance as of 1 July of each financial year	No, except at IPART's discretion.

5.3.10 Emergency Preparedness and Response

5.3.10.1 Emergency Procedures

Planning for emergency situations is described in the scope of 'Planning and preparation for abnormal operations' in Section 5.2.4.

Emergencies that impacts on safety, reliability of supply, the environment, or TransGrid's business are managed as quickly and safely as possible through the following procedures:

> Corporate Response and Emergency Management Plan (CREMP)
> Power System Emergency Response Plan (PSERP)
> HSE Hazard and Incident Management

TransGrid's CREMP and PSERP:

> Categorises emergency levels; and
> Details specific commands and responsibilities for each emergency level.

Substations, offices and depots emergency response procedures are an implementation of the PSERP at such sites. They detail specific site evacuations and emergency procedures. These procedures comply with Australian Standard – AS 3745-2010 Planning for Emergencies in Facilities, where appropriate.

These procedures are in place for controlling emergencies in buildings, structures and workplaces (for example, bomb threat, fire, chemical spill, or explosion). Visitors to sites are advised of these procedures as part of their site induction. The emergency response plans for each substation site are available on *The Wire* and at site for access by relevant personnel and contractors, and are regularly reviewed, tested and updated.

First aid equipment and trained first aid personal are available at each site and work location. In the event of a critical incident, the employee assistance program (EAP) is available to all employees for debrief and support.

Following any major incident and after emergency response drills a review ('lessons learnt') is undertaken that review the response and ensure that personnel have follow emergency management processes.

TransGrid holds an annual Safety Day. These Safety Days heighten awareness and improve emergency response skills, and ensure that people understand their requirements to managing safety.

5.3.10.2 Testing and review of emergency plans

Emergency plans are reviewed following any significant emergency to ensure the plan was applied and that it was effective. Anything needing amendment is updated. From time to time an independent observer is engaged during planned exercises to monitor compliance with objectives and to participate in debriefings.

Site emergency response equipment is regularly inspected and audited. All emergency and fire protection equipment, exit signs and alarm systems are inspected, tested, and maintained according to TransGrid's procedures.

TransGrid has a requirement to monitor the type and quantity of dangerous goods and hazardous substances stored on its premises. This helps manage storage areas, ensure that all Material Safety Data Sheets are obtained, and where required, manage notification to the relevant authorities. The site emergency response manuals show the locations of gas bottles and chemical storage, and fire equipment.

The following relevant documents are available on *The Wire:*

> Fire Protection Manual Operations and Maintenance.
> First Aid Services.
> Hazardous Chemicals Storage and Transport.
> Safe Working Practices, Equipment, and Tools.

5.3.10.3 Supply restoration

TransGrid ensure relevant personnel follow supply restoration procedures after a load interruption event (forced outage or manual load-shedding). Network load is to be restored in a controlled manner in accordance with a restoration plan developed by the respective operations teams at the time of the event. The plan is intended to restore load in maximum permissible block sizes to minimise the period load is interrupted. During the development of the plan consideration is to be given to the network capacity of all of the TransGrid and the applicable DNSPs at the time of the incident.

Following any major incident a review ('lessons learnt') is undertaken that review the response and ensure that personnel have followed supply restoration processes.

5.3.10.4 Critical incident training

Every year in June, TransGrid holds a Critical Incident training event that includes emergency response and supply restoration scope. During this training, TransGrid operates along with AEMO, Ausgrid, Endeavour, Essential, Essential Energy, Evoenergy, Snowy Hydro, AGL, and Tomago Aluminium operators to practice restoring the NSW and ACT networks after state-wide outage.

To provide the training TransGrid has modelled the generators, the entire NSW and ACT transmission network, and a large portion of the NSW distribution network in PowerWorld. This application is a specialised operator training simulator that enables multiple participants to simultaneously interact with the simulation using an interactive graphical interface. Each market participant is given a computer terminal and a phone so they can interact with the simulation and communicate with other market participants just as they would in real life. As a team all the market participants work together to restore the NSW and ACT network, discussing important operational issues along the way.

5.4 Measurement and Evaluation

5.4.1 Monitoring and Measurement

TransGrid monitor network performance through the following processes:

> Continuously through the Asset Monitoring Centre
> Reactively through the use of oversight committees as described in section 5.5.2.

TransGrid has in place a range of indicators that are used to monitor and measure the safety and performance of the transmission network assets. The indictors leverage data from asset management forum (Network Performance Review forum) and health and safety management forum. The following list documents the indicators monitored through these forums:

> Safety incident against the IPART reporting matrix
> Major incident descriptions against the ESSNM objectives.
> Incident description against the ESSNM objectives.
> Network asset annual functional failure – assisted and unassisted statistics
> Vegetation contact with conductors statistics
> Unintended contact, unauthorised access and electric shocks statistics
> Reliability and quality of supply statistics
> Reliability and quality of supply – critical infrastructure incidents

- Network initiated property damage events
- Amendments and improvements description to FSA or associated risk treatments
- Design, construction and commissioning project statistics
- Inspection (assets) task statistics
- Inspection (vegetation, aerial , ground based) task statistics
- Public electrical safety plans and activities description
- Internal audits performed on any aspect of the ENSMS – scope, non-compliance and corrective action descriptions
- External audits performed on any aspect of the ENSMS – scope, non-compliance and corrective action descriptions
- Bushfire risk profile description
- Pre-summer bushfire inspection statistics
- Vegetation tasks statistics
- Asset tasks statistics
- Environmental breaches reporting (required for ACT)
- Serious property damage reporting (required for ACT)
- Licence breaches (required for ACT)
- Environmental Protection Licence (EPL) reporting

The indicators relevant to the ENSMS objectives and the Asset Management System are covered in the Network Asset Strategy document.

The indicators relevant to the ENSMS objectives and the Health and Safety Management System and the Environment Management System are covered in the Works Delivery action plans.

External and internal reporting on these indicators informs relevant committees of:

- TransGrid's success in achieving the ENSMS objectives
- Trends to trigger review of processes
- Actions to improve TransGrid's position in achieving the ENSMS objectives

The types of indicator reporting relevant to the committees are provided in the Network Asset Strategy, and Health, Safety, Environment and Network Safety Communication and Reporting documents.

5.4.2 Data acquisition and analysis

Asset condition monitoring data and the requirements for analysis and reporting are specified in the relevant asset class manuals and maintenance plans.

Asset condition data is acquired through field inspection managed through the Ellipse ERP solution and Asset Inspection Manager (AIM) respectively.

Where available on-line condition monitoring is made available and monitored through the Asset Monitoring Centre located in Sydney. Typical online monitoring systems are:

- Alarms triggered by pressure switches (e.g. Buchholz relays)
- SF_6 gas pressure levels

5.4.3 Incident investigation

The purpose of TransGrid's incident management processes is to control people, activities and information following the occurrence of an event, asset or work practice instigator, that has led to or could have led to injury to people, damage to property, damage to environment, loss of supply, and/or some other loss.

TransGrid uses an incident notification system (a module of CAMMS) for the recording and reporting of health and safety incidents to prevent a recurrence. All reported incidents are responded to and investigated to determine the causes and corrective actions required. Incident investigation occurs as follows:

- Health, safety and environmental incident reporting and investigation notification is managed through the 'HSE hazard and Incident Management' procedure and 'CAMMS', a hazard, incident and risk

management system which allows the tracking, management, investigation, reporting and auditing of hazards, incidents, risks, waste disposal and compliance for TransGrid.

- For property or network damage related incidents these are investigated in accordance with the 'Asset Event and Investigation Reporting Procedure'. This procedure requires that investigations into network incidents review whether they were a result of deficiencies in controls related to the Key Hazardous Events as identified in the respective FSAs. A listing of the investigation requirements is provided in 5.4.3.
- Network incidents such as loss of supply or an outage that do not result in a HSE related event are reviewed at the Network Performance Review meeting and classification is confirmed as 'Statistical', 'Minor', or 'Major'. The investigation of these events is undertaken in accordance with the 'Asset Event and Investigation Reporting Procedure'.

Serious incidents are reported to the appropriate authorities (for example, SafeWork NSW, IPART and UTR as applicable) and investigated if required by the respective jurisdictional authorities.

TransGrid has an obligation to report certain 'Reportable Incidents' to the AEMO. Reportable Incident means an incident that involves a malfunction or reduction in performance or functionality of its prescribed network, including:

- any information included in the Database ('Registered Data') relating to the transmission network is incorrect, and provide details in relation to proposed changes.
- any malfunction or degradation to performance or functionality of the prescribed network that has resulted in or has potential to result in:
  - disconnected or reduced load or generation
  - apparatus operating outside specified ratings
  - unacceptable quality of supply of electricity
  - any condition affecting the ability to maintain the transmission system in a secure operating state.
- any matter affecting the prescribed network that has resulted in death or serious injury to a person.
- an event involving the prescribed network that is likely to receive media coverage.
- incidents involving property damage that, in the AEMO's reasonable opinion, could be attributed to the prescribed network.
- breaches of security involving a member of the public climbing on or gaining entry to the prescribed network.
- any human error incident.
- any damage to, or incorrect operation of, the prescribed network.
- the manual or automatic isolation of any part of the prescribed network from the Victorian Transmission Network or the Interface.

All incidents which involve contractors or outsourced service providers are required to be reported to TransGrid immediately.

5.4.4 Corrective and Preventive Actions

Corrective actions related to the direct rectification of physical asset related issues are managed through the 'Corrective Maintenance Process'.

Corrective actions related to management systems and processes are raised and monitored in the TransGrid's Compliance, Audit, Risk and Safety Management System (CAMMS). Corrective action records are maintained in accordance with legislative requirements and TransGrid practices.

Independent internal review occurs within the relevant asset management committee forum for checking the completion of preventive and corrective actions.

5.4.5 Records

5.4.5.1 Documents

TransGrid's documented information is managed in accordance with the framework specified in TransGrid's Business Management System that is certified to ISO 9001. The core procedures that cover management of documented information are:

Table 11: Document Management Procedures Relevant to the ENSMS

Document	Description
Business Management System Description	Defines the BMS and includes the overriding requirements for the management and maintenance of documentation at TransGrid.
Document and Records Management Procedure	Defines the way in which TransGrid manages and controls its corporate documents and records to meet its business objectives and to maintain compliance with external legislative and regulatory obligations. This has particular requirements for Corporate Controlled Documents and requires business owners to define control processes for business unit controlled documents.
Network Planning and Operation (NP&O) Document Management Procedure	Defines the actions to be undertaken within the Network Planning and Operations business unit when revising existing or creating new documents to ensure compliance with TransGrid's Document and Records Management procedure and business management system.
Grid Operating Manual – OM – 001, Preparation and Distribution of Operating Manuals	Defines the responsibilities for the production of operating manuals for use by TransGrid and for reference by AEMO. It also sets down a quality procedure for their preparation and distribution, and details a uniform style of presentation which will help achieve clarity to instructions that are prepared by different groups within Asset Management
ISMS Document and Record Management Procedure	Defines the procedures for the identification, preparation, review, approval, distribution and maintenance of documents and records supporting the Information Security Management System (ISMS) within TransGrid

5.4.5.2 Storage of Documents

Corporate records are those that typically relate to the substantive business of the TransGrid. Corporate records are kept in TRIM and SharePoint and if a corporate record contains information that is relevant to TransGrid's functions and activities and has continuing value to TransGrid. Consequently, a corporate record must always be captured into a recordkeeping system. The principle systems unless defined otherwise for the storage of documents are:

- TRIM is the corporate document management system.
- *The Wire* readily accessible by all employees contains current versions of relevant documents.
- The Electronic Document Management System (EDMS) is a repository for all engineering and design drawings.
- *TSS* is TransGrid's Spatial System from which detailed information of specific assets may be obtained,
- Ellipse is the corporate ERP system which contains details of all the assets.
- Network LAN for storage and sharing of working documents or controlled documents where defined under a business unit procedure.

All staff are responsible for keeping records. Records are constantly and routinely created by all TransGrid staff including executives, managers, supervisors, administrators, and contractors in the normal course of their duties and are a part of and result from business activities and provide evidence of those activities.

TransGrid 'Information Security Controls - General Users' document describes the Information security IS definitions as 'Preservation of confidentiality, integrity and availability of information'.

> Confidentiality - Ensuring that information is accessible only to those authorised to have access.
> Integrity - Safeguarding the accuracy and completeness of information and processing methods.
> Availability - Ensuring that authorised users have access to information and associated assets when required.

The review period is dependent on the risk associated with the relevant document management procedure. Corporate controlled documents are reviewed every 3 years. Documents are reviewed more regularly if there are:

> Changes to legislation.
> Changes to expectations and requirements of interested stakeholders.
> Changes in the product, processes, activities, plant, or equipment of the organisation.
> Changes to the structure of the organisation.
> Advances in science and technology in the industry.
> Lessons to be learned from TransGrid incidents, inspections, or audits.
> Reports and communications from health and safety committees.
> Comments from employees.

TransGrid complies with all record keeping provisions of self-insurance licence requirements, and the requirements of the Health and Safety Management System, as well as those record keeping requirements prescribed in national standards, codes of practice and/or legislation.

These records are held on secure servers and backed up as per the 'Backup Procedure'

Table 12 – ENSMS Records Management

Category	Document Management
Included Documents	The following documents are 'Included Documents' for the purpose of records management in the ENSMS: > ENSMS > Formal Safety Assessments > Audit Reports of ENSMS and ongoing audit documents > Incident investigation reports for network incidents within the scope of the ENSMS. > Reports submitted to Energy Safe Victoria
Storage of Included Documents	The above documents are stored and archived as follows: > Electrically on the TransGrid Intranet 'the Wire'. > On the TRIM document management system > Paper documents are scanned and stored electronically > Records of incidents and actions resulting from incident investigations are stored in the Compliance, Audit, Risk and Safety Management System (CAMMS). > Records of findings and associated actions are stored in the Compliance, Audit, Risk and Safety Management System (CAMMS).
Retention period	For the Included Documents these are retained for: > As long as required to be of value for decision making within the ENSMS, AMS, EMS and/or the HSMS. > A time required by any direction for the relevant regulatory body.

5.4.5.3 Asset management information

Asset management information is critical to asset management decision making, at both the strategic and tactical levels. TransGrid's asset data, both financial and non-financial, supports all the primary decision making and activity components of the asset management system, including the development of optimised asset strategies, the production and implementation of asset management plans, and the reporting of asset costs and expenditures.

The scope of asset data that TransGrid captures records and maintains is broad, including asset type, location, age, capability, condition, failure histories and consequences, work histories, financial data, such as unit costs, construction costs, maintenance expenses, and as-built drawings. The description of the key information systems that store asset data is identified in Table 13.

TransGrid maintains the following engineering records and drawings for the transmission system:

> Drawings:
  – All electrical layouts and diagrams for all sites and equipment are maintained in the Electronic Drawing Management System (EDMS).
> Maintenance Records:
  – All records of completed maintenance work are maintained electronically in the Enterprise Resource Planning System (Ellipse) and Asset Inspection Manager (AIM).
> Operating Records:
  – The operators log is used by TransGrid's control room staff to record all significant activity associated with operating the network (OPSlog).
> Outage requests and records of all completed outages are maintained in TransGrid's outage system, 'THEOS'. Management of outages under TransGrid's Safety Rules including Requests for Access, preparation of switching instructions and the management of Access Authorities is done via the HVPRI application.
> Resource allocation is managed through the TransGrid Resource Allocation Calendar (TRAC). This is an in-house developed system that allocates resources on a specific date to a Work Order for the performance of work. This system links in the Authority to Work (ATW) that will not allow a job to proceed if the allocated resource does not have the required competencies.

Table 13 - Key Information Systems

Asset Data Type	Asset Data Detail	System of Record
Equipment Registration.	Asset records. Nameplate details. Equipment location (network).	Ellipse ERM
	Equipment location (spatial).	TSS
Equipment Lifecycle – Key Dates.	Purchase date. Commissioning Date. Decommissioning Date. Disposal date.	Ellipse
Asset Management Strategy.	Maintenance Schedule. Standard Jobs. Inspection Scripts. Projects (replacement and augmentation).	Ellipse
	Service Instructions.	The Wire
Equipment Lifecycle.	Work Order History, including costs.	Ellipse

Asset Data Type	Asset Data Detail	System of Record
	Failure History.	FEOR
Equipment Condition.	Inspection Results. Condition Monitoring Results.	Ellipse AIM
	Meter accuracy results	Metering Management
Financial - Balance Sheet.	Asset Value. Remaining Life.	Ellipse
Equipment Operation.	Ratings. Utilisation.	SCADA
	Outage Requirements. Operation records	THEOS OPSlog
	Secondary systems relay settings.	PRIM
Design and Integration.	Installation Drawings. Equipment Manuals.	EDMS Project files/folders
Non-Equipment Information.	Environmentally sensitive areas. Easement Details. Property Owners.	TSS
	Environmental incidents. Safety Incidents.	CAMMS

TransGrid recognises that its asset managers can only make better and more informed asset management decisions if they have better and improved asset data. TransGrid sees the ongoing continual improvement of its asset data and asset management information systems as a driving component of its AMS improvement.

Details on the initiatives for continual improvement of the asset data and asset management information systems are set out in the Asset Management Information Strategy, which is available on *The Wire*.

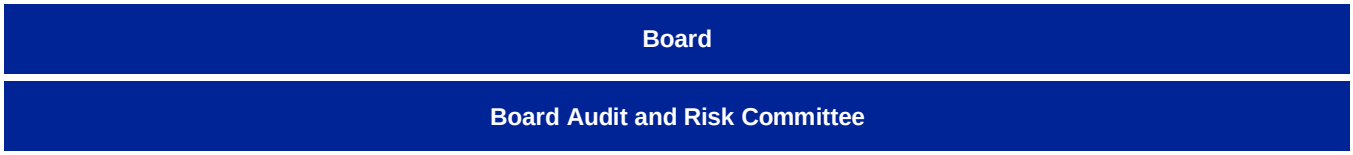
5.4.6 System Audits

5.4.6.1 Corporate Oversight

Corporate oversight is provided through the 'Corporate Compliance Management Framework' that provides a 'three lines of defence' approach as shown in Figure 9.

In TransGrid's 'Risk Management Framework', the Board is responsible for defining TransGrid's strategy including its agreement that risk management is a central part of strategic and operational management of TransGrid's business, its assets, and its compliance responsibilities. TransGrid has adopted the 'three lines of defence' model to ensure clearly defined risk ownership responsibilities within functional areas of the business that provides visibility back to the Board on the status of implementation of risk management activities. These risk management activities are also subject to independent assurance through internal and external audit processes. TransGrid's internal audit function reports monthly to the executive, and to the Board, on the status of its assurance processes and outcomes.

Figure 9 – Corporate Compliance Framework



1st Line of Defence	2nd Line of Defence	3rd Line of Defence
Executives, Business Units, Managers, all staff and contractors *(Management control)*	Corporate Risk and Compliance *(Independent review and challenge)*	Internal and External Audit *(Independent assurance)*
Responsible for adhering to and implementing the requirements as set out in the Corporate Compliance Management Framework, including: • Identification and effective management/mitigation of compliance risks; and • Issues and incident identification, recording, escalation and management.	Responsible for independent oversight of the compliance risk profile and compliance management framework, including: • Effective challenge to activities and decisions that materially affect the compliance risk profile; • Assistance in developing and maintaining the compliance management framework; and • Independent reporting lines to appropriately escalate issues.	Responsible for independent assurance on the appropriateness, effectiveness and adequacy of the compliance management framework, including that: • The framework is used to support decision-making; • 1st and 2nd lines of defence operate effectively; and • Improvements to the 1st and 2nd lines of defence activities are identified and recommended.
Legal Provides input and advice across all Three Lines of Defence		

Supporting the implementation of this framework the Legal Governance and Risk group develop an annual Internal Audit Plan to ensure that TransGrid's management systems are maintained in line with licencing and regulatory requirements.

5.4.6.2 Compliance management

Corporate oversight of compliance is managed by the Head or Compliance who maintains the obligations register in CAMMS. This register includes TransGrid's obligations under the ESSNM for an AS5577 compliant ENSMS.

The actioning of all processes related to the ENSMS are performed through either the Health & Safety Management System, Environmental Management System or the Asset Management System. The key components of an ENSMS system audit is to check the effectiveness of the elements of these management systems that delivers the ENSMS objectives. The objectives of TransGrid's system audit programs are to:

- Determine whether the management systems:
  - Conform to TransGrid's requirements
  - Has been effectively implemented and maintained
  - Is effective in meeting TransGrid's Health and Safety Policy, Environment Policy, Asset Management Policy and their respective management strategies and objectives.
- Provide information to senior management to assist with their monitoring of the management systems.
- Identify areas for improvement in policies, procedures, work practices, and technologies and to identify opportunities to adopt good practices where there is ongoing benefits to TransGrid in doing so.
- Identify areas of risk and non-compliance to those functional policies, procedures, work practices, technologies, and information systems that support the management system.
- Identify new and emerging risks to the ENSMS and the FSAs.
- Adequately communicate potential or actual management system risk or non-compliance to line management for action and close out.
- Provide assurance to the EM/Network Planning and Operations of TransGrid's ongoing ability to comply with all relevant management system requirements across all asset lifecycle stages.
- Enable ongoing certification of TransGrid's management systems to be maintained.

The individual process audit objectives are to ensure that TransGrid's management systems can be continually improved and optimised in support of achieving the organisational objectives by:

- Assessing whether the identified elements of the management system are defined appropriately and implemented effectively
- Identifying potential deficiencies and opportunities for improvement
- Recommending corrective actions, improvements, or areas for further investigation.

5.4.6.3 System audits

Compliance of the ENSMS to AS 5577 and the Regulation is to be validated through an independent, external audit. These audits include:

- Corporate Audits:
  - These are audits to confirm that TransGrid's management systems and associated processes are managed in accordance with its obligations and key strategic risks are controlled in accordance with TransGrid's Risk Appetite Statement (RAS). These audits are undertaken under the authority of the Head of Internal Audit.
  - The forward plan for Corporate audits is included in the 'FY20 Internal Audit Strategy and Plan' or its latest update available on the Wire.
- AMS and ENSMS Audits:
  - These are audits to confirm that the AMS and ENSMS are appropriately defined and effectively implemented, also identifying instances of risk, non-compliance, and opportunities for improvement. The AMS and ENSMS Audits are undertaken by the Asset Systems and Compliance Manager in conformance to licence and regulator auditing requirements.
  - The scope and plan for AMS and ENSMS audits is set out in the 'AMS and ENSMS Audit Procedure' that includes:
    - Health check reviews
    - Annual Surveillance or compliance audit by an accredited ISO55001 certifier.
    - Guidance on ENSMS audits performed by an external auditor under a Notice of Direction by the regulator.
    - ESMS audit requirements (Victoria).
    - Requirements for Control Assurance Reviews.
- WHS and Environmental Management System audits focusing on:
  - The Health Safety and Environment (HSE) audit strategy sets the direction for both internal and external HSE audit for the next three years and will be supported by an annual review of the audit schedule to ensure alignment with TransGrid's strategic HSE priorities. HSE Operational Risks are audited in a systematic manner.
  - The scope of the WHS&E audits is to assure the management of HSE related operational risks including:
    - Health and Safety Critical Risks
    - Secondary level health, safety and environmental risks. Generic Health and Safety Hazard and Risk Register
    - HSE leadership or planning
    - Implementation of HSE procedures and/or work instructions
    - Management of externally appointed/contracted resources
    - Environmental aspects – Register of Significant Environmental Aspects, Environmental Critical Risks
    - Management of vegetation hazards – Vegetation Maintenance Hazard and Risk Register
    - Management of construction related HSE risks

5.4.6.4 Audit Quality and Auditor Competence

The 'AMS and ENSMS Audit Procedure' stipulates the competence requirements for auditors and the processes for assessing competence. The guidelines for auditor competence are as follows.

For external auditing, the criteria is based on that used for IPART audits[3] that require the auditor to:

- Follow a process in compliance with ASAE 3000, AS/NZS ISO 19011, ISAE 3000.
- "Use the standard of skill, care and diligence that would be reasonably expected of a person with the requisite skills and expertise in the provision of services of the same or a similar nature to those to be provided by the Auditor in undertaking the Audit, in particular being a person who:
  - is skilled and has substantiated experience in the areas identified in the IPART Audit Guidelines as areas in which an auditor must have experience
  - has detailed knowledge of the matters which are identified in the IPART Audit Guidelines as matters of which an auditor must have detailed knowledge."

For internal auditing the auditor shall:

- Have substantiated experience in the areas identified in the internal audit scope.
- Follow a process in general alignment with AS/NZS 19011.

The Asset Systems and Compliance Manager will review the competency of auditors and ensure compliance with the requirements of this ENSMS.

5.4.6.5 Reporting of audit results

The results of these audits are monitored as follows:

- Minor and major non-conformances are entered as findings into CAMMS. These findings are assigned via a CAMMS action to the relevant person to action with a relevant risk owner assigned. The actions in the CAMMS have a required completion date assigned. If the action to rectify the audit issue is not closed off by the due date it escalates to the risk owner. The Legal Governance and Risk group monitor CAMMS and provide a regular report to the Executive of overdue items in CAMMS.
- The ENSMS and various management systems that support the delivery of the ENSMS objectives are monitored and reviewed by the Asset Management Committee.
- Health and Safety Management System, the Environment Management System and Fire Management procedures are monitored and reviewed by the Executive.

Issues of a lesser concern that represent opportunities rather than business risk are reviewed for efficacy and placed into a relevant continuous improvement register for action based on benefit.

5.5 Management Review and Change Management

5.5.1 Management Review

The ENSMS is continually monitored, evaluated, and reviewed by:

- Asset Management Committees and strategically (i.e. strategic risk register) by the BARC. The 'Asset Management Committees Strategy and Plan' procedure is found on *The Wire*.
- The Work Health and Safety Committees

In order to ensure the implementation and performance of the ENSMS two key governance structures are in place in TransGrid to monitor and review compliance

At a Corporate level the review of the Strategic Risk Register includes a consideration of emerging threats and risk at a corporate level. This work would include:

- Review of the existing risk controls in the annual review by the BARC.
- The identification of emerging risks relevant to the ENSMS objectives is to be addressed in the periodic review of the ENSMS.

At the asset class and sub-class level emerging threats are considered in the Renewal and Maintenance Strategy. This review specifically assess the emerging risks through:

[3] IPART (NSW) Electricity Networks Audit Guideline

- Including a review of performance related to the key hazardous events by review of KPIs.
- Review of asset health based on analysis of data for each asset class with appropriate control actions identified and implemented where required. The asset health index is applied using 'Network Asset Health Framework' and its application is described in the relevant Renewal and Maintenance Strategy.

5.5.2 Oversight Committees

5.5.2.1 Board Audit and Risk Committee

The BARC is a sub-committee of the Board of Directors for TransGrid. The rights and duties of a Director serving as a member of the BARC are the same as a member of the Board of Directors. The primary function of the BARC is to assist the Board in fulfilling its statutory and oversight responsibilities relating to:

- Risk management process of TransGrid and determination of the risk appetite for TransGrid;
- Financial reporting process.
- Overall audit process of TransGrid.
- Systems of internal control of TransGrid which management and the Board of Directors have established.
- The process for monitoring compliance with the organisation's compliance obligations and the Code of Conduct.

As part of its function to monitor risk within TransGrid it receives annual updates on the strategic risks and controls that are applicable the ENSMS.

The Charter for the BARC is provided in the 'Board Audit and Risk Committee Charter'

5.5.2.2 Asset Management Committees

The Asset Management Committees are integral to the governance and oversight of the following processes:

- Providing forums for management review on the performance of the AMS and ENSMS throughout the lifecycle of the assets.
- Ensuring that there is active communication both between the various asset lifecycle stages but also up and down the organisation in terms of setting objectives (down) and reporting of KPIs (up).
- Identify defects and areas for improvement of the AMS and ENSMS.
- Approve changes to the AMS and ENSMS.
- Review and ensure actioning of issues contained in the CAMMS and Continuous Improvement Register.
- Fostering continuous improvement in the systems.

5.5.2.3 Work Health, Safety and Environment Committees

The Health, Safety, and Environment group have the following committees to assist with governance of the ENSMS:

- **Board HSE Committee** – meets quarterly
- **Incident Review Board** – Made up of the Executive and Manager HSE – Reviews all serious incidents (HCI, potential HCI and LTI) – chaired by the CEO – meets as required
- **PSSR Committee** – made up of SME's from across the business. This committee is chaired by the Manager Network Operations
- **WHS Committees** – 6 regionally based committees that meet on a quarterly basis to discuss field related issues. This committee is chaired by local WHS representatives and attended by senior management and HSE representative

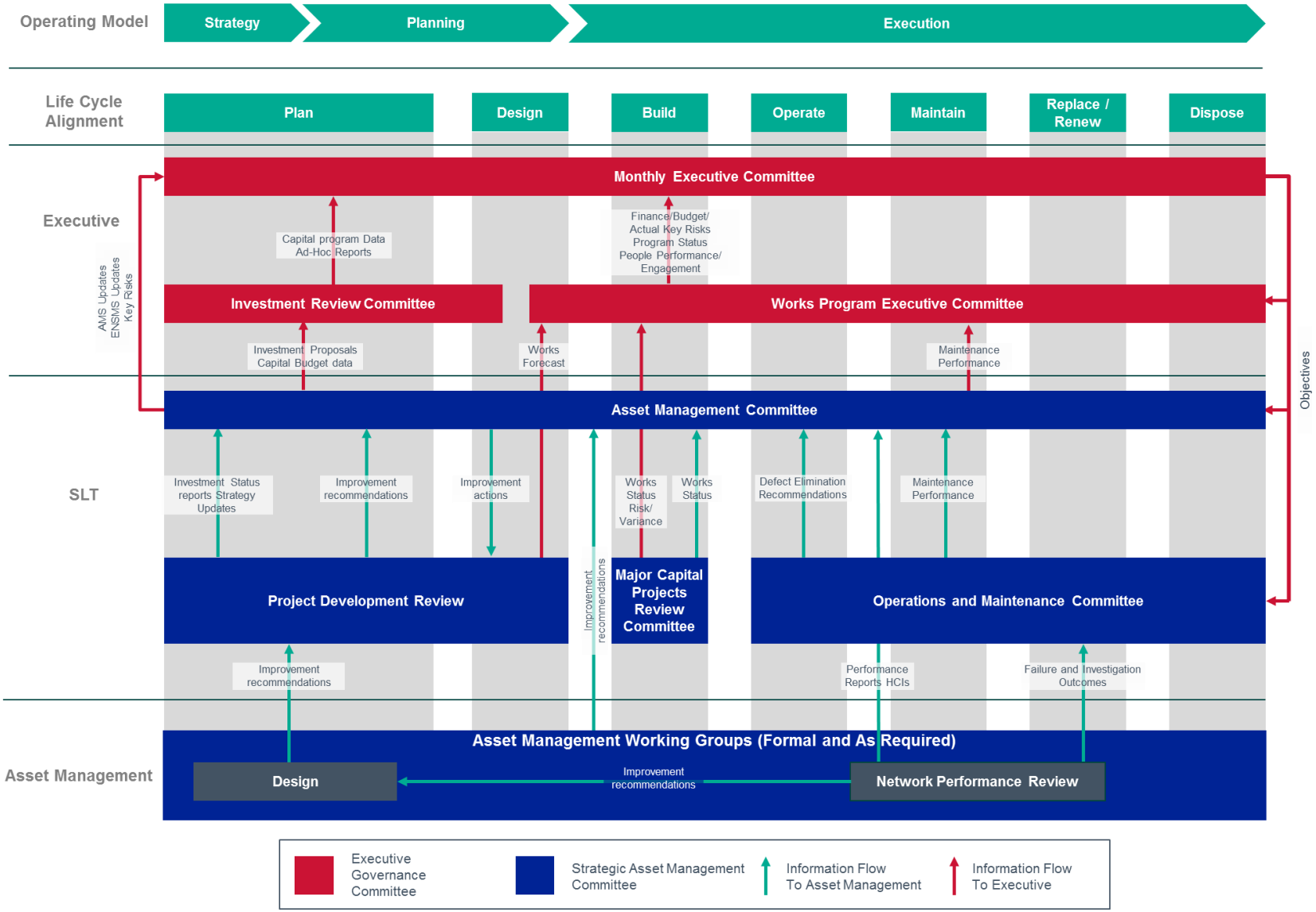
The nominal frequency for asset management committees to consult is shown in Table 31.

Table 14 – Asset Management Committee Frequency

Committee	Forum Type	Nominal Frequency
Monthly Executive Committee	Executive	Monthly

Investment Review Committee	Executive	Monthly
Works Program Executive Committee	Executive	Monthly
Asset Management Committee	Senior Leadership Team	Quarterly
Project Development Review	Senior Leadership Team	Quarterly
Major Capital Projects Review Committee	Senior Leadership Team	Monthly
Operations and Maintenance Committee	Senior Leadership Team	Monthly
Network Performance Review	Asset Management	Monthly

Figure 10 – Asset Management Committee Structure



5.5.3 Performance Measures

TransGrid has in place a range of performance indicators that are utilised for management review of the ENSMS. The indictors leverage data from asset management forum (Network Performance Review forum) and Health and Safety Management forum. 5.5.3 lists the key measures monitored through these forums.

Table 15 – Performance Measures Related to the ENSMS

Measure	Issue types	Performance Indicator
Number of fires started by network assets	> HV equipment explosive failure, asset fire, no vegetation fire. > HV equipment explosive failure, vegetation fire. > Conductor drop/structure failure, vegetation fire. > Conductor sag/low span, vegetation fire. > Grass/vegetation fires resulting from work on assets.	> Zero network related fire starts > Zero network related LTIs
Effectiveness of network maintenance programs in preventing asset failures and fires	> Conductor drop. > Pole and structure failure, leaning or fallen conductor support structure to the point where the live conductors have become a hazard. > Cross arm failure, complete or partial deterioration of the cross arm wood to the point where the live conductors have become a hazard. > HV equipment explosive failure resulting in an asset fire. > Easement management.	> Maintain 5 year average level of Key Hazardous Events (catastrophic failure, conductor drop, uncontrolled discharge/contact with electricity, and unauthorised entry) > Maintain 5 year average level of loss of supply events > Maintain 5 year average level of unplanned outage related Key Hazardous Event > Maintain system reliability (achieve 99.9997%) > Maintain 5 year average level of network related environmental incidents > Maintain 5 year average level of environment related Key Hazardous Events (contaminant or pollutant release) > Maintain average age of asset class population to a sustainable level
Number of major failures resulting in loss of load and/or potential safety risks	> Conductor drop. > Steel structure failure. > Wood or concrete pole failure. > HV equipment explosive failure. > Cable failure	> Maintain 5 year average level of Key Hazardous Events (catastrophic failure, conductor drop, structure failure, uncontrolled discharge/contact with electricity, and unauthorised entry) > Maintain 5 year average level of loss of supply events > Maintain 5 year average level of unplanned outage related Key Hazardous Event > Maintain system reliability (achieve 99.9997%)

Measure	Issue types	Performance Indicator
Extent to which community safety was impacted by persons	> Gaining unauthorised access to transmission structures. > Gaining unauthorised access to the network assets. > Having contact with transmission lines.	> Zero network related LTIs > Zero network related fire starts > Maintain 5 year average level of Key Hazardous Events (catastrophic failure, conductor drop, structure failure, uncontrolled discharge/contact with electricity, and unauthorised entry)
Number and severity of electrical incidents attributable to network assets	> Electric shock – Fatal or serious Injury (Public – excludes vehicle accident). > Electric Shock – fatal or serious injury (TransGrid staff and Contractors). > Electric Shock – No fatality or Non-serious injury	> Zero network related LTIs
Staff and contractor safety	> Number of Lost Time Injuries (LTIs). > Number of Non-Lost Time Injuries. > Lost Time Injury Frequency Rate. > Average Lost Time Injury Rate. > Number of work days lost due to statistical LTI. > Number of work days lost due to non-statistical LTI. > Number of days since last LTI. > Number of High Consequence Incidents (HCIs)	> Zero network related LTIs > Zero network related fire starts > Maintain 5 year average level of Key Hazardous Events (catastrophic failure, conductor drop, structure failure, uncontrolled discharge/contact with electricity, and unauthorised entry) > Maintain average age of asset class population to a sustainable level

5.5.4 Continuous Improvement

TransGrid strives to continually improve its ENSMS, AMS, HSMS and EMS through a series of processes and forums that are illustrated in Figure 11. Continual improvement is fundamentally embedded in the principles, practices, and a procedure in each of TransGrid's supporting management systems. The ideas for continual improvement within TransGrid are identified through internal review of processes and procedures, such as:

> Analysis of asset performance, including defect history, and outages and incidents; this analysis is undertaken in a range of forums, such as via the asset stream working groups, asset manager meetings.
> Conduct of research, such as by the asset managers, service providers.
> Meetings between the asset managers and service providers, such as Working Groups.
> Management reviews of the AMS.
> Results of audits of the AMS.
> Results of Technical Performance Assessments.
> Results of other audits, such as quality, safety, and environmental.

Proactive identification of opportunities is also undertaken by:

> Participating in international benchmarking studies such as ITOMS and ITAMS.
> Participating in international and national electricity industry groups, such as CIGRÉ, Grid Australia, and ESAA.

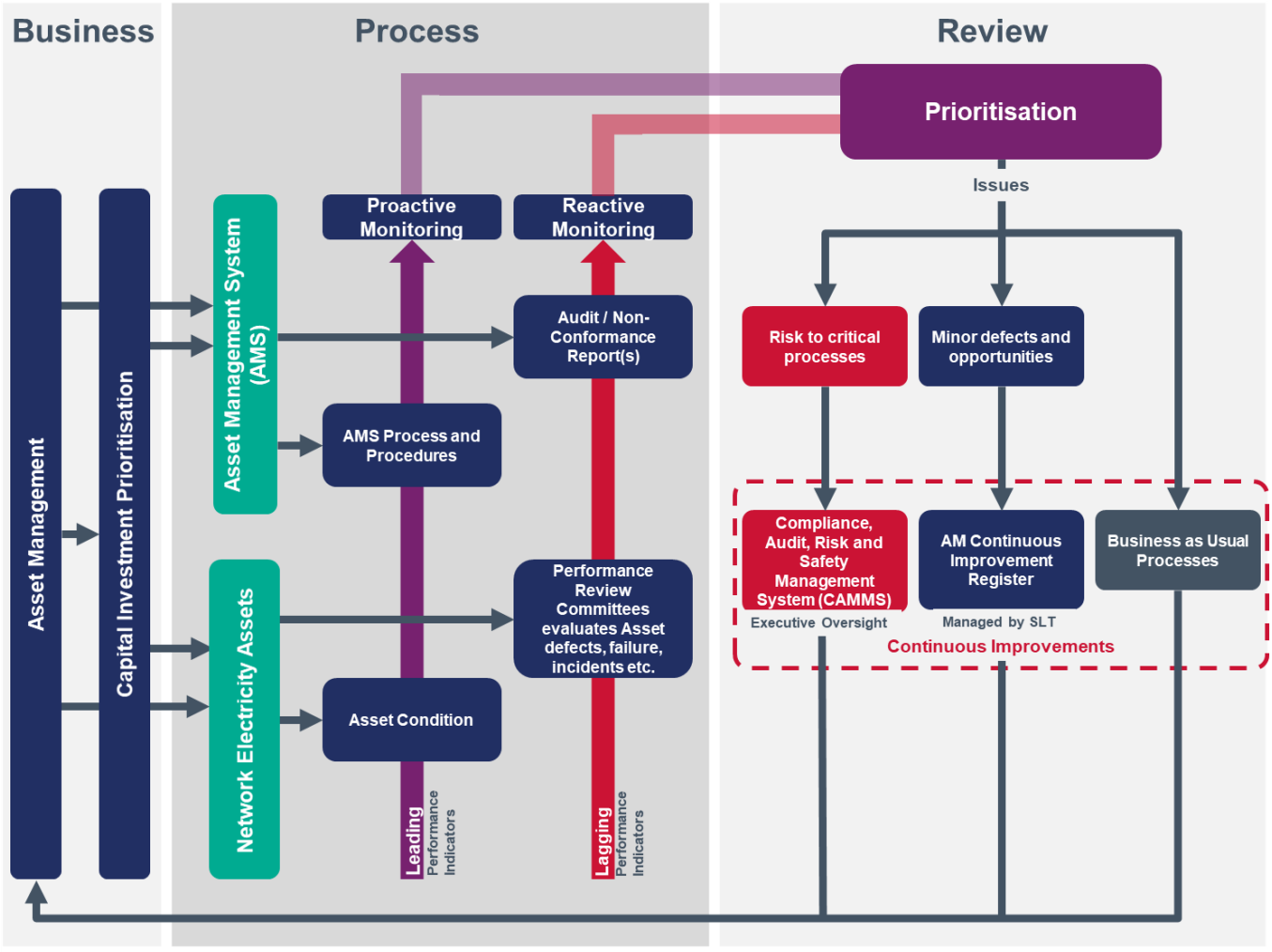
> Participating in professional bodies, such as the Institute of Asset Management, Asset Management Council, and ESAA.

The key components of this framework relevant to this system are:

> Systems Auditing
> Asset Condition
> Correcting Deficiencies (Issues)
> Performance Review and Auditing
> Regulatory reporting

The key concept in this framework is to continually improve TransGrid's ENSMS through a closed loop approach utilising a combination of proactive and reactive monitoring and auditing.

Figure 11 – TransGrid Monitor and Review Processes

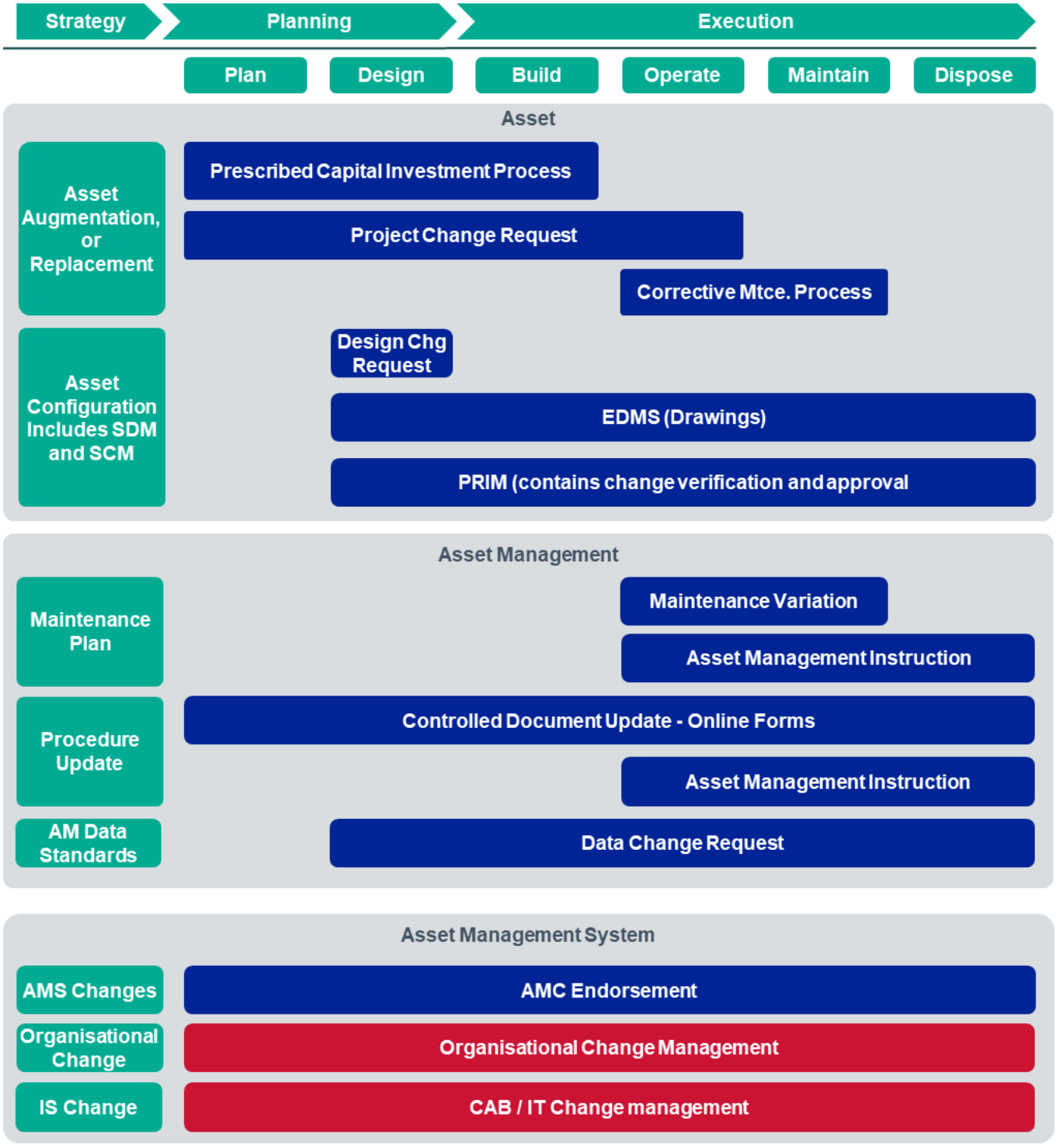


5.5.5 Change Management

5.5.5.1 Change Initiation

TransGrid utilise a variety of change processes to manage risk throughout the life cycle of its assets. Changes to the ENSMS and FSAs are managed the same as those to the AMS in accordance with the 'Asset Management Change Procedure'. This procedure identifies that change occurs in a number of categories and can be initiated from a number of functional activities as show in Figure 12. For clarity changes to the ENSMS will be treated the same as the AMS.

Figure 12 – Management of Change Framework



Formal change management for the ENSMS is undertaken in the event of:

> Upgrade or modification of engineering design
> Newly identified hazard initiates an operational, technical or procedural change in the measure to:
  – Protect the network and associated components
  – Promote public safety awareness of the network
  – Operate and maintain the network safety
  – Implement emergency response arrangements
  – Prevent or minimise loss of supply
  – Carry out required inspections

  - Ensure that the plans and procedural continue to comply with the network's engineering and design standards
- Organisational restructure
- Regulatory changes that have an impact on the way TransGrid manages its assets (e.g. NEM Rule changes, Health and Safety Legislation)
- Coronial findings and Royal Commission recommendations
- Changes to AMS, EMS, HSMS and RMF policies, strategy and plans
- Functional policies, processes, and/or procedures that support the management systems;
- Service providers for the network assets.
- Technology
- Information systems that support the AMS (e.g. Ellipse, SCADA).

These change processes are supported by the 'Health, Safety, Environment and Network Safety Communication and Reporting' document that describes how changes to the HSMS and EMS processes and key documents are managed.

The type of management processes applied are commensurate to the nature of the change involved.

5.5.5.2 Change documentation

Where management of change is required the owner of the change maintains and stores documentation appropriate to the type of change and the level of risk that type of change poses in the relevant information system on the network drive, the Wire or in TRIM.

5.5.5.3 Regulatory Change

TransGrid monitor changes to regulations and standards through:

- Subscription to relevant government and jurisdictional authorities' websites in order to be aware of regulatory changes.
- Monitoring of changes to standards through the standards associations and industry best practice forums listed in Appendix C and Appendix D.

Where a change in regulation occurs that has a material effect on the ENSMS the change is managed as described in this Section.

5.5.5.4 Change risk assessment

TransGrid utilise a variety of process for managing change that are based on the category and type of change that is being undertaken that will require change control from simple document review and approval through to formalised risk assessment under the corporate Risk Management Framework. Table 16 describes the risk management processes that are applied to the types of change management being applied.

Table 16 – Change management documentation and approval

Category	Primary Change Management Artefacts	Risk Assessment
Capital (REPEX, AUGEX, non-network CAPEX)	Project Approval Document (PAD)	A risk assessment is submitted in or referenced from the PAD.
	Safety In Design Procedure	The SID process fulfils a key role as a control identified in the FSA as part of the ENSMS.
	Project Change Request (PCR)	A risk assessment is included or reference from section 4 of the PCR and is required as part of the template.

OPEX, Operate and Maintenance / Asset Management System	Variation requests (Work Orders)	The variation request must describe the change and show that there is no risk in the variation to an existing work order.
	Asset Management owned procedures	The Asset Management Instruction requires that a formal risk assessment is undertaken if appropriate.
	Document change approval process	Risk assessment is implicitly undertaken by the reviewers in assessing the document submitted for approval.
Management System Changes	Committee paper to asset management committee.	The asset management committee has executive involvement who will not endorse the paper unless they are satisfied that risks of the proposal have been addressed

5.5.5.5 Change Communication

Where a change is required to the ENSMS or its key processes that change is communicated to relevant stakeholders. The process for communicating change is included in the 'Asset Management Change Procedure' that includes identifying change management requirements including stakeholder identification, and what communication is required such as email, formal presentation, training, specific instructions, etc.

6. Accountability

Title	Responsibilities
Executive Manager / Network Planning and Operations	Accountable for the ENSMS Responsible for approving all FSAs except Worker Safety FSA
Executive Manager / Works Delivery	Responsible for approving Worker Safety and Property and Environment FSA
Head of Asset Management	Responsible for implementation of the ENSMS
Asset Systems and Compliance Manager	Responsible for coordinating compliance of all three asset management system to AS5577 and IPART Electricity Networks Audit Guideline Responsible for managing the effectiveness of controls in the AMS.
Manager Health, Safety and Environment	Responsible for implementing and monitoring the Worker Safety FSA and Property and Environment FSA Responsible for managing the effectiveness of controls in the HSMS and EMS

7. Implementation

The Head of Asset Management is responsible for the implementation of the ENSMS.

8. Monitoring and review

This document is reviewed annually. Effectiveness is monitored by the Asset Management Committee.

9. Change from previous version

Rev.	Approved by	Date	Amendment
0	Managing Director	31/3/2015	Initial issue
1	EM/ Network Planning and Operations	23/3/2017	Formal Safety Assessments – process for developing and references updated. Organisational titles update for new operating model.
2	EM/ Network Planning and Operations	30/11/2017	Updated to reflect changes in the operating model and general update
3	EM/ Network Planning and Operations		Updated to include updated document references, processes, and OFIs identified in March 2019 IPART Audit

10. References

AS 5577 – Electricity Network Safety Management Systems

AS4801 – Occupational health and safety management systems - Specification with guidance for use

AS/NZS ISO 31000 – Risk Management

ISO 55001 – Asset Management

ISO 14001 – Environmental management systems — Requirements with guidance for use

Business Management System Description

Appendix A Corporate Risk Framework Overview

A.1 Overview

TransGrid's Enterprise Risk Management (ERM) Framework provides for an integrated and structured approach to managing Risks within the risk appetite established by the TransGrid Board.

The ERM Framework provides guidance on expected Board, management and staff behaviours when managing Risks as they arise in our pursuit of strategic and operational objectives.

A.2 Risk Matrix and Tolerance

TransGrid Risk Assessment Matrix

For criteria for consequence and likelihood values refer to the 'Risk Management Framework'

TransGrid Risk Matrix						
		CONSEQUENCES				
		Minimal 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
LIKELIHOOD	Almost Certain 5	Low	Medium	High	**Extreme**	**Extreme**
	Likely 4	Low	Medium	High	High	**Extreme**
	Possible 3	Low	Medium	Medium	High	High
	Unlikely 2	Low	Low	Medium	Medium	High
	Rare 1	Low	Low	Medium	Medium	Medium

TransGrid Risk Tolerance

- TransGrid has a uniform Risk Tolerance set at "Medium", meaning that it is mandatory to identify treatments for any risk that is rated "High" or "Extreme".
- It is expected that for residual risks, where ratings level are assessed as "High" or "Extreme", that the treatments are escalated to the CEO for approval.
- Inherent risks rated "High" or "Extreme" must have their associated treatments approved by the Executive Manager of the Business Unit.

Appendix B Standard Design and Construction Manuals

Table 17 – TransGrid Standard Design manuals (SDMs)

Manual	Document Type
Standard Design Manuals	
Standard Design Manual	Design Standard
Transmission Cable Design and Installation Manual	Design Standard
Transmission Line Construction Manual	Design Standard
Transmission Line Design Manual	Design Standard
Volume 1 - Standard Design Manual - Civil and Structures	Design Standard
Volume 2 - Standard Design Manual - Primary Design	Design Standard
Volume 3 - Standard Design Manual - Condition Monitoring	Design Standard
Volume 4 - Standard Design Manual - Protection and Metering	Design Standard
Volume 5 - Standard Design Manual - Control	Design Standard
Volume 6 - Standard Design Manual - Communications	Design Standard
Volume 7 - Standard Design Manual - Automation	Design Standard
Standard Construction Manuals	
Standard Construction Manual Rev 1.01.pdf	Construction Standard

Each of the FSAs lists the relevant Australian and industry standards, codes and guidelines for identification of best practice.

Appendix C Standards and Codes

Table 18 - Standards and Codes

Standards relevant to management systems	Scope of Standard
Electricity Network Safety Management System	
AS5577	Provides requirements for the development of an Electricity Network Safety Management System (ENSMS) by an Electricity Network Operator
AS3745	Outlines the minimum requirements for the establishment, validation, and implementation of an emergency plan for a facility to provide for the safety of occupants of that facility and its visitors leading up to, and during an evacuation.
Asset Management System	
ISO55001	Specifies the requirements for the establishment, implementation, maintenance, and improvement of a management system for asset management, referred to as an "asset management system".
Health and Safety Management System	
AS 4801-2001	OHS Management Systems Specification with guidance for use
AS/NZS 4804:2001	Provides general guidance on: How to set up an OHSMS How to continually improve on OHSMS The resources required to set up and continually improve an OHSMS
Environmental Management Systems	
AS 14001-2016	Specifies the requirements for an environmental management system that an organisation can use to enhance its environmental performance.
AS 14004-2004	Describes the elements of an environmental management system and provides organisations with guidance on how to establish, implement, maintain, or improve an environmental management system.
Risk Management	
AS/NZS ISO 31000- 2009	Provides principles and generic guidelines on risk management
HB89-2013	Provides general guidance to assist in the selection and application of techniques that can be applied to various risk assessment activities.
Auditing Standards	

Standards relevant to management systems	Scope of Standard
ASEA 3000 (June 2014)	Establishes requirements and provides application and other explanatory material regarding the assurance practitioner's responsibilities for accepting, conducting, and reporting on assurance engagements other than audits or reviews of historical financial information covered by Australian Auditing Standards or Auditing Standards on Review Engagements.
ASEA 3500	Establishes mandatory requirements and to provide explanatory guidance for undertaking and reporting on performance engagements. This ASAE applies to assurance practitioners conducting performance engagements.
ISO19011	Provide guidance on auditing management systems, including the principles of auditing, managing an audit program and conducting management system audits, as well as guidance on the evaluation of competence of individuals involved in the audit process, including the person managing the audit program, auditors and audit team.

Appendix D Industry Good Practice Controls

Sources of minimum industry good practice risk controls to be assessed in the FSA's:

- Eco Logical Australia Bushfire Risk Prioritisation Technical Report (referred to as ELA)
- Industry knowledge gained from discussions with colleagues in other utilities (referred to as Utilities)
- ISSC 3 - Guideline for the management of vegetation in the vicinity of electricity assets (referred to as ISSC 3)
- ISSC 20 - Guideline for the management of activities within electricity easements and close to electricity infrastructure (referred to as ISSC 20)
- ISSC 33 - Guideline for network configuration during high bushfire risk days (referred to as ISSC 33)
- Energy Networks Australia Doc 008-2006 National Guidelines on Electrical Safety for Emergency Services Personnel (referred to as Doc 008-2006)
- Energy Networks Australia Doc 016-2006 Guideline for the management of risks when working alone (referred to as Doc 016-2006)
- Energy Networks Australia Doc 017-2008 ENA industry guideline for the Inspection, Assessment and maintenance of overhead power lines (Doc 017-2008)
- Energy Networks Australia NENS 08-2006 National Guidelines for Aerial Surveillance of overhead electricity networks (referred to as NENS_08-2006)
- Energy Networks Australia NENS Doc 001-2008 National Electricity Network Safety Code (referred to as NENS_001-2008)
- CIGRE Panels
  - Transformers
  - High-Voltage Equipment
  - Insulated Cables
  - Overhead Lines
  - Substations
  - VDC and Power Electronics
  - Protection and Automation
  - System Development and Economics
  - System Operation and Control
  - System Environmental
  - System Technical Performance
  - Electricity Markets and Regulation
  - Distribution Systems and Dispersed Generation
  - Materials and Emerging Test Techniques
  - Information Systems and Telecommunications

ITOMS and ITAMS best practise presentations

Appendix E Internal Stakeholder Management

E.1 Relevant internal Stakeholders

The internal stakeholders that are relevant to development and implementation of the formal safety assessments is shown in Table 19.

Table 19 Relevant internal stakeholders

Business Unit	Business Group	Business Branch	Public Safety	Work Health and Safety	Bushfire	Network Reliability	Property and Enviro.	ESMS Safety Case
Corporate Services	Information Security	Cyber Security				Y		Y
Legal Governance and Risk	Audit	Audit	Y	Y	Y	Y	Y	Y
Legal Governance and Risk	Risk and Compliance	Risk and Compliance	Y	Y	Y	Y	Y	Y
Network Planning & Operations	Asset Management	Asset Analytics and Insights	Y	Y	Y	Y	Y	Y
Network Planning & Operations	Asset Management	Asset Systems and Compliance	Y	Y	Y	Y	Y	Y
Network Planning & Operations	Asset Management	Digital Infrastructure Asset	Y	Y	Y	Y		Y
Network Planning & Operations	Asset Management	Substations Asset	Y	Y	Y	Y		Y
Network Planning & Operations	Asset Management	Trans Lines & Cables Asset	Y	Y	Y	Y		Y
Network Planning & Operations	Asset Management	Technology and Standards	Y	Y	Y	Y	Y	Y
Network Planning & Operations	Executive	Executive Manager	Y		Y	Y		Y
Network Planning & Operations	Network Operations	Asset Monitoring Centre	Y		Y	Y		Y

Business Unit	Business Group	Business Branch	Public Safety	Work Health and Safety	Bushfire	Network Reliability	Property and Enviro.	ESMS Safety Case
Network Planning & Operations	Network Operations	Control Centre	Y		Y	Y		Y
Network Planning & Operations	Network Operations	Operation Technology & Analysis				Y		Y
Network Planning & Operations	Network Operations	Operations Planning				Y		Y
Network Planning & Operations	Network Planning	Main System Planning				Y		Y
Network Planning & Operations	Network Planning	Project Planning	Y	Y	Y	Y	Y	
Works Delivery	Project Development	Primary Design	Y	Y	Y	Y		Y
Works Delivery	Project Development	Secondary Design				Y		Y
Works Delivery	Project Development	Trans Line & Cable Design	Y	Y	Y	Y		
Works Delivery	Construction Programs	Substations & Comms	Y	Y	Y	Y	Y	Y
Works Delivery	Construction Programs	Transmission Lines & Cables	Y	Y	Y	Y		
Works Delivery	Construction Programs	Customer Works	Y	Y	Y	Y		Y
Works Delivery	Executive	Executive Manager		Y			Y	
Works Delivery	Field Resources	Field Resources Various (6 Areas)	Y	Y	Y	Y	Y	Y
Works Delivery	Field Support	Program Planning			Y	Y		Y
Works Delivery	Field Support	Service Delivery			Y	Y		Y
Works Delivery	Field Support	Training	Y	Y	Y	Y		Y
Works Delivery	Health Safety & Environment	Compliance		Y			Y	Y
Works Delivery	Health Safety & Environment	Environment			Y		Y	Y

Business Unit	Business Group	Business Branch	Public Safety	Work Health and Safety	Bushfire	Network Reliability	Property and Enviro.	ESMS Safety Case
Works Delivery	Health Safety & Environment	Power System Safety Rules		Y		Y		Y
Works Delivery	Health Safety & Environment	Safety Services	Y	Y			Y	
Works Delivery	Health Safety & Environment	Systems	Y	Y	Y		Y	Y
Works Delivery	Maintenance Programs	Easements	Y	Y	Y	Y	Y	
Works Delivery	Maintenance Programs	Property and Facilities	Y	Y	Y		Y	Y
Works Delivery	Maintenance Programs	Secondary Systems		Y		Y		Y
Works Delivery	Maintenance Programs	Substations	Y	Y	Y	Y		Y
Works Delivery	Maintenance Programs	Telecomm & Network Services	Y	Y		Y		Y
Works Delivery	Maintenance Programs	Transmission Lines & Cables	Y	Y	Y	Y		

E.2 Stakeholder Engagement During the ENSMS life cycle

The ENSMS has 4 life cycle stages to help focus activities in ensuring the FSAs remains effective. These life cycle stages and engagement level are defined in Table 21.

Table 20 Engagement Levels

Engagement Levels	Definitions
Consult (C)	Engage with stakeholder during Develop and/or Review stages of the FSAs.
Keep Informed (KI)	Make stakeholders aware of controls they are responsible for implementing.
Monitor (M)	These stakeholder provide insight on the effectiveness of controls and the overall assurance of the system.

Table 21 Life cycle stages of the FSA defined

Life cycle stage	Definition	Engagement Level
Develop	Completion of the risk assessment or update of the FSAs based on the feedback from stakeholders in Review stage.	C
Implement	Implementation of the controls identified in the FSAs.	KI
Monitor	Monitoring of the effectiveness of the controls, and auditing of the processes stated in the FSAs.	M
Review	Initiate review of incidents and non-compliance to determine if update to the FSAs is required.	C

The relevant stakeholders per ENSMS life cycle stages is provided in Table 22.

Table 22 Internal stakeholders mapped to ENSMS life cycle stages

Business Group	Business Branch	Develop	Approve	Implement	Monitor	Review
Information Security	Cyber Security	C		KI		
Audit	Audit				M	
Risk and Compliance	Risk and Compliance	C				
Asset Management	Asset Analytics and Insights	C		KI		
Asset Management	Digital Infrastructure Asset	C		KI		
Asset Management	Substations Asset	C		KI		
Asset Management	Transmission Lines & Cables Asset	C		KI		
Asset Management	Technology & Standards	C	C	KI	M	KI
Executive	Network Planning & Operations Executive Manager		C			
Network Operations	Asset Monitoring Centre	C		KI	M	
Network Operations	Control Centre	C		KI		
Network Operations	Operation Technology & Analysis	C		KI		
Network Operations	Operations Planning	C		KI		
Network Planning	Main System Planning	C		KI		

Business Group	Business Branch	Develop	Approve	Implement	Monitor	Review
Project Development	Primary Design	C		KI		
Project Development	Secondary Design	C		KI		
Project Development	Transmission Line & Cable Design	C		KI		
Project Development	Project Planning	C		KI		
Construction Programs	Substations & Comms	C		KI		
Construction Programs	Transmission Lines & Cables	C		KI		
Construction Programs	Customer Works	C		KI		
Executive	Works Delivery Executive Manager		C			
Field Resources	Field Resources (various)	C		KI		
Field Support	Program Planning	C		KI		
Field Support	Service Delivery	C		KI		
Field Support	Training	C		KI		
Health Safety & Environment	Compliance				M	
Health Safety & Environment	Environment	C		KI		
Health Safety & Environment	Power System Safety Rules	C		KI		
Health Safety & Environment	Safety Services	C		KI		
Health Safety & Environment	Systems	C		KI		C
Maintenance Programs	Easements	C		KI		
Maintenance Programs	Property and Facilities	C		KI		
Maintenance Programs	Secondary Systems	C		KI		
Maintenance Programs	Substations	C		KI		
Maintenance Programs	Telecomm & Network Services	C		KI		
Maintenance Programs	Transmission Lines & Cables	C		KI		

Appendix F External Stakeholder Management

F.1 Relevant External Stakeholders

Table 23 identifies the relevant external stakeholders for each FSA based on TransGrid's identification of their interest in the risk management activities associated with TransGrid's network, including those involved in design, construction, commissioning, operation, maintenance and decommissioning of the network. In addition, stakeholders are identified based on a review of the TransGrid Business Plan.

Table 23 Relevant external stakeholders

External Stakeholders	Public Safety FSA	Work Health and Safety FSA	Bushfire FSA	Network Reliability Safety FSA		ESMS Safety Case
Access Canberra	Y					
ACT Ambulance	Y	Y				
ACT Fire & Rescue	Y					
ACT Police Force	Y			Y		
ACT RFS	Y		Y			
ACT SES	Y		Y			
AEMO				Y		Y
CASA	Y					Y
Contractors	Y	Y	Y			Y
Department of Planning, Industry and Environment (NSW)				Y		
Distribution Network Service Providers (DNSPs) - ActewAGL, Evoenergy (ACT), Ausgrid, Endeavour Energy, Essential Energy (NSW), Powercor (VIC)	Y	Y	Y	Y		Y
Electricity Consumers				Y		
Environment, Planning and Sustainable Development Directorate – Environment (ACT, includes Parks and Conservation)			Y	Y		
Forestry Corporation of NSW			Y			
ICRC (ACT)	Y	Y	Y	Y		
IPART	Y	Y	Y	Y		
Landowners (where TransGrid assets are situated)	Y		Y			Y
NSW Ambulance	Y	Y				
NSW Fire & Rescue	Y					
NSW National Parks and Wildlife Service			Y			
NSW Police Force	Y			Y		

External Stakeholders	Public Safety FSA	Work Health and Safety FSA	Bushfire FSA	Network Reliability Safety FSA		ESMS Safety Case
NSW RFS	Y		Y			
NSW SES	Y		Y			
RMS	Y					
Safe Work NSW	Y	Y	Y			
TransGrid Customers (including generators)	Y					
UTR (ACT)	Y	Y	Y	Y		
WorkSafe ACT	Y	Y	Y			

F.2 Stakeholder Engagement During the ENSMS life cycle

Table 8 lists the relevant stakeholders for the ENSMS life cycle stages.

Table 24 External stakeholders mapped to ENSMS life cycle stages

Stakeholders	Development	Implement	Monitor
Access Canberra	Y	Y	
ACT Ambulance	Y	Y	
ACT Fire & Rescue	Y	Y	
ACT Police Force	Y	Y	
ACT Rural Fire Service (RFS)	Y	Y	
ACT SES	Y	Y	
AEMO			Y
AusNet Services (Transmission Network Service Provider)	Y	Y	
Civil Aviation Safety Authority (CASA)		Y	
Contractors	Y	Y	
Department of Environment, Land, Water and Planning		Y	
Department of Planning and Environment			Y
Distribution Network Service Providers- ActewAGL (ACT), Ausgrid, Endeavour Energy, Essential Energy (NSW and ACT), Evoenergy (ACT), Powercor (VIC)	Y	Y	
Electricity Consumers		Y	
Energy and Water Ombudsman			Y
Environment, Planning and Sustainable Development Directorate - Environment (including Parks and Conservation)			Y
Forestry Corporation of NSW	Y	Y	
ICRC			Y
IPART			Y
Landowners (where TransGrid assets are situated)		Y	

NSW Ambulance	Y	Y	
NSW Fire & Rescue	Y	Y	
NSW National Parks and Wildlife Service	Y	Y	
NSW Police Force	Y	Y	
NSW Rural Fire Service (RFS)	Y	Y	
NSW State Emergency Service (SES)	Y	Y	
Roads and Maritime Services (RMS)	Y	Y	
Safe Work NSW			Y
TransGrid Customers (including generators)	Y	Y	
Utilities Technical Regulator (ACT)			Y
WorkSafe ACT			Y

Appendix G Responsibilities and Accountabilities for TransGrid's ENSMS

The authority to approve documents that capture the processes in the ENSMS satisfies the requirements in the Business Management System Description document.

The responsibilities and accountabilities for personnel with respect to TransGrid's electricity network safety management system are set out in.

Table 25 - Responsibilities and accountabilities for ENSMS

ENSMS Requirement	Responsibility and Accountability	Key Document / Procedure
Approve policies.	Chief Executive Officer.	Safety Policy. Asset Management Policy. Environment Policy. Quality Policy. Financial and process authorities procedure.
Approve procedures.	The Board, Chief Executive Officer, Audit and Risk Committee.	Risk Management Framework. Corporate Governance Framework. Risk Appetite Statement
	EM / Network Performance and Operations, M/Asset Management	Electricity Network Safety Management System Description. Asset management system description. Network investment risk assessment process. Project prioritisation process.
	EM/Works Delivery	Health and Safety Management System Framework. Power System Safety Rules. Environmental Management System Framework. Work place safety risk assessments and procedures. Safe work methods. Commissioning procedures. Project delivery manual. Construction risk management. Project risk management.
	EM/Corporate Services	Procurement procedures.
	EM / Network Performance and Operations	Design Standards Safety in design. Corporate and regional emergency management plan. Continuity of transmission supply plan.
Prevent safety issues arising from a loss of supply.	EM / Network Performance and Operations.	Design management. Network planning. Operating manuals. Substation emergency response plans.
	EM/Works Delivery	Site emergency and evacuation plan.

ENSMS Requirement	Responsibility and Accountability	Key Document / Procedure
		Work place instructions and procedures. Safe work methods.
	EM/Corporate Services.	Information technology disaster recovery.
	EM/Works Delivery	Work place instructions and procedures.
Prevent environmental impact	EM / Network Performance and Operations	Bushfire Risk Management Plan.
	EM / Network Performance and Operations	Public Electrical Safety Awareness Plan.
Correct electricity network safety issues.	EM/Works Delivery	Work place instructions and procedures. Safety committees and communication. Safety training.
	EM / Network Performance and Operations.	Operating manuals.
	EM/Legal Governance and Risk	Internal audit reporting guide.
Identify, record and report on any existing or potential deficiencies with the ENSMS.	EM / Network Performance and Operations.	Asset Management System audits.
	EM/Risk and Compliance	Internal audits.
	EM/Works Delivery	Safety audits. Site Conformance Inspections.
	EM / Network Performance and Operations.	Asset Management System audits. Technical performance assessments.
Initiate, recommend, approve, and monitor corrective and preventative actions in relation to existing or potential deficiencies within the ENSMS.	EM/Works Delivery	Incident notification system. Safety audits. Site Conformance Inspections.
	EM/Legal Governance and Risk	Internal audits. Action and Risk Management System.
	EM / Network Performance and Operations.	Asset Management System audits. Technical performance assessments. Asset management system review committee.
Evaluate and verify the effectiveness of any corrective actions.	EM/Works Delivery	Safety audits. Site Conformance Inspections.
	EM/Legal Governance and Risk	Internal audits. Action and Risk Management System.
	EM / Network Performance and Operations.	Asset management system review committee.

Appendix H Asset Register

A full schedule of TransGrid's Assets is available in Ellipse and the TransGrid 'Data Book' available on the Wire.

H.1 Schedule of Substations and Switching Stations

Highest Voltage	Substation Site	Site Code	Voltage Levels	Year Comm.	Regulatory Category
Prescribed Network					
500	Bayswater 500/330kv Substation	BAY	500/330KV	1984	Prescribed Assets
500	Eraring 500/330kv Substation	ER0	500/330KV	1984	Prescribed Assets
500	Kemps Creek 500/330kv Substation	KCR	500/330KV	1984	Prescribed Assets
500	Mount Piper 500/330/132kv Substation	MTP	500/330/132KV	1986	Prescribed Assets
500	Wollar 500/330kv Substation	WOL	500/330KV	2009	Prescribed Assets
330	Armidale 330/132/66kv Substation	AR1	330/132/66KV	1972	Prescribed Assets
330	Avon 330kv Sw Station	AVS	330KV	1974	Prescribed Assets
330	Beaconsfield 330/132kv Substation	BFD	330/132KV	1979	Prescribed Assets
330	Canberra 330/132kv Substation	CA1	330/132KV	1967	Prescribed Assets
330	Coffs Habour 330/132/66kv Substation	COF	330/132/66KV	1979	Prescribed Assets
330	Dapto 330/132kv Substation	DPT	330/132KV	1962	Prescribed Assets
330	Darlingpoint 330/220/132kv Substation	DNT	330/220/132KV	1988	Prescribed Assets
330	Dumaresq 330kv Sw Station	DMQ	330KV	2000	Prescribed Assets
330	Haymarket 330/132kv Substation	HYM	330/132KV	2004	Prescribed Assets
330	Holroyd 330/132kv Substation	HLD	330/132KV	2014	Prescribed Assets
330	Ingleburn 330/66kv Substation	ING	330/66KV	1984	Prescribed Assets
330	Jindera 330/132kv Substation	JDA	330/132KV	1979	Prescribed Assets
330	Kangaroo Valley 330kv Sw Station	KVS	330KV	1976	Prescribed Assets
330	Liddell 330kv Switching Station	LD1	330KV	1970	Prescribed Assets
330	Lismore 330/132kv Substation	LSM	330/132KV	1992	Prescribed Assets
330	Liverpool 330/132kv Substation	LP1	330/132KV	1985	Prescribed Assets
330	Lower Tumut 330kv Sw Station	LT1	330KV	1972	Prescribed Assets
330	Macarthur 330/132/66kv Substation	MAC	330/132/66KV	2009	Prescribed Assets
330	Marulan 330/132kv Substation	MRN	330/132KV	1992	Prescribed Assets

Highest Voltage	Substation Site	Site Code	Voltage Levels	Year Comm.	Regulatory Category
330	Muswellbrook 330/132kv Substation	MRK	330/132KV	1983	Prescribed Assets
330	Munmorah 330/132kv Substation	MN1	330/132KV	1967	Prescribed Assets
330	Murray 330/132kv Substation	MUR	330/132KV	1967	Prescribed Assets
330	Newcastle 330/132kv Substation	NEW	330/132KV	1969	Prescribed Assets
330	Regentville 330/132kv Substation	RGV	330/132KV	1997	Prescribed Assets
330	Rookwood Road 330/132kv Substation	RWR	330/132KV	2014	Prescribed Assets
330	Sydney East 330/132kv Substation	SE1	330/132KV	1976	Prescribed Assets
330	Sydney North 330/132kv Substation	SYN	330/132KV	1963	Prescribed Assets
330	Sydney South 330/132kv Substation	SYS	330/132KV	1961	Prescribed Assets
330	Sydney West 330/132kv Substation	SYW	330/132KV	1965	Prescribed Assets
330	Tamworth 330/132kv Substation	TA1	330/132KV	1968	Prescribed Assets
330	Tomago 330/132kv Substation	TOM	330/132KV	1983	Prescribed Assets
330	Tuggerah 330/132kv Substation	TGH	330/132KV	1986	Prescribed Assets
330	Upper Tumut 330kv Sw Station	UT1	330KV	1959	Prescribed Assets
330	Vales Point 330/132kv Substation	VP1	330/132KV	1962	Prescribed Assets
330	Vineyard 330/132kv Substation	VYD	330/132KV	1994	Prescribed Assets
330	Wagga 330/132kv Substation	WG1	330/132KV	1973	Prescribed Assets
330	Wallerawang 330/132kv Substation	WW1	330/132KV	1975	Prescribed Assets
330	Waratah West 330/132kv Substation	WRH	330/132KV	1992	Prescribed Assets
330	Wellington 330/132kv Substation	WL1	330/132KV	1984	Prescribed Assets
330	Williamsdale 330/132kv Substation	WDL	330/132KV	2012	Prescribed Assets
330	Yass New 330/132kv Substation	YSN	330/132KV	2006	Prescribed Assets
220	Balranald 220/22kv Substation	BRD	220/22KV	2001	Prescribed Assets
220	Broken Hill 220/22kv Substation	BKH	220/22KV	1979	Prescribed Assets
220	Buronga 220kv Sw Station	BRG	220KV	1988	Prescribed Assets
330	Albury 132/22kv Substation	ALB	132/22KV	1958	Prescribed Assets
220	Anm 132kv Substation	ANM	132KV/11KV	1981	Prescribed Assets
220	Beryl 132/66kv Substation	BER	132/66KV	1976	Prescribed Assets
220	Boambee South 132kv Substation	BOS	132KV	2010	Prescribed Assets
220	Burrinjuck 132kv Switchyard	BUK	132KV	1950	Prescribed Assets

Highest Voltage	Substation Site	Site Code	Voltage Levels	Year Comm.	Regulatory Category
220	Coleambally 132kv Switchyard	CLY	132KV	1993	Prescribed Assets
220	Cooma New 132/66/11kv Substation	COA	132/66/11KV	2016	Prescribed Assets
220	Cowra 132/66kv Substation	CW2	132/66KV	1960	Prescribed Assets
132	Deniliquin 132/66kv Substation	DN2	132/66KV	1971	Prescribed Assets
132	Finley 132/66kv Substation	FNY	132/66KV	1991	Prescribed Assets
132	Forbes 132/66kv Substation	FB2	132/66KV	1969	Prescribed Assets
132	Gadara 132/11kv Substation	GAD	132/11KV	2000	Prescribed Assets
132	Glen Innes New 132/66kv Substation	GNS	132/66KV	2007	Prescribed Assets
132	Griffith 132/33kv Substation	GRF	132/33KV	1964	Prescribed Assets
132	Gunnendah 132/66kv Substation	GN2	132/66KV	1985	Prescribed Assets
132	Guthega 132kv Switchyard	GTH	132KV	1970	Prescribed Assets
132	Hume 132kv Switchyard	HU2	132KV	1957	Prescribed Assets
132	Inverell 132/66kv Substation	INV	132/66KV	1984	Prescribed Assets
132	Kempsey 132/66/33kv Substation	KS2	132/66/33KV	1967	Prescribed Assets
132	Koolkhan 132/66kv Substation	KLK	132/66KV	1963	Prescribed Assets
132	Macksville 132kv Switchyard	MVL	132KV	2010	Prescribed Assets
132	Manildra 132kv Switchyard	MNL	132KV	2012	Prescribed Assets
132	Molong 132/66kv Substation	MOL	132/66KV	2001	Prescribed Assets
132	Moree 132/66kv Substation	MRE	132/66KV	1984	Prescribed Assets
132	Mount Piper 132/66kv Substation	MPP	132/66KV	1988	Prescribed Assets
132	Munyang 132/33kv Substation	MNY	132/33KV	1989	Prescribed Assets
132	Murrumburah 132/66kv Substation	MRU	132/66KV	1985	Prescribed Assets
132	Nambucca 132/66kv Substation	NAM	132/66KV	2001	Prescribed Assets
132	Narrabri 132/66kv Substation	NB2	132/66KV	1965	Prescribed Assets
132	Orange North 132kv Sw Station	ONO	132KV	2012	Prescribed Assets
132	Orange 132/66kv Substation	ORG	132/66KV	1954	Prescribed Assets
132	Panorama 132/66kv Substation	PMA	132/66KV	1979	Prescribed Assets
132	Parkes 132/66kv Substation	PKS	132/66KV	1993	Prescribed Assets
132	Port Macquarie 132/33kv Substation	PMQ	132/33KV	1979	Prescribed Assets
132	Queanbeyan New 132/66kv Substation	QBY	132/66KV	2010	Prescribed Assets
132	Raleigh 132kv Substation	RAL	132KV	2009	Prescribed Assets
132	Tamworth New 132/66kv Substation	TMW	132/66KV	2016	Prescribed Assets

Highest Voltage	Substation Site	Site Code	Voltage Levels	Year Comm.	Regulatory Category
132	Taree 132/66/33kv Substation	TRE	132/66/33KV	1958	Prescribed Assets
132	Tenterfield 132/22kv Substation	TTF	132/22KV	1970	Prescribed Assets
132	Tumut 132/66kv Substation	TU2	132/66KV	1967	Prescribed Assets
132	Wagga 132/66kv Substation	WG2	132/66KV	1955	Prescribed Assets
132	Wagga North 132/66kv Substation	WGN	132/66KV	2009	Prescribed Assets
132	Wallerawang New 132/66kv Substation	WWS	132/66KV	2013	Prescribed Assets
132	Yanco 132/33kv Substation	YA2	132/33KV	1969	Prescribed Assets
Non-Prescribed Network					
132	Sunraysia Windfarm Substation	SNR	220/33kV	2019	TransGrid Services
132	Grafton East Substation	GFT	132/11KV	2019	TransGrid Services
132	Deer Park Terminal Station	DPK	220/66KV	2017	Non-Regulated Asset Owned by TG
132	Limondale Solar Substation	LMD	220/33kV	2018	Non-Regulated Asset Owned by TG
132	Silverton Windfarm Substation	SVT	220/33kV	2018	Non-Regulated Asset Owned by TG
132	Bodangora Substation	BOD	132/33KV	2018	Non-Regulated Asset Owned by TG
132	Beryl Solar Farm Substation	BSF	132/66KV	2019	Non-Regulated Asset Owned by TG
330	Crookwell 330/33kv Substation	CKW	330/33kV	2018	Negotiated / Connection Assets
330	Capital Wind Farm 330kv Sw Station	CWF	330KV	2009	Negotiated / Connection Assets
330	Gullen Range 330kv Sw Station	GUR	330KV	2013	Negotiated / Connection Assets
330	Sapphire Wind Farm	SAP	330/33kV	2017	Negotiated / Connection Assets
132	Boggabri East 132kv Switching Station	BGE	132KV	2014	Negotiated / Connection Assets
132	Boggabri North 132kv Swtiching Station	BGN	132KV	2015	Negotiated / Connection Assets
132	Uranquinty 132kv Sw Station	URQ	132KV	2007	Negotiated / Connection Assets
66	White Rock Wind Farm 132/33kv Substation	WRK	132/33KV	2017	Negotiated / Connection Assets

H.2 Schedule of overhead Transmission Lines and Underground Cables

Circuit Number	From (Site 1)	To (Site 2)	Length (Km)	Construction Type	Comm. Year
500 kV					
5A1	Eraring Ps	Kemps Creek 500kv	140.9	Double Circuit Steel Tower	1984
5A2	Eraring Ps	Kemps Creek 500kv	140.9	Double Circuit Steel Tower	1984
5A3	Bayswater Ps	Mt Piper 330kv	227.2	Double Circuit Steel Tower	1986
5A4	Bayswater Ps	Wollar 500kv	114.7	Double Circuit Steel Tower	1986
5A5	Wollar 500kv	Mt Piper 330kv	112.6	Double Circuit Steel Tower	1986
5A6	Mt Piper 330kv	Bannaby 500kv	141.2	Double Circuit Steel Tower	1992
5A7	Mt Piper 330kv	Bannaby 500kv	141.2	Double Circuit Steel Tower	1992
330 kV					
1	Upper Tumut 330kv	Canberra 330kv	100.5	Single Circuit Steel Tower	1959
10	Dapto 330kv	Avon 330kv	11	Single Circuit Steel Tower	1964
11	Dapto 330kv	Sydney South 330kv	68	Single Circuit Steel Tower	1962
12	Liverpool 330kv	Sydney South 330kv	17.5	Double Circuit Steel Pole	1961
13	Kemps Creek 500kv	Sydney South 330kv	24.3	Single Circuit Steel Tower	1963
14	Sydney North 330kv	Kemps Creek 500kv	50.6	Single Circuit Steel Tower	1963
16	Marulan 330kv	Avon 330kv	70.5	Single Circuit Steel Tower	1967
17	Macarthur 330kv	Avon 330kv	41.1	Single Circuit Steel Tower	1964
18	Dapto 330kv	Kangaroo Valley 330kv	43	Single Circuit Steel Tower	1964
1C	Sydney West 330kv	Holroyd 330kv	9.9	Double Circuit Steel Tower	2013
1F	Sydney West 330kv	Holroyd 330kv	9.9	Double Circuit Steel Tower	2013
2	Upper Tumut 330kv	Yass 330kv	146.9	Single Circuit Steel Tower	1962
20	Sydney West 330kv	Sydney North 330kv	33.3	Single Circuit Steel Tower	1964
21	Tuggerah 330kv	Sydney North 330kv	64.7	Single Circuit Steel Tower	1965
22	Vales Point Ps	Sydney North 330kv	86.1	Single Circuit Steel Tower	1963
23	Munmorah Ps	Vales Point Ps	6.7	Single Circuit Steel Tower	1965
24	Vales Point Ps	Eraring Ps	30.7	Single Circuit Steel Tower	1984
25	Eraring Ps	Vineyard 330kv	109	Double Circuit Steel Tower	1981
26	Munmorah Ps	Sydney West 330kv	123.5	Double Circuit Steel Tower	1962
27	Sydney North 330kv	Sydney East 330kv	21.8	Single Circuit Steel Tower	1975
28	Sydney North 330kv	Sydney East 330kv	22.7	Single Circuit Steel Tower	1997
29	Vineyard 330kv	Sydney West 330kv	20.8	Double Circuit Steel Tower	1963
2M	Munmorah Ps	Tuggerah 330kv	39.5	Single Circuit Steel Tower	1964
3	Lower Tumut 330kv	Yass 330kv	128.7	Single Circuit Steel Tower	1966
30	Sydney West 330kv	Liverpool 330kv	16.8	Single Circuit Steel Tower	1961
31	Bayswater Ps	Regentville 330kv	171.2	Double Circuit Steel Tower	1971

Circuit Number	From (Site 1)	To (Site 2)	Length (Km)	Construction Type	Comm. Year
32	Bayswater Ps	Sydney West 330kv	188.2	Double Circuit Steel Tower	1971
33	Liddell Ps	Bayswater Ps	6	Double Circuit Steel Tower	1971
34	Liddell Ps	Bayswater Ps	6	Double Circuit Steel Tower	1971
35	Bannaby 330kv	Marulan 330kv	20	Double Circuit Steel Tower	1992
36	Bannaby 330kv	Marulan 330kv	19.9	Double Circuit Steel Tower	1992
37	Kemps Creek 500kv	Macarthur 330kv	21.8	Single Circuit Steel Tower	1964
38	Regentville 330kv	Sydney West 330kv	17	Double Circuit Steel Tower	1969
39	Bannaby 330kv	Sydney West 330kv	114.1	Single Circuit Steel Tower / UG Cable	1967
3C	Canberra 330kv	Williamsdale 330kv	48.1	Single Circuit Steel Tower	2013
3H	Gullen Range 330kv	Crookwell 2 330kv	15.5	Single Circuit Steel Tower	1969
3J	Yass 330kv	Gullen Range 330kv	65.6	Single Circuit Steel Tower	1969
3W	Capital Wind Farm 330kv	Kangaroo Valley 330kv	129	Single Circuit Steel Tower	1976
4	Yass 330kv	Marulan 330kv	114	Single Circuit Steel Tower	1959
41	Sydney South	Beaconsfield West	19.7	Underground Cable	1979
42	Sydney South	Haymarket	27.5	Underground Cable	2004
43	Holroyd	Rookwood Road	15.4	Underground Cable	2014
44	Holroyd	Rookwood Road	15.4	Underground Cable	2014
5	Yass 330kv	Marulan 330kv	118.2	Single Circuit Steel Tower	1962
51	Lower Tumut 330kv	Wagga 330kv	100.5	Single Circuit Steel Tower	1973
6	Canberra 330kv	Capital Wind Farm 330kv	60	Single Circuit Steel Tower	1976
60	Jindera 330kv	Dedarang	22.3	Single Circuit Steel Tower	1980
61	Crookwell 2 330kv	Bannaby 330kv	43.8	Single Circuit Steel Tower	1969
62	Wagga 330kv	Jindera 330kv	99.5	Single Circuit Steel Tower	1980
63	Wagga 330kv	Darlington Point 330kv	151.7	Single Circuit Steel Tower	1988
64	Lower Tumut 330kv	Upper Tumut 330kv	40.6	Single Circuit Steel Tower	1957
65	Upper Tumut 330kv	Murray 330kv	45.8	Single Circuit Steel Tower	1957
66	Lower Tumut 330kv	Murray 330kv	73	Single Circuit Steel Tower	1957
7	Lower Tumut 330kv	Canberra 330kv	98.7	Single Circuit Steel Tower	1974
70	Mt Piper 330kv	Wallerawang 330kv	8	Double Circuit Steel Tower	1984
71	Mt Piper 330kv	Wallerawang 330kv	8	Double Circuit Steel Tower	1984
72	Mt Piper 330kv	Wellington 330kv	169.7	Single Circuit Steel Tower	1984
76	Wallerawang 330kv	Sydney South 330kv	143.2	Double Circuit Steel Tower	1977
77	Wallerawang 330kv	Ingleburn 330kv	122	Double Circuit Steel Tower	1977
78	Sydney South 330kv	Ingleburn 330kv	21.3	Double Circuit Steel Tower	1980
79	Wollar 500kv	Wellington 330kv	117.1	Single Circuit Steel Tower	2010

Circuit Number	From (Site 1)	To (Site 2)	Length (Km)	Construction Type	Comm. Year
8	Marulan 330kv	Dapto 330kv	70.4	Single Circuit Steel Tower	1962
81	Liddell Ps	Newcastle 330kv	102.9	Single Circuit Steel Tower	1960
82	Liddell Ps	Tomago Switching Stn	118.2	Single Circuit Steel Tower	1983
83	Liddell Ps	Muswellbrook 330kv	18.3	Single Circuit Steel Tower	1969
84	Liddell Ps	Tamworth 330kv	139.4	Single Circuit Steel Tower	1971
85	Tamworth 330kv	Armidale 330kv	103.6	Single Circuit Steel Tower	1963
86	Tamworth 330kv	Armidale 330kv	111	Single Circuit Wood Pole	1982
87	Armidale 330kv	Coffs Harbour 132kv	136.2	Single Circuit Steel Tower	1983
88	Muswellbrook 330kv	Tamworth 330kv	127.4	Single Circuit Steel Tower	1984
89	Coffs Harbour 132kv	Lismore 330kv	171.2	Single Circuit Steel Tower	1991
8C	Dumaresq 330kv	Armidale 330kv	172.4	Double Circuit Steel Tower	2000
8E	Sapphire 330kv	Armidale 330kv	113.5	Double Circuit Steel Tower	2000
8J	Dumaresq 330kv	Sapphire 330kv	59	Double Circuit Steel Tower	2000
8L	Bulli Creek	Dumaresq 330kv	48.8	Double Circuit Steel Tower	2000
8M	Bulli Creek	Dumaresq 330kv	48.8	Double Circuit Steel Tower	2000
9	Canberra 330kv	Yass 330kv	45	Single Circuit Steel Tower	1959
90	Eraring Ps	Newcastle 330kv	21.2	Double Circuit Steel Tower	1964
92	Newcastle 330kv	Vales Point Ps	34.8	Double Circuit Steel Tower	1984
93	Newcastle 330kv	Eraring Ps	19.5	Double Circuit Steel Tower	1984
94	Newcastle 330kv	Tomago Switching Stn	24.3	Double Circuit Steel Tower	1983
95	Newcastle 330kv	Tomago Switching Stn	25.4	Double Circuit Steel Tower	1986
96	Newcastle 330kv	Waratah West 330kv	18.4	Double Circuit Steel Tower	1983
9W	Tomago Switching Stn	Waratah West 330kv	8.9	Single Circuit Steel Tower	1996
BYPASS	Feeder 9	Feeder 3c	0.3	Single Circuit Wood Pole	2003
L1	Tumut 3	Lower Tumut 330kv	0.7	Single Circuit Steel Tower	1971
L3	Tumut 3	Lower Tumut 330kv	0.7	Single Circuit Steel Tower	1971
L5	Tumut 3	Lower Tumut 330kv	0.5	Single Circuit Steel Tower	1971
M1	Murray 1	Murray 330kv	4.7	Single Circuit Steel Tower	1966
M11	Murray 2	Murray 330kv	2.3	Single Circuit Steel Tower	1969
M13	Murray 2	Murray 330kv	2	Single Circuit Steel Tower	1969
M3	Murray 1	Murray 330kv	4.7	Single Circuit Steel Tower	1966
M5	Murray 1	Murray 330kv	4.9	Single Circuit Steel Tower	1966
M7	Murray 1	Murray 330kv	4.9	Single Circuit Steel Tower	1966
M9	Murray 1	Murray 330kv	4.9	Single Circuit Steel Tower	1966
NO 1 TX	Bannaby 500kv	Bannaby 330kv	0.5	Single Circuit Steel Tower	2009
NO 2 TX	Bannaby 500kv	Bannaby 330kv	0.5	Single Circuit Steel Tower	2009

Circuit Number	From (Site 1)	To (Site 2)	Length (Km)	Construction Type	Comm. Year
U1	Tumut 1	Upper Tumut 330kv	5.2	Single Circuit Steel Tower	1957
U3	Tumut 1	Upper Tumut 330kv	5	Single Circuit Steel Tower	1957
U5	Tumut 2	Upper Tumut 330kv	3.8	Single Circuit Steel Tower	1959
U7	Tumut 2	Upper Tumut 330kv	4	Single Circuit Steel Tower	1959
220 kV					
0X1	Redcliffs	Buronga 220kv	23.9	Single Circuit Steel Tower	1979
X2	Buronga 220kv	Broken Hill 220kv	259.5	Single Circuit Steel Tower	1979
X5/1	Darlington Point 330kv	Balranald 220kv	249.7	Single Circuit Steel Tower	1988
X5/3	Balranald 220kv	Buronga 220kv	148.2	Single Circuit Steel Tower	1988
X6	Broken Hill 220kv	Silverton	25.9	Single Circuit Steel Pole	2018
X7	Balranald 220kv	Sunraysia	2.3	Single Circuit Concrete Pole	2019
X8	Balranald 220kv	Limondale Sf	1.1	Underground Cable	2019
132 kV					
097B	Blowering Dam	Tumut 132kv	13.4	Single Circuit Wood Pole	1969
250SP	Sydney North 330kv	Tower 1	0.1	Single Circuit Steel Tower	1964
92Z	Sydney North 330kv	Sydney East 330kv	23.8	Double Circuit Steel Tower	1965
944	Wallerawang 132kv	Orange North 132kv	98	Single Circuit Wood Pole	1957
945	Molong 132kv	Wellington 330kv	65	Single Circuit Concrete Pole	1959
947	Wellington 330kv	Orange North 132kv	89.4	Single Circuit Wood Pole	1968
948	Panorama 132kv	Orange North 132kv	43.8	Single Circuit Wood Pole	1963
949	Mt Piper 132kv	Orange North 132kv	94	Single Circuit Wood Pole	1968
949/1	Mt Piper 132kv	Mt Piper	1.9	Single Circuit Wood Pole	1984
94B	Wellington 330kv	Beryl 132kv	52.3	Single Circuit Concrete Pole	1979
94E	Wallerawang 132kv	Mt Piper 132kv	9	Single Circuit Wood Pole	1976
94G	Orange North 132kv	Orange 132kv	0.7	Single Circuit Concrete Pole	2013
94H	Parkes 132kv	Manildra 132kv	81.7	Single Circuit Concrete Pole	2011
94K	Wellington 330kv	Parkes 132kv	115.6	Single Circuit Wood Pole	1986
94M	Mt Piper 132kv	Beryl 132kv	129	Single Circuit Wood Pole	1976
94P	Molong 132kv	Manildra 132kv	26.7	Single Circuit Concrete Pole	2002
94T	Molong 132kv	Orange North 132kv	29.3	Single Circuit Concrete Pole	2010
94U	Parkes 132kv	Forbes 132kv	30.4	Single Circuit Wood Pole	1986
94X	Wallerawang 132kv	Panorama 132kv	57	Single Circuit Wood Pole	1963
94Y	Mt Piper 132kv	Mt Piper 330kv	1.8	Single Circuit Wood Pole	1986
959	Sydney North 330kv	Sydney East 330kv	23.8	Double Circuit Steel Tower	1965
963	Tomago Switching Stn	Taree 132kv	108.7	Single Circuit Wood Pole	1992
964	Taree 132kv	Port Macquarie 132kv	66.1	Single Circuit Wood Pole	1978

Circuit Number	From (Site 1)	To (Site 2)	Length (Km)	Construction Type	Comm. Year
965	Armidale 330kv	Kempsey 132kv	143	Single Circuit Wood Pole	1966
966	Armidale 330kv	Koolkhan 132kv	177	Single Circuit Wood Pole	1963
967	Koolkhan 132kv	Lismore 330kv	90	Single Circuit Concrete Pole	1962
968	Tamworth 330kv	Narrabri 132kv	174.2	Single Circuit Wood Pole	1976
969	Tamworth 330kv	Gunnedah 132kv	65.1	Single Circuit Wood Pole	1964
96C	Armidale 330kv	Coffs Harbour 132kv	140	Single Circuit Wood Pole	1979
96F	Tomago 132kv	Stroud	61.8	Single Circuit Concrete Pole	2013
96G	Kempsey 132kv	Port Macquarie 132kv	43	Double Circuit Concrete Pole	2012
96H	Coffs Harbour 132kv	Koolkhan 132kv	80.5	Single Circuit Wood Pole	1970
96K	Armidale 330kv	Str 87-14	4	Single Circuit Wood Pole	1984
96L	Tenterfield 132kv	Lismore 330kv	124.1	Single Circuit Wood Pole	1972
96M	Narrabri 132kv	Moree 132kv	107	Single Circuit Concrete Pole	1972
96N	Armidale 330kv	Inverell 132kv	111.2	Single Circuit Wood Pole	1984
96P	Taree 132kv	Stroud	86	Single Circuit Wood Pole	1974
96R	Glen Innes 132kv	Tenterfield 132kv	80.2	Single Circuit Wood Pole	1970
96T	Armidale 330kv	Glen Innes 132kv	96.1	Single Circuit Wood Pole	1970
96X	Waratah West 330kv	Bhp	1.7	Double Circuit Steel Tower	1966
96Y	Waratah West 330kv	Bhp	1.7	Double Circuit Steel Tower	1966
970	Yass 330kv	Burrinjuck	37.3	Single Circuit Concrete Pole	1940
973	Yass 330kv	Cowra 132kv	119.6	Single Circuit Wood Pole	1968
976/1	Canberra 330kv	Queanbeyan 132kv	51.3	Single Circuit Wood Pole	1963
976/2	Yass 330kv	Spring Flat	38	Single Circuit Wood Pole	1963
977/1	Canberra 330kv	Queanbeyan 132kv	53.8	Single Circuit Wood Pole	1967
978	Williamsdale 330kv	Cooma 132kv	74	Single Circuit Wood Pole	1987
979	Munyang 132kv	Guthega 132kv	0.5	Single Circuit Wood Pole	1991
97A	Tamworth 330kv	Tamworth 132kv	3	Single Circuit Wood Pole	1976
97B	Tamworth 330kv	Tamworth 132kv	3.3	Double Circuit Concrete Pole	1967
97C	Tamworth 330kv	Tamworth 132kv	3.8	Single Circuit Wood Pole	1976
97D	Williamsdale 330kv	Cooma 132kv	80	Single Circuit Wood Pole	1985
97G/1	Murray 330kv	Geehi 132kv	17.5	Single Circuit Wood Pole	1960
97G/2	Geehi Dam	Geehi 132kv	0.3	Single Circuit Wood Pole	1960
97G/3	Geehi 132kv	Guthega 132kv	19.8	Single Circuit Wood Pole	1960
97K	Munyang 132kv	Cooma 132kv	76.6	Double Circuit Steel Tower	1953
97L	Guthega 132kv	Jindabyne Pump	20.3	Single Circuit Wood Pole	1957
990	Wagga 132kv	Yass 330kv	150.4	Single Circuit Concrete Pole	2009
991	Murrumburrah 132kv	Wagga North 132kv	115	Single Circuit Wood Pole	1968

Circuit Number	From (Site 1)	To (Site 2)	Length (Km)	Construction Type	Comm. Year
992	Burrinjuck	Tumut 132kv	52.8	Single Circuit Wood Pole	1963
993	Gadara 132kv	Wagga 330kv	79.4	Single Circuit Wood Pole	1963
994	Wagga 330kv	Yanco 132kv	127.9	Single Circuit Concrete Pole	1969
995	Hume 132kv	Albury 132kv	12.4	Single Circuit Wood Pole	1957
996	Wagga 330kv	Anm 132kv	106	Single Circuit Concrete Pole	1957
998	Cowra 132kv	Forbes 132kv	88.6	Single Circuit Concrete Pole	1959
999	Yass 330kv	Cowra 132kv	114.7	Single Circuit Steel Tower	1959
99A	Uranquinty 132kv	Finley 132kv	169.2	Single Circuit Wood Pole	1971
99B	Jindera 330kv	Albury 132kv	17	Single Circuit Wood Pole	1979
99D	Yanco 132kv	Darlington Point 330kv	37.5	Single Circuit Wood Pole	1983
99F	Uranquinty 132kv	Yanco 132kv	109	Single Circuit Steel Pole	1971
99H	Jindera 330kv	Anm 132kv	11.5	Single Circuit Wood Pole	1980
99J	Yanco 132kv	Griffith 132kv	45.5	Single Circuit Wood Pole	1969
99K	Darlington Point 330kv	Griffith 132kv	59.5	Single Circuit Concrete Pole	1985
99L	Coleambally 132kv	Deniliquin 132kv	152.9	Single Circuit Concrete Pole	1990
99M	Yass 330kv	Murrumburrah 132kv	72.1	Single Circuit Wood Pole	1984
99P	Tumut 132kv	Gadara 132kv	8.2	Single Circuit Wood & Concrete Pole	1963 / 2019
99T	Darlington Point 330kv	Coleambally 132kv	13.4	Single Circuit Concrete Pole	1990
99W	Wagga 330kv	Wagga 132kv	9.9	Double Circuit Steel Tower / Single Circuit Concrete Pole	1970 / 2009
99X	Wagga 330kv	Wagga 132kv	10.2	Double Circuit Steel Tower	1973
99Z	Anm 132kv	Albury 132kv	9.9	Single Circuit Wood Pole	1980
9C5	Tomago 132kv	Brandy Hill 132kv	18.2	Double Circuit Concrete Pole	2014
9C6	Tomago	Brandy Hill 132kv	13.9	Double Circuit Concrete Pole	2014
9C8	Brandy Hill 132kv	Stroud	48.5	Double Circuit Concrete Pole	2014
9GP	Wellington 330kv	Str 4	0.7	(blank)	
9R1	Wagga 330kv	Uranquinty 132kv	16.7	Single Circuit Concrete/Steel Pole	2008
9R2	Wagga 330kv	Uranquinty 132kv	16.5	Single Circuit Concrete/Steel Pole	2008
9R3	Finley 132kv	Deniliquin 132kv	45.3	Single Circuit Wood Pole	1971
9R5	Wagga 330kv	Wagga North 132kv	14.7	Double Circuit Steel Tower	2009
9R6	Wagga 132kv	Wagga North 132kv	10.4	Double Circuit Steel Tower	2009
9S4	Haymarket	Beaconsfield South	3.6	Underground Cable	2012
9U2	Inverell 132kv	Moree 132kv	143.2	Single Circuit Concrete Pole	1998
9U3	Gunnedah 132kv	Boggabri East Swt Station	66.9	Single Circuit Wood Pole	1964
9U4	White Rock 132kv	Inverell 132kv	45.8	Single Circuit Concrete Pole	2012

Circuit Number	From (Site 1)	To (Site 2)	Length (Km)	Construction Type	Comm. Year
9U5	Tamworth 132kv	Gunnedah 132kv	14.7	Double Circuit Concrete Pole	2010
9UG	White Rock 132kv	Glen Innes 132kv	38	Double Circuit Concrete Pole	2017
9UH	Boggabri North Swt Stn	Narrabri 132kv	52.1	Single Circuit Wood Pole	1964
9UJ	Boggabri East Swt Station	Boggabri North Swt Stn	12.7	Double Circuit Concrete Pole	2014
9W0	Grafton East 132kv	Koolkhan 132kv	23.7	Double Circuit Concrete Pole	2019
9W2	Kempsey 132kv	Raleigh 132kv	84.5	Double Circuit Concrete Pole	2011
9W3	Raleigh 132kv	Coffs Harbour 132kv	25.5	Double Circuit Concrete Pole	2010
9W5	Kempsey 132kv	Macksville 132kv	52.5	Double Circuit Concrete Pole	2010
9W6	Macksville 132kv	Nambucca 132kv	13.4	Double Circuit Concrete Pole	2010
9W7	Boambee South 132kv	Nambucca 132kv	36.3	Double Circuit Concrete Pole	2011
9W8	Coffs Harbour 132kv	Boambee South 132kv	13.4	Double Circuit Concrete Pole	2010
9W9	Kempsey 132kv	Port Macquarie 132kv	43.3	Double Circuit Concrete Pole	2012
NO 6 TX	Tomago 330kv	Tomago 132kv	0.5	Single Circuit Concrete Pole	2015
NO 7 TX	Tomago 330kv	Tomago 132kv	0.4	Single Circuit Concrete Pole	2015
NO 8 TX	Tomago 330kv	Tomago 132kv	0.4	Single Circuit Concrete Pole	2015
T1	Orange North 132kv	Orange 132kv	0.5	Single Circuit Concrete Pole	2013
T2	Orange North 132kv	Orange 132kv	0.7	Single Circuit Concrete Pole	2013
T3	Orange North 132kv	Orange 132kv	0.7	Single Circuit Concrete Pole	2013
66 kV					
86P	BERYL 132kv	BERYL SOLAR FARM	0.5	Underground Cable	2019
886	Glen Innes 132kv	Glen Innes 132kv	10.4	Double Circuit Concrete Pole	2012
89P	Parkes 132kv	Goonumbla Sf	0.25	Underground Cable	(blank)
8C1	Molong 132kv	Molong Tee	11.2	Double Circuit Concrete Pole	2002
33 kV					
9C9/2	Dungog	Martins Creek	23.8	(blank)	2014
9C9/3	Dungog	Stroud	15	(blank)	2014
22 kV					
No.4	Balranald 220kv	Limondale 2 Sf	2.329	Underground Cable	2019
11kV					
No1 Talbingo Town Supply	Lower Tumut 330kv	Talbingo (Ese)	0.2	Underground Cable	1971