# PWC Asset Class Management Plan

# Communications

January 2023

PowerWater

# Version control

This document has been approved in accordance with the Delegation of Authority (DoA) as evidenced by signatures and dates contained herein.

| Rev | Date | Description | Author | Endorsed | Approved |
|---|---|---|---|---|---|
| **1** | 17/01/2023 | Revised and moved to new template | M Van Doornik<br>Asset Engineer | B Kaye<br>Manager Asset Strategy and Risk | S Eassie<br>Senior Manager Asset Management |

# Contents

# 1. Introduction

ISO 55000 defines an Asset Management Plan (AMP) as documented information that specifies the activities, resources and timescales required for an individual asset, or a grouping of assets, to achieve the organisation’s asset management objectives.

## 1.1 Purpose and context

The purpose of this Asset Management Plan (AMP) is aligned to the requirements specified in ISO 55000. This AMP:

- Defines what is included and exclude from its scope
- Describes the asset class being managed
- Defines how this asset class will contribute to achieving the Asset Management Objectives that are defined in the Strategic Asset Management Plan (SAMP)
- Identifies the challenges we are expecting to encounter over the AMP planning horizon
- Sets out the projects and programs that we will invest in to ensure we achieve the AM Objectives and address the identified challenges
- Quantifies the risk posed by this asset class with and without the proposed projects and programs of work

By reviewing this AMP and reassessing asset performance on an annual basis, we will ensure that any emerging issues are identified and can be addressed prior to becoming a significant risk. The outcome of the annual review will support the annual update of the Statement of Corporate Intent (SCI) and provide an input into the annual Transmission and Distribution Annual Planning Report (TDAPR).

## 1.2 Scope of the AMP

This AMP covers the Communications assets used to support the control and monitoring of the power network.

The AMP excludes:

- Non-regulated or Indigenous Essential Services (IES) assets that are managed by Power and Water

This AMP will avoid, as far as practicable, repeating information that is contained in other documentation. Instead, it will provide a reference to the relevant document or data source.

## 1.3 Timeframe of the AMP

This AMP is focused on a 10-year planning horizon, with respect to expenditure forecasts, that aligns with the requirements of the SCI and TDAPR. However, when assessing future challenges and emerging trends we may consider longer timeframes and will comment by exception if any longer term issues are expected to arise.

## 1.4 Asset management framework

Power and Water has a Strategic Asset Management System[1] which sets out the framework for asset management and the hierarchy of documents. This provides line of sight from the corporate objectives through to the asset objectives and how management of this asset class will contribute to achieving those objectives. Figure 1 highlights how the AMP fits in with the overall asset management system.

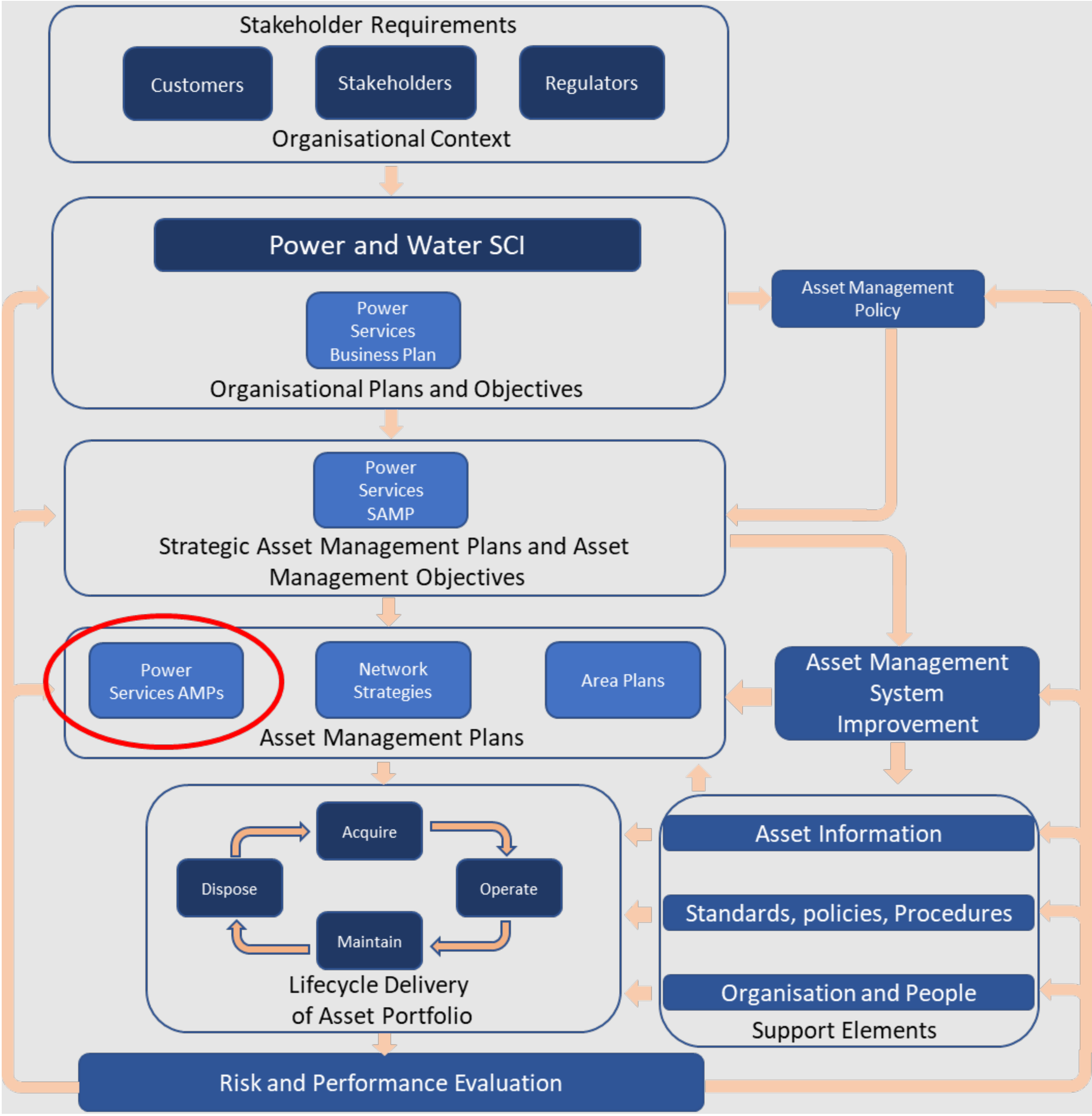


*Figure 1*: The AMP within the context of the Asset Management System

[1] CONTROL0548

## 1.5 Document structure

This document has been structured to align with the Power and Water Asset Management Standard and fits under the SAMP in the hierarchy of documentation. The document has been designed to be concise and provide the outcomes of detailed analysis with references, and not repeat the analysis in this document.

The purpose of each section is described below:

- **Asset profile** provides an overview of what the asset is to provide context to the reader of the asset's role in the electricity transmission and distribution network. It provides a breakdown by asset characteristics and volumes as well as the age profile which is an important input to asset management.
- **Asset objectives and performance** sets out the asset objectives and how they apply to this asset class. Any gaps or emerging trends are identified and linked to a project or program, if relevant, to address the issue and ensure the asset objectives are achieved.
- **Asset challenges and emerging issues** outlines any existing or emerging challenges that may impact the performance of the asset class or may otherwise impact the management of, or need for, the asset class.
- **Implementation plan** sets out the project and programs with expenditure per year for the 10-year planning horizon. This is a point in time assessment that is updated periodically so it may not align fully to the SCI and TDAPR if additional analysis has been completed subsequent to the AMP update.
- **Risk quantification and mitigation** describes the approach to risk-based investment decision-making and demonstrates the risk mitigated by the proposed implementation plan.
- **Asset lifecycle management** describes the asset management approach at each stage in the asset lifecycle.
- **Continuous Improvement** outlines the improvement plans related to the asset class.

# 2. Asset Profile

Communication assets transmit data between field devices (e.g. for protection signalling), and from field devices to the SCADA system utilised by System Control, which allows Power and Water to efficiently and safely operate the network. It also provides the backbone for two-way radio voice communications for our field crews.

## 2.1 Fleet characteristics

The communications network is comprised of several different base layer subsystems, such as microwave, fibre optic and UHF/VHF radio. These subsystems require a wide variety of assets for them to function correctly and with appropriate levels of service. Table 1 summarises the communications assets into key groups and shows the quantity of each of those asset groups.

| Asset category | Asset description | Quantity |
|---|---|---|
| Communications network assets | 3G/4G Modems | 45 |
| | DWDM Systems | 2 |
| | Firewalls | 14 |
| | Microwave Terminals | 64 |
| | MPLS Routers | 29 |
| | PDH Multiplexors | 151 |
| | SDH Multiplexors | 62 |
| | Telemetry Systems | 64 |
| | UHF System | 51 |
| | Tele-protection systems | 44 |
| Communications site infrastructure | Battery Systems | 119 |
| | Power Supply | 74 |
| | Shelter | 27 |
| | Solar Systems | 88 |
| | Structure | 17 |
| Communications linear assets (km) | Fibre cable | 291 |
| | Pilot cable | 83 |

*Table 1 - Overview of in-scope regulated assets*

Power and Water's Communication assets vary by type, model, function, age, location and many other factors within the network. This variety results in unique risk profiles, and thus unique expenditure and management implications. Descriptions of communications asset types are provided below.

## 2.2 Age profile

Asset age profiles provide an overview of the communications asset fleet in its current state.

It is important to note that electronic/digital communications assets, such as radios and multiplexors, have relatively short functional lives of typically 5 to 20 years. The functional lives are typically dictated by the availability of support from the manufacturer and compatibility with technology used by associated assets. Structures, shelters, and cables have expected lives of up to 50 years based on condition.

Since 2010, Power and Water has carried out several zone substation renewals. These substations typically contained communications assets that were at, or approaching, end of life. Power and Water aligned the replacement of the communications equipment with the substation renewal. This approach has two key benefits; it ensures both asset compatibility and cost-efficiency.

Table 2 provides an overview of how many assets are currently at end of life. This includes those that have reached or exceeded their serviceable life as well as any that have been issued an End of Support notice from the manufacturer.

| Asset category | Asset description | Functional life (yrs) | Percentage at end of life |
|---|---|---|---|
| Communications network assets | 3G/4G Modems | 15 | 10% |
| | DWDM Systems | 15 | 100% |
| | Firewalls | 15 | - |
| | Microwave Terminals | 15 | 21.9% |
| | MPLS Nodes | 15 | - |
| | PDH Multiplexors | 15 | 100% |
| | SDH Multiplexors | 15 | 100% |
| | UHF (telemetry) System | 15 | 13.7% |
| | Tele-protection systems | 15 | - |
| Communications site infrastructure | Battery Systems | 15 | 10% |
| | Power Supply | 15 | 2.7% |
| | Shelter | 50 | - |
| | Solar Systems | 15 | - |
| | Structure | 50 | - |
| Communications linear assets | Fibre cable | 50 | 10% |
| | Pilot cable | 50 | - |

*Table 2 - Summary of communications fleet age*

Figure 2 shows the age profile of all discrete communications assets on the network and Figure 3 shows the age profile of the communication linear assets by length of cable (km). These figures highlight the significant renewal of the asset fleet that has occurred since 2010.

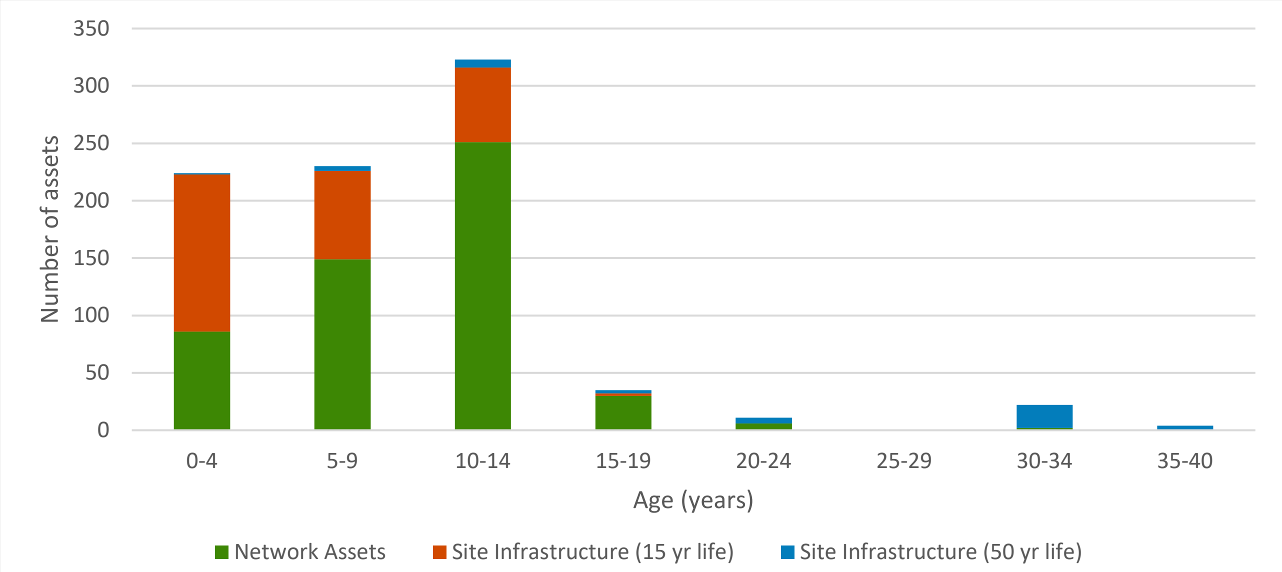


*Figure 2 - Asset age profiles for discrete asset categories*

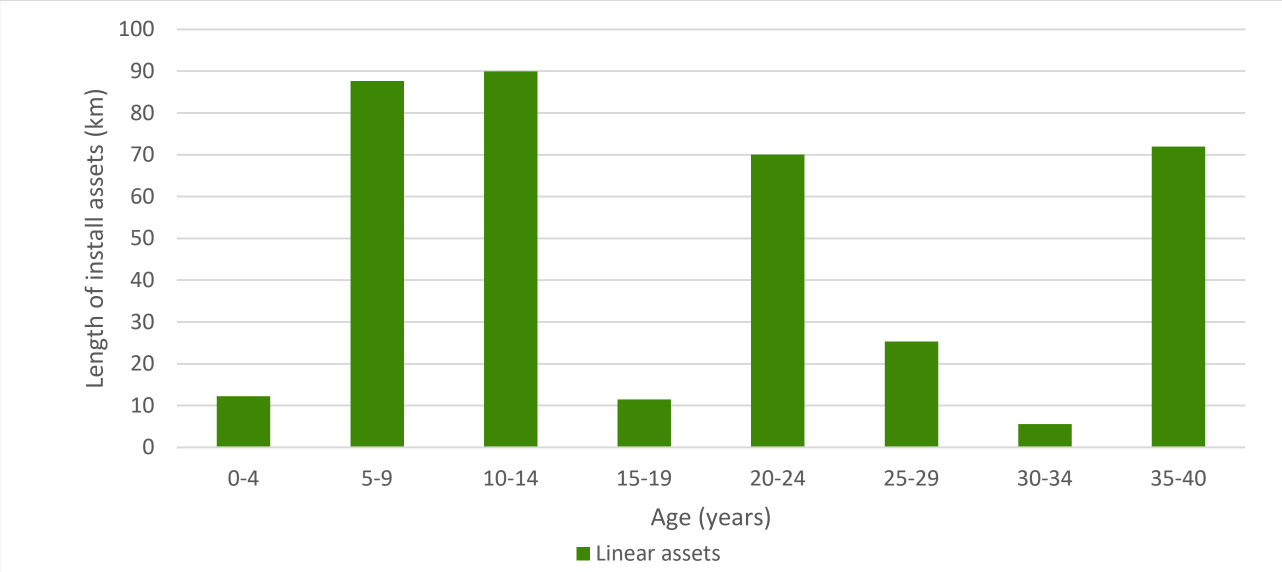


*Figure 3 - Communications linear assets age profile*

## 2.3 Criticality

Power and Water has established a Risk Quantification Procedure for Investment Decision Making to assess the overall risk posed by the asset fleet. However, when undertaking detailed scheduling and prioritisation of assets within the fleet for specific tasks, such as testing and inspection or replacement, we consider the localised characteristics of individual assets to account for relative criticality within the fleet.

The criticality assessment considers the diversity of the network including impact on public safety, service disruption (reliability) or environmental incidents. The location and function of an asset has a significant impact on the likelihood and severity of any consequences.

The assessment of criticality considers the following key aspects:

- The purpose of the asset and service it provides

- The level of redundancy in the network for an individual asset
- The time required for Power and Water to repair/replace these assets

Details of the criticality assessment approach can be found in our Health and Criticality Method (D2018/72550).

# 3. Asset objectives and performance

The Strategic Asset Management Plan (SAMP) defines the Asset Objectives and how they support Power and Water achieving the corporate objectives. This section shows how the Asset Objectives are supported by this asset class by establishing the measures and targets to assess if the Asset Objectives are being achieved, and any gap in performance that needs to be addressed.

Table 3 states the asset management objectives from the SAMP, identifies whether they are relevant to this asset class, and defines the measures of success, targets and performance gaps. This provides a 'line of sight' between the discrete asset targets and Power and Water corporate Key Result Areas.

The performance shown here represents the historical performance of the asset class to date. It is expected that benefits from investments proposed in the next regulatory period will manifest as benefits in these key objectives.

<table>
<tr><th>Objectives</th><th>Measures</th><th>Targets</th><th>Performance</th></tr>
<tr><td>Ensure appropriately skilled and qualified staff are employed to meet the current and future needs of the network.<br><br>Embed a fit for purpose Asset Management System across the business that is consistent across Regulated, Non-Regulated and IES.</td><td colspan="3">A capability development plan will include the requirements to ensure each asset class has defined capability requirements to enable effective management and performance.<br><br>The development of our Capital and Operational Works Plan (COWP) will define capacity requirements across different capabilities to achieve asset management objectives.</td></tr>
<tr><td rowspan="2">Maintain the safety of customers, community and staff demonstrated by reducing worker and public safety incidents and implementing public incident reporting metrics into asset plans.</td><td>Public injuries</td><td>0</td><td>0</td></tr>
<tr><td>Worker injuries</td><td>0</td><td>0</td></tr>
<tr><td>Reduce by 50% the number of feeders and communities exceeding performance targets by more than 100% by 2025.<br><br>Enable greater visibility of planned and unplanned interruptions to customers through improved online services for all networks and improve accuracy and transparency of</td><td>SAIDI and SAIFI targets.</td><td>Target by feeder type as set by the Utilities Commission.</td><td>Targets achieved. Refer to section 3.1</td></tr>
</table>

| | | | |
|---|---|---|---|
| reliability performance metrics for isolated remote communities. | | | |
| Implement risk quantification for all regulated network (system) capital investment decisions by Jan 2023, and extend for remote generation and networks by 2025. | Implementation of risk quantification for decision making. | Use of Risk Quantification to assess investment needs for all aspects of the asset fleet. | Partly achieved, qualitative assessment only. |
| Implement by EOFY 2023 asset criticality process to support granular prioritisation of corrective works based on public safety, reliability, security and other factors, and implement in the AMS and supporting systems by 2025 | A quantitative criticality assessment criterion that can be integrated into defect management processes and supported by our ICT systems to be developed for all asset classes. | | |
| Preparing our network and systems to be ready for the future, including building in flexibility for future uncertainty, maximising hosting capacity for customer DERs and enabling the energy transition to reviewable energy according to the governments targets. | Vendor support, compatibility and functionality of technology | Vendor support available for electronic devices | 6% |
| | | No compatibility or functionality issues | Minor compatibility issues with PDH multiplexors |
| | Cyber security maturity in a more diverse and widespread communications network | As required by the SOCI Act / Australian Energy Sector Cyber Security Framework (AESCSF) | In Progress |

*Table 3 - Asset Management Objectives*

# 4. Asset Challenges and emerging issues

Power and Water has undertaken a review of the asset class including asset age and condition, condition deterioration drivers, economic drivers, assessed trend in the asset population and trends/changes in the operating environment. We have identified the challenges described below that are expected to impact this asset class during the 10-year planning horizon.

There are six primary challenges in relation to Power and Water's communications network assets:

- End of vender support
- Insufficient functionality to meet standards required by Power and Water, NT NER & the Technical Code
- New cyber-security obligations
- Environmental challenges – temperature, cyclone resilience & wet season accessibility
- Sufficient and appropriately skilled personnel
- Obtaining and managing appropriate asset information for managing the communications assets

These are described further below.

## 4.1 End of vendor support

A key asset challenge is asset obsolescence related to end-of-vender support. Vendor support is critical to having equipment repaired, resolving software/firmware issues, updating security patches to guard against cyber threats, and overall specialist support in configuring and maintaining this equipment. When equipment is at End of Support (EoS), the vendor support is no longer available, and vendors do not sell spares or undertake repairs of faulty equipment. Power and Water has limited capacity and capability to address difficult technical issues related to the configuration and maintenance of complex telecommunications systems where the issues that need to be resolved are more complex than the normal day to day activities experienced with a communications network.

Power and Water has identified an increasing risk presented by obsolescence of the PDH and SDH and vendors ending support of assets currently used by Power and Water and ceasing to develop new assets using the PDH and SDH technologies. Instead, vendors are moving towards the new MPLS technology.

The assets impacted include:

- Microwave links
- Synchronous Digital Hierarchy (SDH) multiplexors
- Plesiochronous Digital Hierarchy (PDH) multiplexors
- Teleprotection systems

Currently, there are some short-term spares management initiatives in place to manage the existing assets while we transition to the new MPLS technology. These include:

- The OMS846 and OMS1240s are in a phase of life extension by strategic replacement of some sites with OMS1410s and the OMS1240s retained for spares.
- The Nokai PDH is in a phase of life extension with the Avara equipment being a direct like for like replacement
- Legacy RFL equipment will be replaced as part of planned major projects replacing existing substations
- The legacy TPD-15 equipment will be replaced as part of the major project DKTL Secondary System Upgrade

- Nokia TPS 64 equipment will be replaced by the DM1200, this is included in the major project DKTL Secondary System Upgrade

Power and Water has already started deploying devices using the MPLS technology and has a strategy to transition the network completely to MPLS as assets require replacement. However, MPLS is significantly more complex that the traditional SDH/PDH system and will present a challenge to Power and Water to ensure there are sufficient staff with the required capability and skills.

## 4.2 Obsolescence of technology

The rapid pace of technological change is an on-going challenge for Power and Water's communications network. The integration of older communications assets with newer digital technologies into one cohesive system is an on-going issue for Power and Water and is expected to remain a challenge.

Key challenges include:

- The changes in technology resulting in the inability to undertake repairs of complex equipment. Repairs can only be undertaken by the vendor, increasing reliance on vendor support and forcing maintenance into a 'black box' replacement methodology
- The requirement to have a very broad breath of knowledge and skills to maintain the various legacy systems in use and compatibility issues between modern and legacy systems
- Incompatibilities with remote control and monitoring platforms

In addition, the functionality required to provide services to our customers and meet relevant standards is changing. This includes the need to support the Future Networks Strategy which is likely to result in increased capacity requirements for communications, as well as changes to requirements specified by Power and Water, the NT NER, the Network Technical Code and Planning Criteria, and the System Control Technical Code. Older assets are unlikely to be able to meet these requirements, which may have implications on technology selection and replacement, or augmentation needs.

## 4.3 Cyber security

The Security of Critical Infrastructure (SOCI) Act has recently been amended in federal parliament. The act contains requirements for critical infrastructure businesses to increase their cyber security capability to defined levels within defined timeframes. These requirements are likely to require upgrading or ring-fencing of existing technologies to enable compliance. The bill contains provisions for penalties for non-compliance.

A recent audit of Power and Water Operation Technology (OT) systems across both Power Services, Water Services and IES against the Australian Energy Sector Cyber Security Framework (AESCSF) has informed the development of plans and investments required to maintain a mature approach to cyber security as our operating environment and regulations continue to evolve.

## 4.4 Environmental challenges

The network covers a range of environments and geographies which present different challenges for communications assets. Table 4 provides an overview of environmental challenges in relation to managing Power and Water's communications assets across its operating regions. Power and Water has unique requirements compared to other DNSPs around Australia due to climatic conditions; extreme temperatures, the wet season and cyclones.

Diverse environmental conditions also result in many additional asset management challenges for ensuring that a reliable Communication system is available at all times. Assets in less accessible areas of the network have an increased level of importance; as such additional battery capacity as well as the availability of mobile assets is required. Furthermore, some assets such as battery systems which operate in non-air-conditioned structures have a reduced expected life when operated in high ambient temperatures.

| Region | Environment | Challenges | Expenditure/ risk implications |
|---|---|---|---|
| **Alice Springs / Tennant Creek** | Desert | • High temperatures contributing to the overheating of assets. | • Infant mortality / early life replacement due to technical failure.<br>• An increased dependence on temperature control / air-conditioning at zone substation control centres and communications shelters. |
| **Darwin** | Coastal / Tropical | • High humidity possibly resulting in damage to internal components of assets.<br>• High temperatures contributing to the overheating of assets if air conditioners within substation control rooms are damaged/fail.<br>• Access to communication asset sites and the ability to work on these assets during the wet season – heat and rain/flooding (safety issue and detrimental to assets).<br>• Cyclonic or storm events resulting in frequent / prolonged power outages-resulting in blocked / flooded roads<br>• Managing personnel and prioritising issues during severe weather events.<br>• Providing adequate emergency communication services in the event of a major system weather related event.<br>• Corporate resiliency assessment and mitigation requirements against extreme weather events | • Increase in maintenance frequency and performance testing.<br>• Increased importance of maintenance to address leaks.<br>• An increased dependence on temperature control / air-conditioning at zone substation control centres and standalone comms sites.<br>• Public and Power and Water employee safety is reduced if assets fail to operate as intended.<br>• Ensuring sufficient battery capacity so that sites remain in operation during severe weather events or periods of prolonged inaccessibility.<br>• Ensuring solar power sites have sufficient battery capacity to maintain load during adverse weather conditions – such as monsoonal conditions where there may be significant cloud cover for weeks at a time.<br>• Functional fleet of mobile communication centres to allow additional / replacement capacity to be quickly deployed to support restoration efforts.<br>• Assessment and management costs to ensure all Power and Water sites meet corporate resilience assessment and mitigation requirements |

| | | | |
|---|---|---|---|
| **Katherine** | Inland / Tropical | • As above | • As above |

*Table 4 - Environmental challenges in relation to Communication asset management*

## 4.5 Workforce capability and location

The majority of staff who are appropriately qualified to work on communications assets are located in Darwin. There is only one part-time communications field staff member located in Alice Springs and none located in Tennant Creek. As a result, undertaking routine inspections or simple replacement tasks has a high time and cost burden often requiring staff from Darwin to be flown in. The climate also has a significant impact on the accessibility of assets.

The distance and time required for specialised staff to operate and maintain network assets has the following implications:

- Increased operational travels costs of maintaining and fixing the communications assets
- Increased battery costs (capex) associated with an increase in battery capacity and reliability to ensure Power and Water sites remain operational during severe weather events or periods of prolonged inaccessibility
- Outages which can last for a prolonged period due to travel times to reach the site or accessibility constraints during the wet season

Power and Water is assessing new technologies (for example, local area networks in substations) that may be able to mitigate some of the costs associated with these problems.

Additionally, the implementation of MPLS could require a complete revision of the support and maintenance staff capabilities to manage a MPLS system.

Attracting sufficient appropriately skilled staff to the Northern Territory and retaining internally trained staff in a very small by highly competitive local market has been difficult and is expected to remain a challenge in the medium term due to the activity currently underway in the electricity industry as a result of the transition to renewable energy.

## 4.6 Asset information

Power and Water is in the process of maturing their approach to asset information management for communications systems. The two key challenges are:

- A lack of comprehensive asset data (both characteristic and condition data)
- Not all Communication assets are recorded in Maximo (asset database). Most of the communications asset data is stored in unique systems developed that do not support consistent data management and quality reporting applied to the majority of network asset information.

Improved data sources are required to fully understand the asset fleet and the impact that deterioration of assets has on the operational integrity and functionality of the communications network. To address this, Power and Water's plan includes all asset information being migrated to Maximo, develop suitable asset condition parameters and establish clear data maintenance processes.

## 4.7 Reliability performance

Performance of the communications network is measured by its availability. Industry standards in energy utilities typically exceed 99.99%[2].

The reliability and availability of the communications link from Darwin to Alice Springs has been identified to be below industry performance standards. This link is essential for Automatic Generator Control (AGC) – a system that automatically dispatches generators based on set points.

The poor performance was described in a review of generator control undertaken following the October 2019 Alice Springs system black[3]. Specifically, Power and Water received an availability of 99.78% for the 12-month period ending 31 August 2020, which is significantly lower than industry standards that typically exceed 99.99%. The frequency and duration of outages that contributed to this poor performance is shown in Figure 4. These outages are defined as when communications have completely failed.

A recommendation from the AGC review was to implement an alternative Darwin to Alice Springs communications pathway to ensure there is N-1 redundancy. Achieving this recommendation would also contribute to our objective of being future ready for high renewables in the Alice Springs power system, increasing the criticality or reliable control systems.

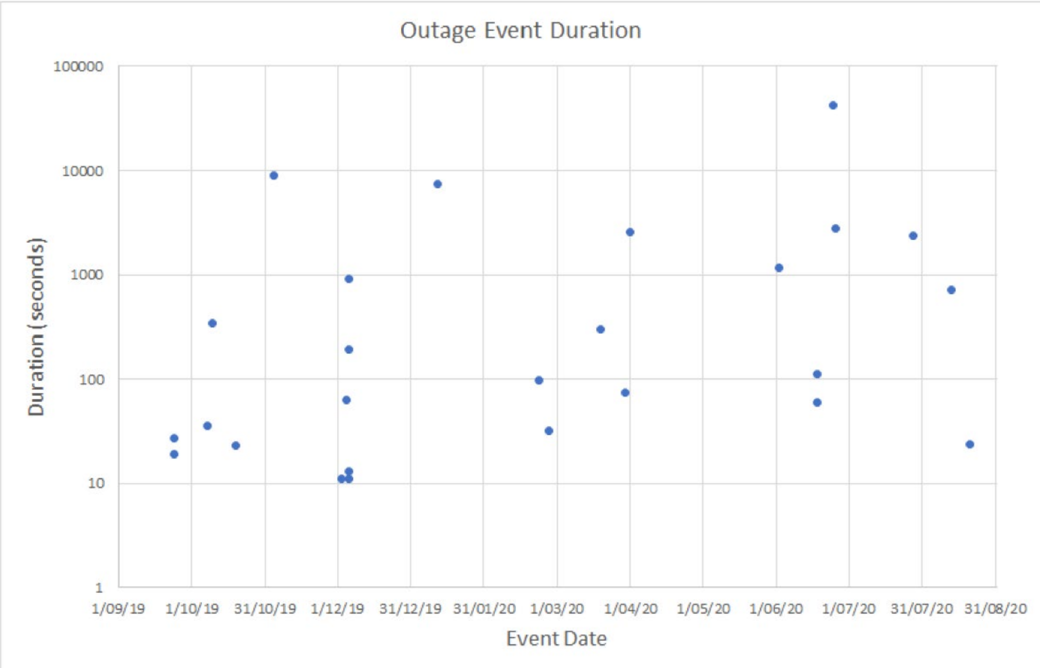


*Figure 4 Alice Springs to Darwin communications outage events*

[2] POWER SYSTEM DATA COMMUNICATION STANDARD, Australian Energy Market Operator, 1st December 2017.

[3] Automatic Generator Control Review, Power System Consultants Australia, 15 October 2020

# 5. Implementation plan

The following set of projects and programs have been developed to address the gaps in asset performance compared to the asset objectives and our long-term view to start planning for forthcoming asset challenges.

## 5.1 Replacement expenditure

Replacement expenditure is defined as work to replace an asset with its modern equivalent where the asset has reached the end of its useful life. Capex has a primary driver of replacement expenditure if the factor determining the expenditure is the existing asset's inability to efficiently maintain its service performance requirement.

The identified projects and programs are listed below. The indicative cost (real FY22) of the project or program for the 10-year horizon is provided and includes the entire project, not only the communications asset components:

- Berrimah zone substation replacement ($28.1 million)
- Obsolete and condition-based replacement ($4.9 million)
- Communications Battery Replacement Program ($1.39 million)
- Code Compliance and Safety Program ($1.27 million)
- Access roads for communications huts ($1.27 million)
- Microwave systems replacement ($1.22 million)
- DWDM retirement ($0.40 million)
- Communications huts refurbishment ($0.39 million)
- Fountain Head Communication Site service replacement ($0.25 million)

## 5.2 Augmentation expenditure

Augmentation expenditure is defined as work to extend the network or to increase its capacity to transmit or distribute electricity. It also includes work relating to improving the quality of supply to customers within the network, for example, to meet regulatory obligations.

The identified projects and programs are listed below. The indicative cost (real FY22) of the project or program for the 10-year horizon is provided and includes the entire project, not only the communications component:

- DKTL Secondary System Upgrade ($6.4 million)
- Sadadeen to Lovegrove fibre upgrade ($1.45 million)
- Alice Springs to Darwin communications connection (MPLS on Lambda) ($0.87 million)
- Antenna monitoring program ($0.28 million)

## 5.3 Operational expenditure

The forecast annual expenditure on maintenance activities is outlined in Table 5 below. Table 5 includes both SCADA and Communications expenditure.

| Maintenance Type | All Assets | SCADA & Communication |
|---|---|---|
| **Routine Maintenance** | $7.0 | $1.4 |
| **Non-Routine Maintenance** | $7.7 | $0.7 |
| **Emergency Response** | $7.6 | $0.0 |
| **Total** | **$22.3** | **$2.2** |

*Table 5 – Forecast annual maintenance expenditure ($ Million FY22)*

## 5.4 Delivery plan

There have been a number of challenges during the current regulatory period that have resulted in under-delivery of capital plans. Power and Water have undertaken a detailed analysis of our internal processes and activities to identify the causes and compiled a detailed plan to address this issue. The analysis and resulting plan to enable delivery of the proposed program of works is described in our Capital Delivery Plan.

# 6. Risk quantification and mitigation

Power and Water has established a Risk Quantification Procedure for Investment Decision Making to assess the overall risk posed by the asset fleet and enable consistent quantification of risk from their assets into dollar terms. Our procedure considers the asset's condition and failure modes, the likely risks of failure on safety, security and reliability of services to customers, and the relative maintenance and capital costs. In some cases, our decision making will be influenced by demand growth or customer upgrade requirements. Essentially, our decision making is based on an economic assessment of risks, costs, and benefits.

The procedure is applicable to most assets where there is a direct link between an asset failure and the impact of that failure on the defined consequence categories. Sufficient network data also needs to be available to derive the required inputs.

The communications assets are difficult to analyse using the risk quantification procedure:

- The communications network has inbuilt redundancy, so a second contingency event is required to possibly result in a disruption of supply or a safety incident.
- Supply of electricity can continue to operate without the communications network, although with a reduced level of control and monitoring. Hence, a loss of the SCADA assets does not necessarily lead directly to an outage or safety incident but may increase the likelihood or consequence of an incident should it occur.
- There isn't sufficient outage data for the communications network recorded to develop appropriate inputs to the risk model. Hence, application of the risk model would require a lot of assumptions with the outcome not likely to be meaningful.

As a result of the above issues, it is not possible to identify the probability of an outage, the likelihood of consequences that may result from an outage, nor the cost impact of any regulatory compliance issues.

Power and Water has undertaken a qualitative assessment of the risks posed by the identified issues as part of each business case.

# 7. Lifecycle asset management

Power and Water's asset management approach considers the entire asset lifecycle. This approach supports prudent asset management decision making to effectively balance risk, cost and performance over the life of the asset. The intended outcomes of a lifecycle approach are to:

- Maximise asset utilisation
- Minimise asset lifecycle costs
- Keep asset risk as low as reasonably practical
- Review and continuously improve asset management practices

The following sections detail Power and Water's lifecycle management activities.

## 7.1 Planning

The asset planning stage defines the need for an asset to exist. It also establishes the functional requirements of the assets and ultimately the number of assets, design, function, criticality, configuration, level of redundancy, capability, and capacity.

Key criteria to ensure optimal line route selection, establishing prudent, cost efficient, intrinsically safe, and sustainable corridors for the life cycle management of the communications assets.

Planning for the communications assets must cover off the requirements set out in both the Network Technical Code and Planning Criteria and the System Control Technical Code.

## 7.2 Design

The design phase involves the detailed specification of the asset function and physical characteristics.

Power and Water develops and maintains standard designs and technical specifications for most distribution assets, including communications assets, and all new communications assets installed in the Power and Water network must comply. Standardisation has many benefits, including staff familiarity, asset and component interchangeability, increased production and productivity, and standardisation of construction equipment and processes.

Asset failures or feedback from maintainers will trigger updates and improvements to our design standards.

## 7.3 Maintenance

Asset maintenance involves the upkeep of assets to ensure they will function to their required capability in a safe and reliable manner from their commissioning through to their disposal. Maintenance requirements can evolve as the condition and performance characteristics of the assets change throughout its life.

Maintenance activities can be classified into three distinct areas:

- **Preventative maintenance** requirements are documented in our Asset Strategies Procedures and SCADA and Communication's maintenance policy which sets out the type and frequency of inspection and testing to be undertaken. The testing schedule is modified, where possible, to align with major asset inspections or works. If an asset is found to fail testing a report is raised to the communications engineers or vendors to determine the most appropriate action to be taken on a case-by-case basis.

- **Corrective maintenance** involves planned activities to repair defects or restore asset condition. Defects are typically identified during preventative maintenance and are prioritised for rectification based on the risk they pose to the network. Corrective maintenance on electronic devices generally cannot be undertaken by Power and Water. The device must be returned to the manufacturer for any maintenance and repair.
- **Unplanned maintenance** involves activities to immediately restore the communication asset or make a site safe in response to asset functional failure. For electronic devices, this typically involves replacement with a spare device and the faulty device is returned to the manufacturer for repair.

## 7.4 Renewal

Asset renewal is the establishment of a new asset in response to an existing asset's condition, or the extension of life of an existing asset. The need for the renewal is identified in the asset maintenance stage and verified in the asset planning stage. Asset renewal aims to optimise the utilisation of an asset whilst managing the safety and reliability risk associated with the failure of the asset.

Section 5 outlines the implementation plans.

## 7.5 Disposal

The decision to reuse or dispose of an asset is made with consideration of the potential to:

- Reuse the asset
- Utilise the asset as an emergency spare
- Salvage asset components as strategic spare parts

The remaining asset is disposed of in an environmentally responsible manner.

# 8. Continuous improvement

Table 6 below outlines the improvement plans related to the asset class.

| Improvement Area | Today | Tomorrow / In Development | Future |
|---|---|---|---|
| **Asset data** | Asset data in unique systems, manual reporting | Create/update assets and transfer data into asset system (Maximo) | Automated reporting, aligned with other asset classes |
| **Engineering access network** | Limited remote engineering access to relays for fault investigation and diagnostics | Developing an architecture and concept design for remote access to protection relays and achieves cyber security objectives | Remote engineering access to all protection relays, including distribution assets, reclosers |
| **Technology strategy and performance** | Transition to MPLS in progress | Enhanced design standards to enable more flexible integration with protection systems and future control schemes | Long term strategy maintained to reduce risk of technology change outpacing capability, particularly for DER management |

*Table 6 - Asset improvement plan*

# Appendix A. Description of asset types

## A.1 Communications network assets

**Management systems - Communications Network Management System (CNMS):** Timely response to faults ensures tele-protection, SCADA and two-way radio voice systems are returned to service as quickly as possible; currently a reliance on 'user' reporting of failures still exists. This reliance is steadily decreasing. The CNMS system also allows remote configuration of equipment leading to a reduction of the requirement to attend sites to make minor system changes. Increasingly IT standards for equipment and systems are being adopted within the utility sector to ensure standardisation of service delivery and quality.

Key functions of the CNMS include:

- Monitors the health of the majority of the operational telecommunications network (OTN)
- Provides early alerts to faults or deterioration in the OTN
- Allows timely response to faults within the OTN
- Provides the tools for efficient configuration and deployments of equipment and services to defined standards.
- Communicates with lower-level equipment specific management platforms and summarises alarms to assist Network Operations Centre (NOC) staff to efficiently troubleshoot.

**Microwave links – includes antennas and feeders**: Antennas and associated coaxial feeders are key components of microwave and UHF radio systems. Periodic assessment of these components is required to ensure the ongoing operation of the associated system.

**Dense Wavelength Division Multiplexor (DWDM) systems**: A communications system capable of providing very high-capacity communications services. It multiplexes different wavelength light signals onto one fibre optic pair. It is very useful where limited fibre optic cable capacity exists.

**Synchronous Digital Hierarchy (SDH) multiplexors** – includes GPS clocks: SDH Multiplex systems provide high-capacity communications services. They combine many lower bandwidth services (2 megabit) into a high-capacity service which typically uses fibre optic cables as the bearer. They also have some inherent features which are very useful for high reliability communications such as automatic fault switching when configured in a ring topology.

**Plesiochronous Digital Hierarchy (PDH) multiplexors:** A low-capacity multiplexor (2 megabit) which combines up to 30 * 64kbit/s services. The output of the PDH multiplexor is typically an input into a SDH multiplexor to allow further aggregation.

Services typically provided by a PDH multiplexor include:

- Tele-protection
- SCADA
- Serial data circuits for telemetry to field devices
- Access to Digital Data Recorders
- Low through-put Ethernet services for OTN system monitoring
- UHF radio site interlinking services
- Corporate IT access to substations
- Some POTS (telephone) services and hot lines.

**Multi-Protocol Label Switching (MPLS):** is a signal router / multiplexor designed to operate in a virtual environment and therefore provide more flexibility as the switching and throughput can be easily changed to meet changing requirements. Being a multiprotocol design mean MPLS can accommodate many other protocols, including PDH and SDH.

Internet Protocol (IP) is used and is fully implemented in a virtual environment. With a virtual implementation, this system is much more flexible than MPLS-TP and can re-route traffic in a dynamic manner, accounting for volume, route capacity and priority of different services. It enables traffic to be dynamically redirected through another path to manage capacity and the Class of Services on different routes. This enables more traffic to be on the network as the allowance for spare capacity in case of an outage is optimised and reliability is improved.

The complexity of this technology is the higher level of traffic management required by skilled staff to ensure beast gains in an ongoing and dynamic manner.

**UHF systems - includes core sites and repeater sites:** a number of UHF radio-based systems exist:

- A UHF 2 Way radio system is used to manage operational activities within the electrical network and for crew dispatch to faults. The UHF radio system consists of a server based central core and the 2-way radio transceivers and associated ancillary equipment.
- A number of UHF radio-based telemetry networks exist. These are typically point to multipoint UHF radio systems which allow the monitoring and control of field devices via an interface back into the SCADA EMS.

**Power Line Carrier (PLC):** provides a small number (two to three) of dedicated tele-protection circuits between zone substations. PLC uses the transmission line wires as its communications bearer. PLC is not suitable for high-capacity communications but is sometimes used as one of the duplicate independent tele-protection circuits provided. Typically, a PLC and microwave or fibre system may be used where the provision of two microwave systems, two fibre systems or a fibre and microwave system is not economically feasible.

**Tele-protection systems**

Tele-protection systems provide a high-speed signal between two substations protection systems where the protection scheme used requires it. A number of tele-protection systems are used with legacy equipment:

- RFL;
- DIMAT (TPD15); and
- Nokia (TPS64).

The current standard tele-protection equipment in use is the DIMAT DM1200.

## A.2 Communications site infrastructure

**Power supply – includes rectifiers and converters:** convert AC power to DC power to maintain the batteries in a fully charged state. In some sites, converters are required to convert one DC voltage to another; e.g. 48VDC to 12VDC where the equipment operating voltages require it. The longer-term aim is to have all equipment with the same operating voltage (48VDC).

**Communications battery systems:** a critical sub system for the correct operation of the OTN. They provide the power supply to the electronic node devices so that they continue to operate if there is a network outage. Battery systems are duplicated to ensure the reliability of the network.

Most communication sites are part of a protected-ring where traffic from other sites will traverse through each site. Hence it is important that the communication equipment stay alive for longer duration than the local equipment on site during a power outage.

**Solar systems - includes frames:** charge batteries in remote locations. Solar panels arrays are located at:

- Robin Falls communications site
- Pine Creek Mesa communications site
- O'Shea communications site
- Mount Bundy communications site

**Shelters – stand-alone communication sites:** house SCADA and Communications assets that are located in remote areas and cannot be located within a zone substation**.** Several different types of shelters exist:

- Steel clad foam sandwich prefab of various sizes (passively cooled)
- Steel clad foam sandwich prefab of various sizes (not passively cooled)
- Concrete block construction
- Shipping containers for battery rooms

**Structures (towers and masts): t**he structures category includes towers and masts as well as other associated assets, such as access roads or tracks and compound equipment (security fencing), that are required for the operation and maintenance of the towers and masts.

Most guyed towers in use were installed around 1988-1989 and the designed wind loading was for gridpack parabolic antennas suitable for low data capacity microwave radio systems and omni-directional antennas for 2-way radio systems. In subsequent years, the guyed towers have been re-designed and strengthened to support additional wind loads as larger diameter and/or solid parabolic antennas and additional omni-directional antennas were required to support increases in the system capacity and availability.

## A.3 Communications linear assets

**Fibre cable – Underground and Optical Pilot Ground Wire (OPGW):** are used to connect network devices to the master station. The fibre optic cable is fully owned by Power and Water and Power and Water leases the majority of the fibre cores to Optus in some routes. In Alice Springs, Power and Water utilises Northern Territory University fibre in some locations.

**Pilot cable:** these are copper cables that are used primarily for analogue differential protection schemes.

## Power and Water Corporation

Senior Manager Asset Management
Power Services
Phone 1800 245 092

powerwater.com.au