Asset Management Plan

April 2022 to March 2032

WAIPA NETWORKS

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Waipa Networks Limited Asset Management Plan was

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Certification Date

This Asset Management Plan was certified by The Board that it describes actual processes and practices on 31 March 2022.

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1. SUMMARY

This Asset Management Plan (AMP) outlines Waipa Networks Limited's (Waipa's) asset management strategy to facilitate the safe and reliable distribution of electricity to consumers in the Waipa's region. Waipa Networks (Waipa) is committed to providing a network that meets the needs of its key stakeholders. Waipa recognises the key role that a safe, reliable, and resilient electricity network has in supporting the livelihoods of people and businesses throughout Waipa's network.

Owning and managing an electricity network in the Waipa region (comprising parts of the Waikato, Waipa, Otorohanga and Waitomo Districts) is not without its challenges, with a fast-growing area. Residential, commercial, and industrial development is combining, requiring ongoing investment in the network. Many kilometres of overhead lines require significant vegetation management to keep vegetation clear of lines.

The majority of the network was upgraded for load growth in the 1970s and 1980s and is therefore relatively young and in good condition.

As a community owned company, Waipa seeks to ensure that its assets are well maintained, that investment decisions are prudent and that replacement decisions are optimally timed. The consumers connected to Waipa's network ultimately fund network operations and are also the beneficiaries of the network. Waipa will endeavour to act in the best interests of its beneficiaries.

This AMP commences by describing how Waipa aligns its objectives and performance levels to the interests of its stakeholders. The network, including each of its planning areas, are described along with detail on the quantity and condition of the more significant asset classes. This plan then sets out the strategy and actions Waipa will undertake in delivering the objectives and service levels it has set and the financial level of investment required.

1.1 Highlights of this AMP

Key areas are highlighted in this AMP:

- The network is expected to be challenged by load growth over this planning period due to customer growth including the potential for new loads from electric vehicles over the medium term. This will require significant investment in transmission connection capacity and sub-transmission to overcome supply constraints.
- Modernisation of Waipa's information systems infrastructure to assist in more effective management of the business. An aerial survey was completed in 2021/22 and this has provided asset health information on poles, cross arms and pole mounted transformers which will assist with understanding network condition. The aerial survey has identified a number of overhead defects and also captured the GPS locations of overhead assets for the upcoming Geographical Information System (GIS). The aerial survey has also captured aerial pictures of the rural overhead assets. Asset health condition of these assets were assessed and defects identified as per our current defect classification framework and a number of sites are identified to be prioritised for maintenance or renewal in the coming financial year. Following on from the GIS a replacement SCADA and Outage Management System is planned, to provide improved real time management of the network and provide stronger outage management, reporting and communication capability. A future asset management system will allow asset health trends to be modelled to produce expenditure forecasts.
- Continuation of Waipa's focus on vegetation management to maintain network reliability.
- The need to address the progressive aging of assets on the network, including the west coast, for safety, reliability, and continuity of supply, with due consideration for economic impacts. Focus on the aging fleet of wooden cross arms and maintaining

progress on asset inspection and renewal of defective assets are the key priorities.

- Continued works to improve the resilience of the network to extreme natural events, including high intensity wind events.
- An ongoing need to maximise energy efficiency throughout Waipa's operations.

1.2 Interaction with Corporate Strategy

Waipa's business planning cycle is integrated with Waipa's Purpose, Statement of Corporate Intent (SCI), annual business plan, capital and operational budgets.

1.3 Duty of care

Waipa has a duty of care in its network operations. Accordingly, this AMP includes works which further mitigate public safety risks including lines renewal risks. In many cases planned works, such as lines renewal, address multiple drivers including network continuance, reliability, and safety and fire liability risk through reducing Waipa's exposure to defective equipment faults.

1.4 Consumer expectations

Through periodic consultation with key consumer groups and through its annual consumer satisfaction survey, Waipa has set new reliability targets as per the DDP3 methodology for this planning period in recognition of the feedback received against the present level of service reliability, and of the present context of the network; requiring above historical levels of planned shutdowns to complete network maintenance and repair defects.

Waipa's rural area has a high proportion of dairy farming with associated processing facilities. The substantial road transport network investment is making the region closer to large urban markets attracting manufacturing and the attractive urban areas are growing due to both increased employment and commuting to the larger employment centre of Hamilton.

Further detail is provided within this AMP on this and other service level targets and objectives. The current level of reliability represents close to average performance on a comparative basis given Waipa's network characteristics, line lengths and environmental exposure. However, improving on this level requires Waipa to continue with its focus on vegetation management and undertaking equipment renewal to prevent an increase in the number of component faults that inevitably arise through network ageing, particularly in the remote parts of the network. This expenditure will be targeted through condition monitoring and focused lines renewal.

Waipa will continue the reliability improvement strategies of splitting feeders, installing reclosers to segment feeders, automating feeder open points with load break switches to reduce restoration times and installing dropout fuses on spur lines. Waipa Networks has an opportunity to further improve its reliability performance due to the abundance of automated devices on the network. There are 119 autoreclosers on the network and they have the potential to be used in loop automation schemes. Loop automation schemes provide self-healing networks, where faults are isolated to the smallest possible extent and healthy network sections are restored quickly using automatically operated reclosers. For a safe loop automation scheme, a robust communication network is needed. As Waipa Networks implement a digital communication network with high bandwidth, loop automation schemes can be extended to a number of feeders thus improving the overall network reliability. Waipa Networks is intending to trial a number of loop automation schemes in 2022/23 in order to quantify the reliability benefits and formulate future strategies.

1.5 Network and Asset Description

Waipa owns and operates the electricity distribution assets in Cambridge and Te Awamutu and their surrounding rural areas in the Waikato and King Country region. Waipa is owned by the Waipa Networks Trust (the shareholder who represents all connected consumers).

Waipa's distribution system has higher load density than most mainly rural networks. Waipa conveys electricity on behalf of a large number of energy retailers from Transpower's Cambridge and Te Awamutu Grid eXit Points (GXPs) via interconnected radial 11kV feeders, 11kV/400V transformers and associated 400V/230V reticulation to 27,720 ICPs (as at 31 March 2021).

1.6 Asset Management Systems, Processes and Information

The AMP describes who is responsible and accountable for asset management from the governance, executive management and operational perspectives.

The Health and Safety at Work Act has not only affected the focus on field workforce safety, but into information systems to assure asset maintenance and public safety inspections occur and the resulting work is completed. Demonstrated compliance and accuracy of system data has increased importance.

Waipa is reviewing the adequacy of the asset management information systems to determine priorities to enhance and update these systems. Current information systems while effective on their own are not integrated and involve multiple data entry. Development of an Information Systems Strategic Plan with an associated roadmap for development of updated systems will address updated asset management systems, including: a geographical information system; a replacement SCADA system for network monitoring and control, an Outage Management System for optimised fault dispatch, digital notification of outages to customers, network management and analysis; a single network model for the update of network information; an asset management system for the assessment of asset risk, asset health and criticality with predictive models for forecasting network capital expenditure; and electronic drawings and document management system. Further incorporation of live low voltage network data into the SCADA system and incorporation of network edge data will follow. Within the same roadmap, replacement of the Financial Management Information System and Works Management System will assist in the financial management of assets and network operations. A new Health and Safety System called Assura has been implemented, to ensure Waipa's people are better equipped with access to information, systems and process documentation in the field, and allow improved management and reporting.

In February 2022 Waipa Networks commenced a project to implement a new ESRI Arcview GIS based on the EPRI Utility Network Common Information Model (UN CIM), as a foundational management system for asset data. The new system will be populated with data obtained from the LiDAR survey of the overhead network and data converted from existing sources of information (including geographical AutoCAD files and asset databases). The project is expected to be complete by September 2022.

1.7 Comparative Performance and Service Levels

Waipa's service level targets for various segments of the network are set in line with the same quality (reliability) targets as a regulated electricity distribution business. Reliability is as expected for the type of network with targets showing a reduction over time. Overall customer satisfaction of 78% measured by an independent survey demonstrates the majority of customers are satisfied with

the current reliability of the network and service levels. While this is above the average of five other EDBs in the survey, potential for improvement is definitely evident.

Current net revenue shows Waipa Networks has lower revenue (line charges per customer) than the industry or other cohort distribution businesses. This is in part due to the simple 11kV distribution architecture of our network compared to networks with sub-transmission networks. However, with future network investment and adoption of sub-transmission in Cambridge it is expected that lines charges will increase over time.

The total network opex shows Waipa Networks as having best-quartile operating cost but below average reliability (impacted by recent planned outage performance driven by network renewal work).

Waipa Networks still has a higher proportion of vegetation faults compared to the cohort level despite increased vegetation and maintenance expenditure. In proportion, Waipa Networks has somewhat lower levels of defective equipment faults demonstrating the effectiveness of maintenance processes.

1.8 Load growth, distributed generation and electric vehicles

Increased transmission connection capacity from Transpower will be required for the Cambridge area in the immediate future when, due to a combination of spot load increases and ongoing load growth, the Cambridge GXP (Grid eXit Point) supply transformer firm capacity was exceeded by a peak load of 48 MVA in 2021. The approach to hot water load control will be changed, to smooth the morning and evening peaks instead of aggressively targeting the transmission pricing periods related to regional coincident peak demand. Of note is a significant new industrial load development, commencing with a new customer of 2.7 MVA that connected in 2020. This load has further load growth potential within five to ten years, along with development of industrial zoned land in the Hautapu area. Transmission capacity upgrade options have been investigated, with the selected solution being to construct a new 220/33kV GXP to the west of Cambridge and install a new 33/11kV zone substation at West Cambridge and two new 33/11kV zone substations in the Hautapu industrial area, with associated cabled sub-transmission circuits. In the interim five to seven-year period while the solution is being planned and constructed, Waipa Networks will deliver non-network capacity support to the Cambridge network, through a portfolio of distributed peaking generation. Investigation of the potential for demand side management and distributed energy resources will continue, but initial engagement with the industry has not resulted in actionable non-network capacity support.

The Te Awamutu GXP supply transformer firm capacity of 41 MVA was exceeded in 2019, with further load increases coming in the next two years from the Fonterra Te Awamutu dairy factory and the Waikeria Prison upgrade and other organic load growth. Transpower are implementing a protection upgrade in June 2022 that will increase the GXP transformer capacity to 52 MVA (summer) and 54 MVA (winter). This will give time to investigate the optimal solution to future network constraints in the Te Awamutu area. Network development planning for Te Awamutu is underway to identify the optimal method to increase GXP transformer capacity, overcome 11kV switchgear rating limitations and address future voltage limitations of the Te Awamutu 11kV network. Solutions being investigated include tendering for non-network capacity support, staged network reinforcement to spread the cost of upgrades and considering alternative technology such as batteries.

Waipa encourages distributed generation on its network and the company continues to have an increasing number of small capacity connections each year. Waipa's strategy to respond to potential disruptive technologies is to maintain a fast follower approach, monitor the potential of non-network solutions and monitor the network development horizon to reduce the risk of network over investment and possible stranding of assets. The fast follower approach will involve trialling new technologies to gain experience prior to possible full-scale deployment, including monitoring the network effects of St Kilda, a high PV penetration subdivision in Cambridge and the pilot solar PV embedded network at Lakewood. The overall objective is to maintain a watching brief on new technologies and position for the likely impacts/opportunities these present for our business.

The potential load increases associated with electric vehicle (EV) adoption are being closely monitored, and scenarios for this uptake have been incorporated into load forecasts. The potential for increased network peak loads if EV charging occurs coincident with the evening peak is concerning, as this would result in a requirement for significant network capacity with associated costs. The portion of the network most vulnerable to overloads is the distribution transformer and low voltage network, where currently there is very little monitoring. The ability to defer EV charging to later in the evening once the load has declined would allow the existing network capacity to be best utilised without the need for upgrades. In order to achieve that, it seems that a whole of industry approach (generator/retailers, transmission and distribution) will be required to signal network peak loading periods and provide seamless and automated technology that makes it easy for EV customers to defer their charging to off-peak periods. This will also include working with public electric vehicle charging providers to understand the demand profile of these new loads.

1.9 Life-Cycle Asset Management

The AMP describes Waipa's life-cycle maintenance criteria (is the asset safe and "fit for purpose") and asset physical condition surveys which drive Waipa's maintenance works. Waipa completed its second asset condition survey in 2020.

Waipa has gathered comprehensive information on the physical attributes of its assets through routine visual surveys and specific partial discharge and corona surveys as required. Based on asset age profiles Waipa does not expect any issues with a significant bow wave of equipment renewals over the next ten years. However, network renewal expenditure over the next ten years will be steady, predominately addressing a deteriorating wooden cross arm population with galvanised steel replacements.

Moving away from an eight-year rotational inspection programme, Waipa has completed an aircraft-based LiDAR (laser 3D survey) and pole imagery survey of the entire network in early to mid-2021. This is intended to achieve multiple objectives, surveying for ground and building clearance compliance with NZECP34, identifying overhead line asset defects via high resolution photographs, determining asset health indicator scores for overhead network assets, identifying and prioritising vegetation clearance issues and obtaining high precision GPS positions of overhead network assets for the new GIS project. The aerial photo survey identified a substantial number of defects on the rural overhead network, giving a useful prioritised view on defect equipment that will need renewal in time. However, the grading of those defects into replacement periods will require further analysis, as the relatively low fault rate of the network does not match the volume of defects identified. Ground mount transformers and ring main units will be inspected every three years and wood poles will continue to be surveyed from the ground.

A routine earth testing and repair programme is used to ensure system safety. Waipa employs an external service provider to carry out an annual thermal survey of switchgear and connections on

the highly loaded first section of each feeder. Any thermal defects identified will be removed as a matter of priority.

Due to high levels of growth and a relatively young network, resources were concentrated on meeting new connection needs. Focus has now returned to network inspection and the resulting equipment renewal is driving a planned SAIDI requirement of around 80 minutes, significantly exceeding the previous target of 40 minutes. The planned SAIDI and SAIFI targets have been reset to match the DPP3 calculated levels, at three times the historical average. This will allow planned work to continue at a higher level to account for the increased defect renewal work. This situation is expected to continue throughout the ten-year period of this AMP. With continued growth external resources have been required to meet the work volume needs. Checks on defects that have been prioritised as lower priority have shown a very infrequent incidence of having caused a fault. The management of criticality has been demonstrated as being effective. Unplanned SAIDI and SAIFI targets have been revised to the DPP3 regulated levels, which are expected to account for an increase in long-duration outages, primarily caused by third party interference vehicle versus pole incidents, out-of-zone vegetation faults and defective equipment (in that order).

Most assets are younger than industry averages with low numbers of assets considered currently in need of replacement. Only pole mounted switches and transformers appear to be approaching the industry average age. Waipa intends to do more work on the air-break switch fleet to assess their condition. Waipa has a large population of voltage regulators and the expected life of a regulator can is 55 years however with good maintenance and servicing programmes these assets may have an operational life in excess of this. There are only two voltage regulator cans in service that is older than 40 years with the remainder of the assets being or younger than 22 years old. Ring main units are either SF6 insulant or vacuum insulant and therefore these assets are recently installed and in good condition. Ground mount transformers are generally also in good condition with some replacements due to corrosion or aging low voltage J type porcelain fuses which is an operational safety hazard. Profiles of age and asset health condition have been obtained for poles, cross arms and pole mounted transformers from the aerial survey programme and are available for analysis through dashboards. The profiles of condition and age do not indicate significant populations of these assets nearing replacement.

Waipa Networks pays particular attention to high criticality assets. There are a number of cables that exit the GXPs that have been temporarily de-rated due to unknown soil conditions and hence temperature at high load. A project is underway to replace these cables. There are also sections of multi-circuit lines with more than one feeder on a pole. These are subject to additional condition monitoring to mitigate the risk of multiple feeder faults. Assets vulnerable to third party damage are protected where possible.

Waipa has a vegetation management programme to minimise interference from trees and maintain reliability. A systematic inspection and cut programme also focus on tree removal. Some years ago, tree outages were above the industry norm and increased resources were applied to tree management. This has resulted in a steady reduction in faults, approaching a point where an optimal level of spend can be evaluated. The LiDAR survey will inform the overall picture of vegetation maintenance needs throughout the network, allowing prioritisation and optimisation of the expenditure to areas of greatest benefit.

1.10 Risk management and resilience to extreme events

Waipa uses an ISO 31000 compliant risk management system. An assessment of asset risks shows a number of serious (but not high) risks and improving controls.

Waipa is a member of the Waikato Lifelines Utilities Group and is updating emergency management plans and processes currently. Waipa has assessed the risk from physical threats to its network posed by naturally occurring hazards (wind, lightning, floods, land erosion, earthquakes, volcanic eruptions and geothermal activity) and concludes that the risk is manageable for likely events and damage to assets can be dealt with using Waipa internal and contracted resources, albeit that outage restoration times may be protracted after a major event. Waipa has a simple radial network with some interconnection for redundancy and planning is in place to restore power safely in an orderly manner after a major event. Waipa has back-up systems for its business systems and is implementing disaster recovery for the SCADA system to continue operating the business in the event of a major incident.

Risks associated with growth and tree trimming are under active management. Waipa has five remaining two pole transformer substation structures comprising hardwood platforms that are over 40 years old and at the end of their economic life. These will be replaced on a condition prioritised basis by either a single pole transformer substation or a pad mounted substation in a programme to be completed in 2022/23.

The risk of widespread outages due to faults on multi-circuit overhead lines that supply adjoining areas on the network (hence limiting back feed capacity to the affected areas) has been evaluated, with the primary risk arising from car versus pole incidents and a secondary risk of insulator or pole top hardware failure causing a multi-circuit flashover fault. Annual acoustic monitoring of these circuits is completed to monitor for insulator failures.

1.11 Performance and Plans for Improvement

Overall Operational Expenditure was $9.2m which was $423k (4%) below forecast of $9.7m set for the disclosure year (March 2021).

Capital Expenditure on network assets was $9.7m which was $4m (29%) below the forecast of $13.6m set for the disclosure year (March 2021). This was due to an underspend on customer connection (Covid lockdown impacts), system growth (delay in a peaking generator installation, deferral of a cable replacement project and voltage regulators) and underspend on quality of supply (reduced spend on remote controlled switches). Asset replacement and renewal was also underspent compared to forecast due to reduced renewal of transformers, switchgear and overhead lines.

Network operational expenditure increased in 2020/21 from 2019/20 by a total of $140k. Additional expenditure of $308k was incurred in the Service Interruptions and Emergencies category due to recognising the cost of historical irrecoverable car accidents. Asset replacement and renewal was underspent by $52k, resulting from increased spending on transformer and pillar box maintenance.

The ten-year network capital expenditure totals $112m, an overall decrease of $44m (-39%) compared to the AMP 2021 ten- year total. There is an increase in customer connections of 4.8m, related to continued strong growth. A decrease in system growth capital of $51m is due to the removal of the Te Awamutu sub-transmission & zone substation project while the scope of the deferred solution is confirmed.

Asset replacement and renewal capital has increased $0.9m due to capitalisation of pole, pole top hardware and LV pillar replacements. Other reliability, safety and environment capital has increased by $1m due to voltage regulator seismic strengthening.

We are following an asset management improvement plan completed in 2018/19, with implementation of improvements to be phased over the coming several years. We aim to reach intermediate level of asset management maturity over time. The improvement plan focuses on process improvement and documentation. Further development of asset management systems in accordance with our Advanced Distribution Management System roadmap and improvements to asset data will assist in making future asset management decisions. In particular, further work is required in developing asset condition data, asset health indicators and forecasts of network equipment renewal expenditure.

1.12 Energy efficiency

Energy efficiency for a lines business is mostly dictated by the degree of its network losses. Waipa's network losses are shown, by comparative analysis, to be completely consistent with other New Zealand lines businesses after consideration of its network characteristics of total line length, installed transformer capacity per consumer and energy delivered. Other aspects of energy efficiency are managed through Waipa's various policies that require consideration of energy efficiency in design, purchase of equipment and plant, and operation of the network together with its ancillary operations.

1.13 Disclosure of this AMP

Section 11.10 Appendix I includes regulatory disclosure requirements map between the regulatory disclosure requirements and this AMP.

1.14 Cost efficiency

Cost efficiency is achieved through:

- Prudent and timely investment in both maintenance and capital expenditure.
- Ensuring that all such expenditure is incurred at minimum cost consistent with the overall requirements for the expenditure.
- Tenders are sought for all major capital purchases.
- All costs are benchmarked against alternatives.
- Internal costs are benchmarked against the same services provided externally.

Overall, comparative assessment of Waipa's rate of return, direct operating expenditure and total cost, does not indicate concern.

2. Background and Objectives

2.1 Purpose of this AMP

The delivery of a safe, reliable electricity supply of adequate capacity to meet consumer requirements is essential for their lives, their homes and businesses. Concurrent in meeting its obligations in the delivery of electricity, Waipa recognises its responsibilities not only to consumers but to its staff, contractors and the public to ensure that all practicable steps are taken to ensure all components of the network are safe and all parties are kept free from harm.

It is a requirement of the Energy Companies Act 1992 that Waipa has regard to energy efficiency and this aspect is considered fundamental in all aspects of Waipa's operations and is integral to the considerations within this AMP.

Waipa recognises that it has an obligation to not only have regard to energy efficiency but the overall efficiency of its operations.

Accordingly, within Waipa there is a commitment to continuous improvement.

This AMP provides an overall strategy which will enable Waipa to meet its identified objectives over the next ten years and beyond.

2.2 Basis of AMP

This AMP documents Waipa's asset management strategy and objectives for its asset management processes. It sets out the assets, their condition, service levels, achieved performance, network development planning, lifecycle planning, fleet management and forecast expenditure. More specifically, this AMP provides detail on how Waipa:

- Maintains and operates all assets in a safe manner to safeguard the health and welfare of staff, consumers, contractors, landowners and the general public consistent with legislative requirements and best industry practice.
- Optimises energy efficiency relative to costs and practical considerations.
- Sets service levels for its network that will meet consumer, community, other stakeholder and regulatory requirements.
- Understands the levels of network capacity, reliability and security of supply required now and, in the future, as well as the issues that drive these requirements.
- Have robust and transparent processes in place for managing all phases of the network life cycle from initial concept to disposal.
- Adequately considers the classes of risk relative to its network business and ensures there are processes in place to mitigate identified risks.
- Makes adequate provision for funding and resourcing all phases of the life cycle of its network assets.
- Makes decisions within structured frameworks at each level within the asset management process.
- Increases its knowledge of its assets in terms of location, age, condition and the likely future behaviour of the overall network as it ages.

This AMP is the key strategic document used by Waipa as part of the asset management system. Disclosure of this AMP also assists Waipa in complying with the requirements of Section 2.6 and Attachment A of the Commerce Commission's Electricity Distribution Information Disclosure (ID) Determination 2012. It is Waipa Networks' practice is to prepare and disclose a full AMP voluntarily each year to assist with its asset management and provide information for interested stakeholders.

2.3 Key stakeholders and objectives

Waipa's key stakeholders are:

- Its owner, the Waipa Network Trust.
- The public within its region.
- Manu whenua iwi within our network area.
- The consumers who take supply from the approximately 27,720 installation connection points (ICPs) to whom Waipa delivers electricity (some of whom

receive supply at 11kV).

- Generators who are directly connected and embedded within the network and produce electricity for use by others.
- The (currently) 15 electricity retailers who operate over our network.
- The territorial authorities, Waka Kotahi (NZTA) and other government agencies who Waipa engages with.
- The Waipa team and contractors who work in or on our network, or work on connections to our network.

The interests of these and other stakeholders is assessed through stakeholder engagement that forms the driving objectives for the strategy, plans and actions set out in this AMP. These objectives are generally expressed through compliance achievement and measurable service level targets set within this plan.

This publicly disclosed AMP also serves as a means of communicating Waipa's intentions to its stakeholders.

2.4 Link to other documents

Other documents related to this AMP include:

- Waipa's Statement of Corporate Intent (SCI) published annually and available on Waipa's website. This document sets Waipa's key strategic objectives each year including network reliability targets, consumer engagement objectives, business development goals (accreditations etc.), consumer discounts, and rate of return to shareholders. Asset related objectives in the SCI are encapsulated within this AMP to ensure achievement.
- Waipa's annual report, which discloses the accounting position and reports on the business performance against budget and on SCI objectives achievement.
- The regulatory disclosures (schedules 1 to 10) required by the Commerce Commission.
- Waipa's annual works plan aligned to the first-year forecast of this AMP and subsequently updated for each successive year.
- The various internal standards, policies and procedures that ensure works are undertaken safely and to appropriate quality standards and in consideration of our stakeholders' wider interests.

2.5 Period covered

This AMP covers the period 1 April 2022 to 31 March 2032. It was adopted by the Waipa Board of Directors on 31 March 2022. A statutory declaration has been made to the Commerce Commission on behalf of the Waipa Networks Directorate for this full AMP.

2.6 Structure of this AMP

Asset management is a process of setting objectives driven by stakeholder requirements then entering a repeating cycle of measure, plan and act. This AMP is therefore structured around this process. Measurable and corrective or enduring service level targets over the planning period are set through measurement of the business performance, stakeholder input and comparative assessment against other electricity distribution businesses. Planning for the achievement of the service level targets is underpinned through Waipa's asset strategy, with its expression in the network development plan and the life cycle fleet strategies.

Implementation of capital expenditure projects is undertaken through the annual works plan with the work guided by Waipa's policies and standards.

The illustration of Figure 1 sets out the structure of this plan and summarises the included content of each section together with the structural relationship between the document sections.

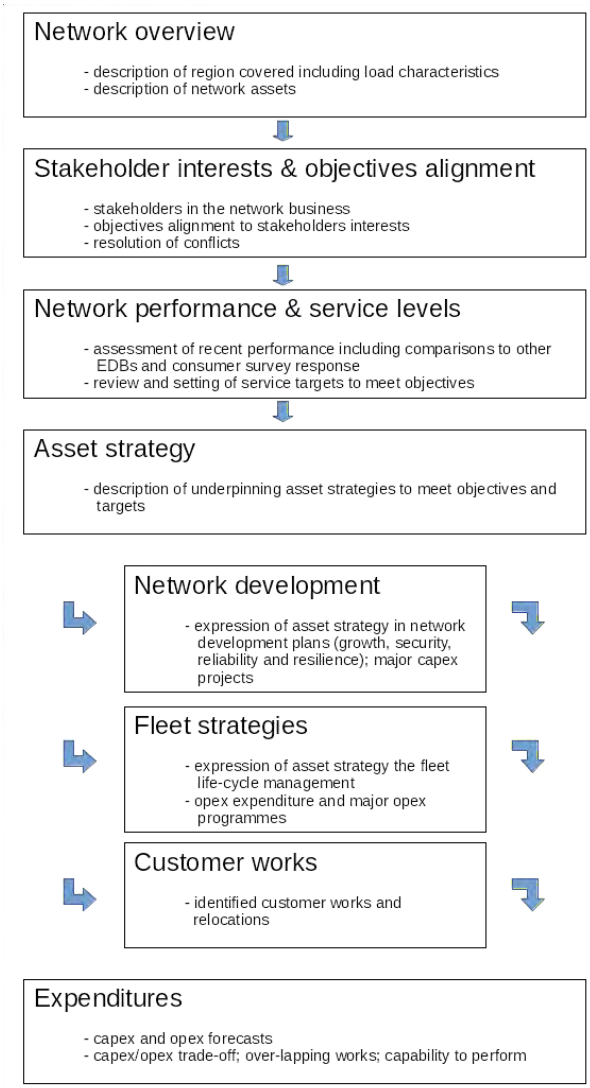


Figure 1:Overview of the structure of this AMP

3. Network overview

This section provides a summary of Waipa's network and the region it operates in.

The geographic view of the 29 11kV feeders on the two networks of Cambridge and Te Awamutu is shown in the following Figure 2. Five communication repeater sites are also shown on this diagram. Section 11.1 Appendix A shows Waipa's 11kV feeder attributes as at 31 March 2021.

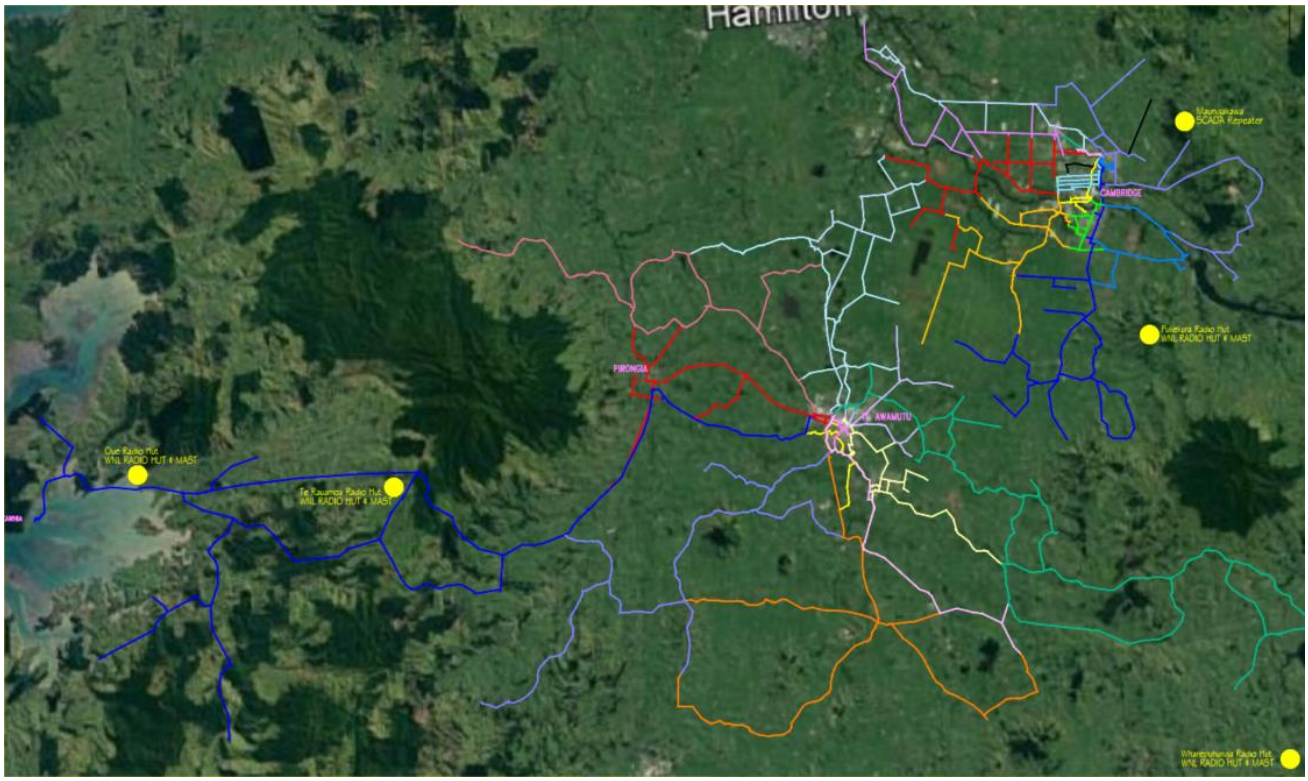


Figure 2: Network Overview

3.1 Region and context

Waipa's electricity network currently distributes electricity to approximately 27,720 consumer connections. Waipa's network covers the Waipa area in the Waikato and King Country region of the North Island as illustrated in Figures 2 and 3. Waipa's distribution system covers 1,865 square kilometres.

Supply area characteristics

Waipa owns and manages electricity distribution assets in Cambridge, Te Awamutu and surrounding areas, which are predominately in the local authority areas of Waipa and Otorohanga Districts, with minor reticulation in part of the Waikato District south of Hamilton and Waitomo District south of Kawhia.

In the urban and suburban areas of Cambridge, Leamington, Te Awamutu, Hairini, Kihikihi, Ohaupo, Pirongia and Kawhia Waipa's distribution assets are generally located within road reserve. In the rural areas of Tamahere, French Pass, Roto-O-Rangi and Kaipaki that surround Cambridge and in Paterangi, Pirongia, Pokuru, Kiokio, Waikeria, Pukeatua and Mystery Creek that surround Te Awamutu, whilst Waipa's distribution assets are generally located within road reserve, there are areas where these assets traverse private property as the most economical way to reticulate the area.

In the remote rural areas of Kawhia and Hauturu with low population densities there are significant areas where Waipa's assets traverse private property.

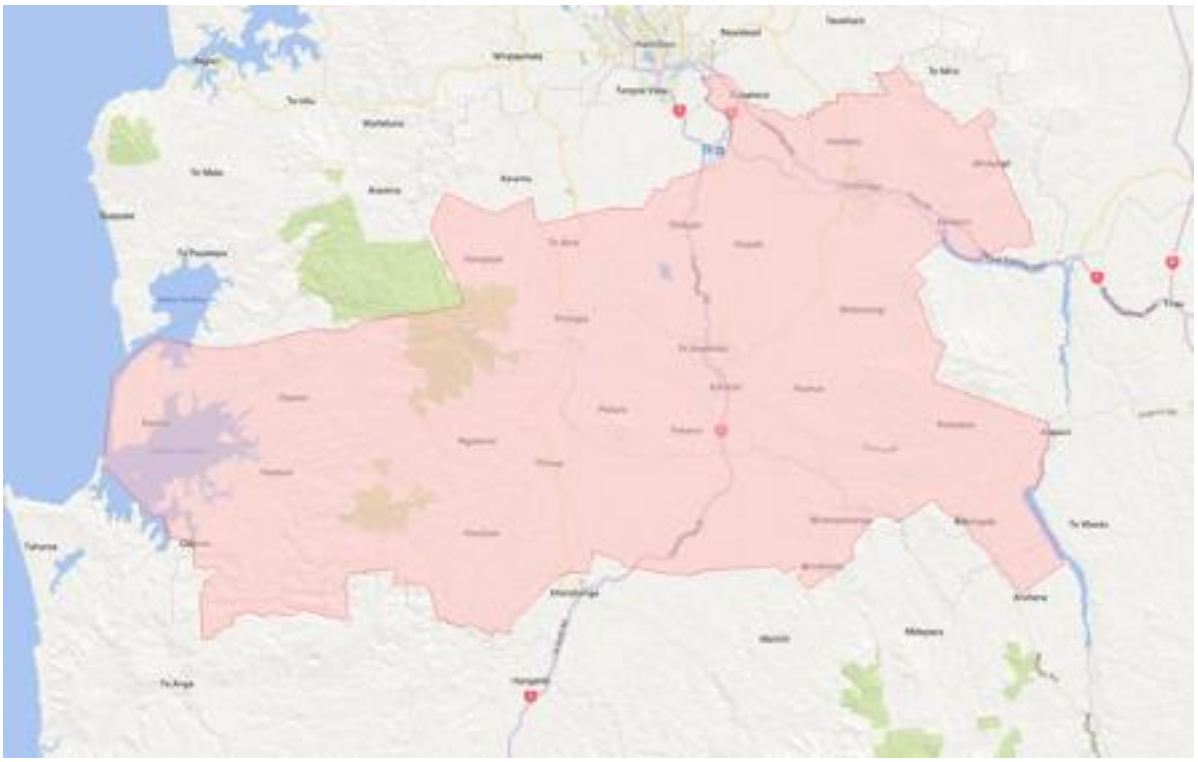


Figure 3:Extent of Waipa's network

Most of the peak load is related to the residential connections peaking in winter, as well as growth in connections over recent years. Similarly, higher demand in summer has resulted from dairy milking, processing and an increase in irrigation load resulting in relatively high summer maximum demands – particularly during prolonged dry and hot periods.

Urban areas

Te Awamutu and Cambridge contain a mix of residential, small commercial and industrial consumers. The maximum demands are predominately a result of winter heating in homes and typically occur between 7am to 11am and 4pm to 8pm during cold temperatures. In total, the towns of Te Awamutu and Cambridge represent approximately 43% of the total.

Residential load growth is growing despite increased use of energy efficient lighting and other appliances and the use of heat pumps rather than conventional heaters. But this general reduction in individual consumption is more than offset by growth in consumer ICP's. Typically, growth in residential ICP's has been constrained by availability of residential sections.

Waipa Networks area

The Waipa networks area is mainly flat but has a relatively high rainfall and a temperate climate that encourages rapid vegetation growth, leading to the need for tree trimming and vegetation control on a short return basis.

A limited number of lines located near the coastal margins are subject to salt spray. These lines require higher levels of inspection and maintenance, with special provisions required to minimise corrosion damage to conductors and transformers, as well as managing salt build-up on insulators and the potential spalling on concrete poles.

These various factors increase both the cost of construction and operation/maintenance of the network. They also reduce the overall operating efficiency of the network relative to installed capacity. The situation is exacerbated by the fact that revenue from more remote consumers does not meet the costs incurred and cross subsidies are required from the consumers in the economic areas.

Significant issues facing Waipa regarding reticulation in the network area are load growth and supply enhancement outstripping the voltage constrained capacity of 11kV feeders. Some of the existing lines are built on private or Government-owned land and constructed in the 1960s and 1970s, with access protected by wayleaves and the "existing works" provisions of the Electricity Act. Waipa has limited easements over line routes. Therefore, upgrades which necessitate changes to the existing layout or create an injurious effect on the land require new easements to be created. This is a challenging, often costly and time-consuming process. Any future major developments in the Waipa area will require very careful analysis and design of both asset and non-asset (e.g.; demand management) alternatives to ensure the optimal solutions are found.

In addition, environmental regulations and changes in line construction code requirements are now more stringent than when the lines were constructed.

Waipa has installed automatic switching devices (sectionalisers, reclosers, etc.) at various points along each of the radial spurs to minimise the areas affected by faults to the network. There is, however, a practical limit to the number of switching devices which can be installed. Over recent years the dedicated SCADA radio system linked to the devices has been expanded and will be further developed to enable increased bandwidth thus enabling remote control of switching devices within the network.

Many areas in the Waikato are subject to prolonged and/or intense rain and/or high wind events. Waipa has an on-going programme of vegetation control in an attempt to minimise interruptions caused by debris such as tree branches being blown across the lines. There are, however, practical limits to the amount of vegetation control which can be undertaken, particularly given the sensitive environment in which these lines are constructed and the distances that branches can be blown or the potential for trees to fall through lines. In some areas the lines have been constructed in environmentally sensitive areas and in others the lines have been surrounded by forestry planted subsequent to the construction of the lines.

Demographics and GDP

At the time of the last published Census (2018), the Waipa District (which comprises the majority of Waipa's network area) had a resident population of about 53,241 people, which was a 2.8% average annual increase from the 2013 Census. The key demographic implication for Waipa's network area is higher population growth.

At the time of writing, the Statistics NZ GDP figures[4] published for the Waikato region were up to Projected Year 2020 and show a small variation around a linear 11% growth trend as illustrated in Figure 4. From this, Waipa anticipates that relatively constant consumer connection growth at the historic average levels will continue over the planning period.

[4] From stats.govt.nz Regional Gross Domestic Product, March 2020.

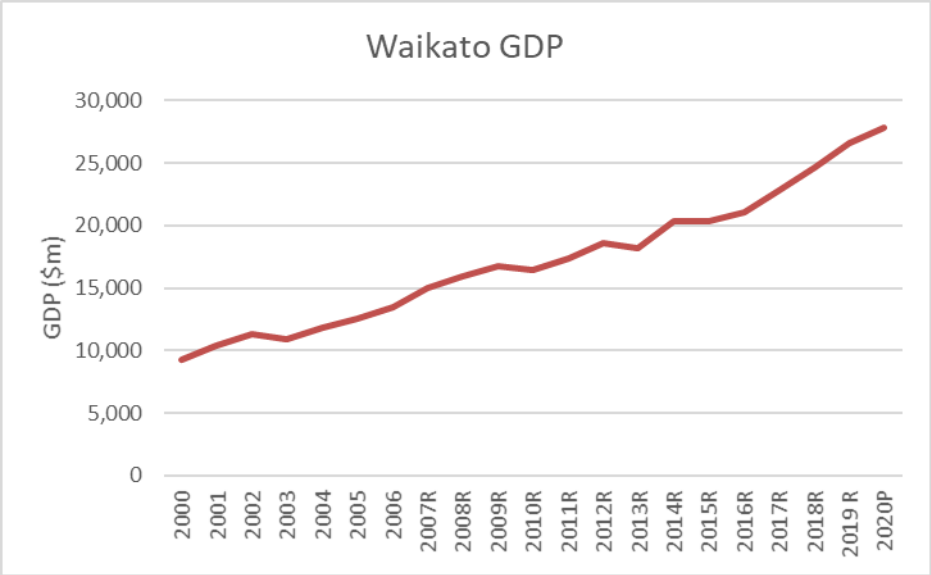


Figure 4: Waikato Region GDP

Issues that may impact economic activity in Waipa's area include:

- Markets for dairy products.
- Government policies on land use, particularly in relation to forestry, water use/quality and climate change.
- Access to water for crop and stock irrigation.

The impact of these issues on Waipa's electricity distribution business is broadly set out in Table 1.

Key Economic Activities

The key economic activities in Waipa's network area include:

- Dairying.
- Food (particularly milk) processing.
- Tourism.
- Correctional facilities.
- Pastoral farming.
- Engineering manufacturing.

The area's economy is therefore strongly influenced by any sustained climate change which impacts on the agriculture industries.

Table 1: Economic influences and impacts on the network

Issue	Impact
Shifts in market demand for milk	Currently there is strong international demand for milk with two large milk processing factories and significant dairy farming activities on Waipa's network. Electricity use from this sector is reasonably static, but changes in milk demand may alter this.
Government policy on nitrogen-based farming	May lead to contraction of dairy shed demand. May lead to contraction of dairy processing demand.
Milk prices	A return to higher prices may lead to further conversion of pastoral land to dairying and subsequent increases in demand, although this now appears unlikely due to environmental concerns and alternative high value land uses. Maintaining levels or reduction of prices are unlikely to have much effect unless prices fell to a level where

	production was uneconomic.
Climate change increases frequency of droughts	May lead to increased irrigation demand.
Lack of generation and/or electricity supply nationally	Very unlikely in the current environment.
Increase in distributed generation including photovoltaic installation on consumer premises	This trend can be expected to continue especially as the costs reduce. This has the potential to diminish electricity distributed over the network and ultimately may necessitate changes to Waipa's pricing structure to ensure equity and fairness by greater recovery of costs on a fixed or capacity basis.
Major storm	The likelihood of future major storm events remains a threat. A major storm has the potential to cause significant disruption to both Waipa's network and the area's economy, particularly in relation to dairy production. Within practical limits, Waipa has sought to insulate its network and operations from the effects of major disaster and has emergency preparedness plans.

Low probability outcomes are considered and addressed within Waipa's risk management framework.

Other drivers of electricity use

Other drivers of electricity use include:

- Low temperatures during winter where frosts can occur in significant areas of Waipa's network.
- The use of heat pumps as air conditioners in the summer.
- Increased utilisation of electricity, as polluting sources of energy, such as coal and wood are phased out. Climate change targets related to decarbonisation of industrial process heat may cause electrification of dairy factories with large increases in demand as a result, although indications are that use of biomass will dominate, with selective use of industrial heat pumps for low-grade process heat.
- Charging of electric vehicles (EVs) becoming more prevalent.

This AMP anticipates regional climate and appliance utilisation to exhibit similar trends to the past. Waipa's planning response to higher electric vehicle up-take is discussed under asset strategy but is not expected to impact the network to any significant extent within this planning period, largely due to expected gradual take-up and efficient load management.

Large Consumers

Waipa supplies two large Fonterra dairy factories located at Hautapu and Te Awamutu. The Hautapu factory is 7 km from Cambridge GXP and is supplied via two dedicated 11kV overhead line feeders. The Te Awamutu factory is located 2km from Te Awamutu GXP and is supplied via two dedicated 11kV cable feeders. Fonterra contracts every year with Waipa for each factory's maximum demand (MD) requirement. Currently, Hautapu maximum demand does not exceed 10.5MW and Te Awamutu MD does not exceed 4.5MW.

Fonterra's MD requirements have a significant impact on Waipa's system peak load control regime and available capacity at Transpower's Cambridge and Te Awamutu GXPs.

A new Stage 1 network supply has been constructed for Architectural Profiles Limited (APL) from the Cambridge GXP to their new glass and aluminium joinery factory at Hautapu. The APL Stage 1

load addition in combination with organic load growth requires a significant upgrade to GXP capacity. Subsequent stages could add another 10 - 12 MVA of load, requiring a new industrial zone substation at Hautapu in conjunction with the GXP capacity upgrade.

Table 2 summarises Waipa's five largest electricity consumer groups. Generally, the load on the network consists of a large number of smaller consumers and while the loss of any large load would affect operation of the network, the effect would be relatively minor compared to the overall impact of changes to the economy, or a decline in one of the significant regional industries. For example, an overall sustained downturn in the dairy industry would have a much greater effect on the operation and development of Waipa, than the loss or gain of two or three of the largest consumers.

Table 2: Five largest consumer groups

Ranking by size	Nature of business	Nature of demand
1	Dairy processing	Dairy season variation – short winter down period
2	Combined dairy milking	Dairy season variation – short winter down period
3	Manufacturing	Constant throughout year
4	Food processing	Constant throughout year
5	Small residential and commercial	Seasonal heating variation, some influence of summer air conditioning

Regional Risks

Earthquake (including liquefaction and tsunami)

Earthquake risk in the Waipa network area is ranked as medium risk in Transpower's category ranking system. However, a significant earthquake in the Waikato region is expected to result in widespread liquefaction similar to found in Canterbury.

Tsunami risk is considered minor, due to both the small area and the degree of the network exposed to the West Coast. A very significant and rare earthquake on the Puyseger Trench (to the South and West of the South Island) could cause some inundation to settlements at Aotea and Kawhia, requiring remediation of a relatively small number of ground mounted assets.

Significant adverse weather events

While infrequent, Waipa is not immune to extreme weather events. Waipa's network is in an area of New Zealand that has one of the lowest recorded average wind speeds. However, seasonal storms have winds that blow debris into the overhead lines annually. In more major storms, such as Cyclone Bola and the 2003 "weather bomb" the network suffered numerous outages with significant damage caused by trees well outside the regulatory growth limit zone being blown over the lines and restoration works were substantial.

3.2 Network and demand

Consumers and load serviced

In FY2020/21, the network delivered 419GWh of electricity to approximately 27,720 connected consumers. The maximum coincident (instantaneous) system demand was 90MW with a load factor of 53%.

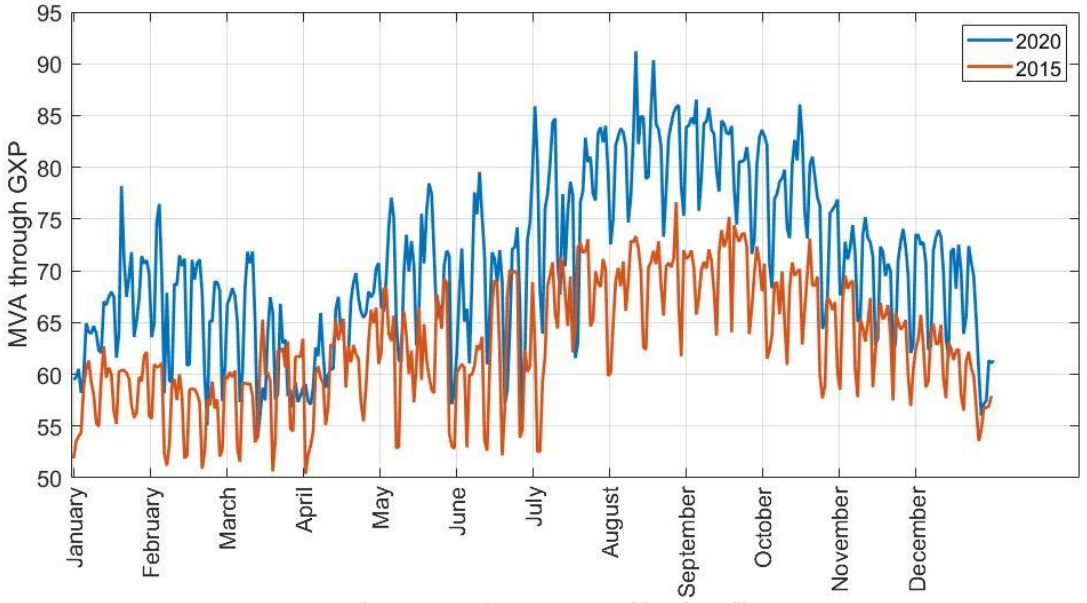
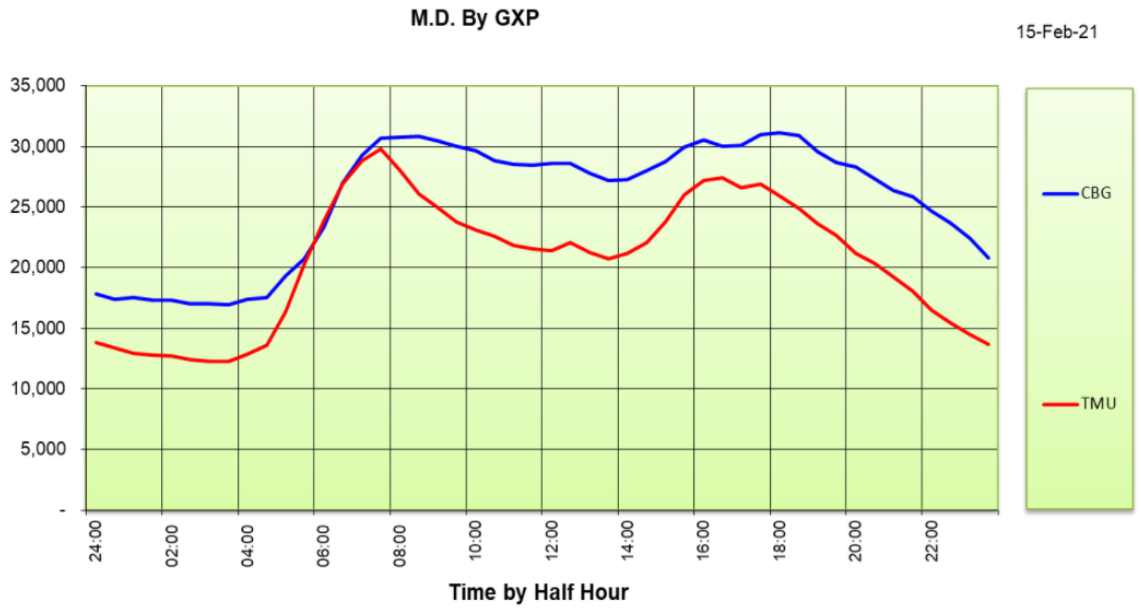


Figure 5: Waipa's seasonal load profile

Waipa's seasonal load profile is largely driven by winter residential and commercial load combined with the ramp up of dairy load in August and September. Maximum demand in summer months is typically subject to dairy milking load dependant on production. This is reflected in Figure 5, which shows the winter peak. There has been significant load growth in the combined GXP load between 2015 to 2021.

Waipa's daily load profile, especially in winter, consists of twin peaks; one in the morning and then again at night. Load management utilising ripple control is applied when appropriate. Generally, the Waipa network is not capacity constrained, but voltage limits are becoming apparent at peak times and during back feed situations. The summer day profile shown in Figure 6 follows this pattern with peaks driven by dairy milking times, underpinned by the baseload dairy processing load.



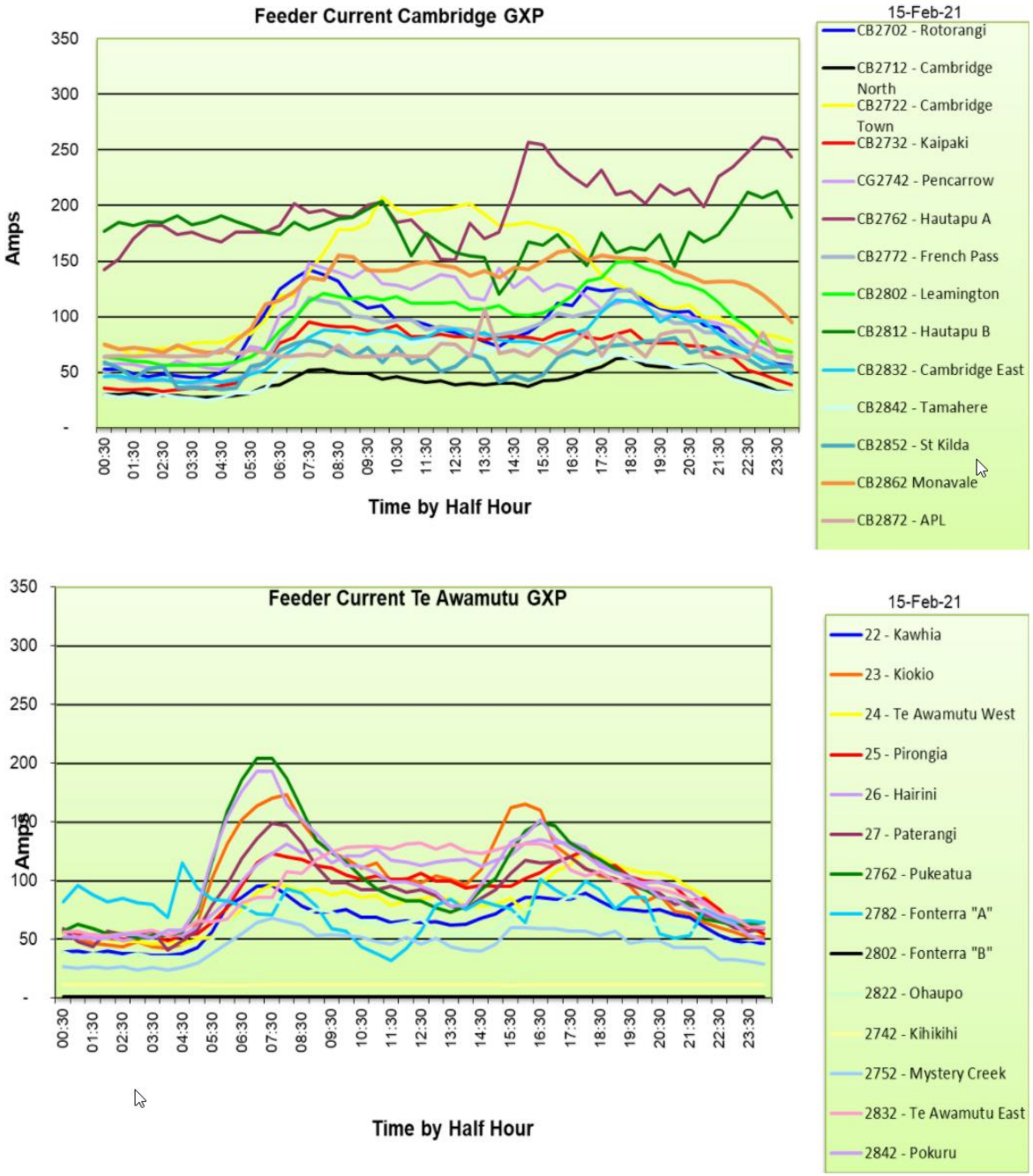


Figure 6: Daily GXP and feeder load profile

Network servicing consumers

Waipa distributes electricity throughout the Waipa region to more than 27,720 consumers (ICPs) on behalf of 15 energy retailers. Figure 7 indicates Waipa's position as operating the distribution function in the electricity supply industry.

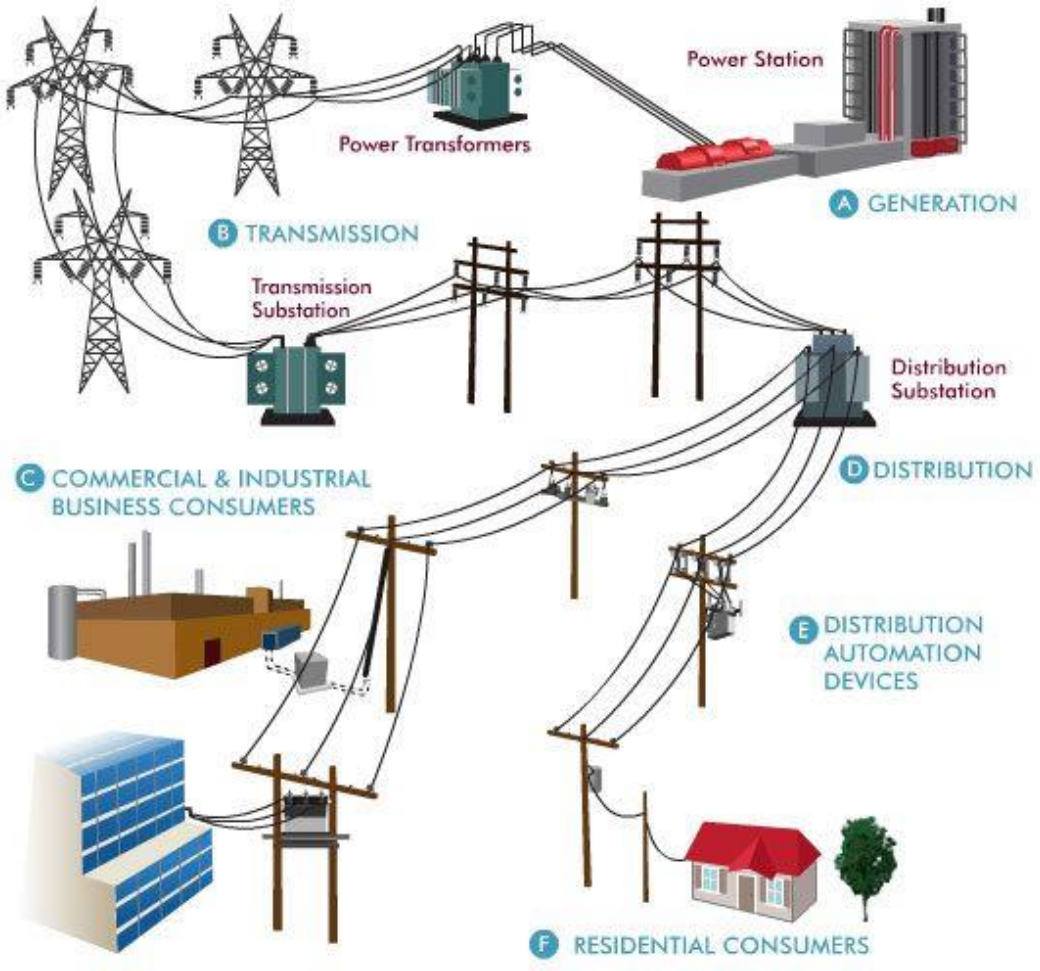


Figure 7: Illustration of the New Zealand electrical supply industry

Background to Waipa's network

Waipa's network originally began as two historically distinct networks:

- The Te Awamutu Power Board, which was established in 1919
- The Cambridge Borough Council electricity department.

In 1993 the company was corporatised and became a company trading as Waipa Power, later being renamed as Waipa Networks Limited in 1998 with the shares held by the Waipa Networks Trust. The beneficiaries of the Trust are the consumers connected to the Waipa network.

3.3 Supply within Waipa's network

Cambridge Network Configuration

There are fourteen 800A rated 11kV circuit breakers supplying radial urban and rural feeders including two feeders supplying a Fonterra dairy factory at Hautapu and one feeder supplying the APL glass factory.

The fourteen 11kV interconnected radial urban and rural feeders are predominately concrete pole lines. These lines, in conjunction with their associated 400V reticulation, supply Cambridge, its suburbs and rural areas adjacent to the Waikato River from Lake Karapiro to Tamahere on the outskirts of Hamilton.

In the urban and suburban areas there is a moderate amount of underground reticulation with pad mounted transformers and pad mounted switchgear.

Te Awamutu Network Configuration

There are fifteen 1250A and 630A rated 11kV circuit breakers supplying radial urban and rural feeders including two feeders supplying a Fonterra dairy factory in Te Awamutu and one feeder supplying the Department of Corrections Waikeria Prison.

The fifteen 11kV interconnected radial urban and rural feeders are predominately concrete pole lines. These lines, in conjunction with their associated 400V reticulation, supply Te Awamutu's urban, suburban and rural areas north to Mystery Creek, south-east to Arapuni, south towards Otorohanga and west to Paterangi, Pirongia, Pokuru and Kawhia.

Two underground cable circuits supply the Fonterra dairy factory. In the urban and suburban areas there is a moderate amount of underground reticulation with pad mounted transformers and pad mounted switchgear.

Distribution Network Characteristics

The 11kV supplies from Cambridge and Te Awamutu GXPs are not configured to be interconnected. There is an 11kV interconnection point to WEL Networks in the Te Pahu area, established to assist WEL with network conductor renewal in that area.

Waipa's legacy distribution substations are predominately pole mounted transformers (up to 200kVA on two pole structures or up to 100kVA on single pole structures) and metal clad pad mount substations (up to 750kVA) in the urban and suburban areas.

Newly commissioned substations are either metal clad pad mounted (typically 50kVA up to 300kVA) or pole mounted up to 100kVA as permitted by the respective District Council Plan requirements.

Waipa's legacy 400V reticulation is predominately overhead except for urban areas. New 400V reticulation is generally underground as required by the respective District Council Plans except for rural and remote rural areas where overhead reticulation is permitted on economic grounds.

Waipa's distribution system comprises (as at 31 March 2021):

Cambridge Area

- 14 11kV feeder circuits connected to Cambridge GXP,
- 461km 11kV circuit (338km overhead line, 123km underground cable),
- 346km 400V circuit (150km overhead line, 196km underground cable),
- 1, 442 11kV/400V transformers (137,657kVA capacity) and
- 6, 974 Poles (6,029 - Concrete, 945 – Wooden, 14% of the total).

Te Awamutu Area

- 15 11kV feeder circuits connected to Te Awamutu GXP,
- 933km 11kV circuit (890km overhead line, 44km underground cable),
- 491km 400V circuit (355km overhead line, 136km underground cable),
- 2,178 11kV/400V transformers (141,059kVA capacity) and

- 15,122 Poles (14,530 – Concrete, 592 – Wooden, 4% of the total).

System switching, isolation and protection are achieved via Transpower's GXP circuit breakers and Waipa's ring main units, line auto reclosers and sectionalisers, disconnectors, 11kV dropout fuses and 400V fuses.

A SCADA system and radio communication system enables remote monitoring and control of distribution switchgear and voltage regulators, and remote monitoring and control of GXP feeder circuit breakers.

Two 11kV ripple injection plants and receiving relays at consumers' installations enable implementation of energy retailers' tariffs, control of street lighting and management of feeder loads and GXP maximum demands.

Transpower point of supply/transmission lines

Waipa takes supply from Transpower's Cambridge and Te Awamutu GXPs at 11kV. Waipa has no 33kV or higher voltages operating as a sub-transmission system or zone substations. However, due to continuous growth and major loads connecting to the network, development plans are underway to establish a sub-transmission system in Cambridge to maintain reliability, security, and continuity of supply. The Hangatiki to Te Awamutu 110kV line is a Waipa Networks owned transmission asset to provide the required n-1 security for Te Awamutu GXP and was commissioned in 2016.

Cambridge

Transpower owns the 110kV line assets, the 110kV/11kV transformers and 11kV switchboard to which Waipa's 11kV feeders are connected. Cambridge GXP is supplied via a double circuit 110kV line from Karapiro to Hamilton and has a 47MVA n-1 security of supply capacity. There are two 40MVA ODAF transformers at Cambridge giving a total installed capacity of 80MVA and a firm capacity of 47MVA with recent protection upgrade work by Transpower and the installation of a feeder load shedding scheme. These transformers operate in parallel and supply an 11kV bus bar via two incoming circuit breakers. However, the 11kV incomers and bus bar are only rated at 2500A or 47.9MVA.

Te Awamutu

Transpower owns the 110kV line assets, the 110kV/11kV transformers and 11kV switchboards to which Waipa Networks Te Awamutu 11kV feeders are connected. Te Awamutu GXP is supplied via a single circuit Transpower 110kV transmission line from Karapiro and a single circuit 110kV transmission line from Hangatiki owned by Waipa Networks.

Te Awamutu also has 7.5MVA of embedded generation (typically operating at 4 to 5 MW) at the Fonterra dairy factory site which is connected to the Transpower's Te Awamutu GXP via 11kV supply cables.

There are two 40MVA OFAF transformers at Te Awamutu giving a total installed capacity of 80MVA and a firm capacity of 41MVA. In 2022 Transpower will complete a protection upgrade that will increase the transformer capacity to 52MVA (summer) and 54MVA (winter). These transformers operate in parallel and supply two 11kV bus bars via four incoming circuit breakers. There are twelve 630A rated 11kV circuit breakers supplying radial urban and rural feeders and two 1250A rated 11kV circuit breakers supplying Fonterra dairy factory site in Te Awamutu.

From the Transpower 11kV circuit breakers supply is distributed to Waipa's 29 feeders. Historical Anytime Maximum Demands (AMD) and total energy conveyed through Transpower's Cambridge and Te Awamutu GXPs sourced from metering data are shown in the following table.

Year	Cambridge GXP		Te Awamutu GXP	
	Units (GWh)	AMD (MW)	Units (GWh)	AMD (MW)
1996	129.54	25.11	143.48	29.12
1997	139.74	26.54	144.37	28.20
1998	144.74	25.43	145.12	29.26
1999	146.32	29.05	142.73	29.96
2000	154.10	27.84	141.44	25.96
2001	159.94	30.07	142.34	26.83
2002	170.43	30.49	149.95	26.21
2003	170.92	29.30	152.08	27.38
2004	169.95	28.10	153.40	27.38
2005	178.86	27.93	155.85	28.11
2006	180.61	30.94	155.77	30.01
2007	186.49	31.84	156.54	28.48
2008	183.33	30.06	158.88	28.87
2009	183.14	32.67	158.77	28.70
2010	195.08	33.20	166.40	29.40
2011	188.70	38.98	167.86	37.30
2012	199.21	36.93	171.29	35.52
2013	202.24	36.11	174.12	34.05
2014	197.46	34.87	172.80	33.38
2015	203.59	39.22	173.45	33.73
2016	214.50	39.38	181.39	34.83
2017	211.45	39.36	182.67	35.19
2018	217.10	37.88	186.19	36.16
2019	220.52	38.90	192.44	38.23
2020	221.21	39.91	189.79	37.50
2021	226.61	47.93*	192.11	37.67

Table 3: GXP load growth

***Actual AMD after load control is lower than this. The increase was seen at the time of no ripple control.**

Distributed generation on consumer premises

Consumer interest is expected to grow as the affordability of distributed generation (DG) systems improves. This is becoming particularly apparent with solar PV installations, where falling costs of photovoltaic panels, greater availability of battery storage solutions and the rise of subscription-based ownership has resulted in another 0.98MWof distributed generation onto Waipa's network in 2021.

Waipa connected 95 new distributed generation installations in 2021. The increase in total installation capacity is due to the average capacity increase of the distributed generation installations. As shown in Figure 8, DG uptake (dominated by small scale solar PV) has increased since 2014, however, this has been influenced by the development of the St Kilda subdivision in Cambridge, where the developer required the connection of at least 3kW of solar DG at every house. The influence of the St Kilda subdivision can be seen in Figure 9, showing that St Kilda

accounts for circa one-third of all DG connections. Some consumers in the Waipa area are opting to offset their electricity consumption through the installation of Distributed Generation (DG) at their premises, but this is more subdued than in other areas of New Zealand. Waipa continues to receive applications for such generation systems, both small-scale (<=10kW) and large-scale (>10kW).

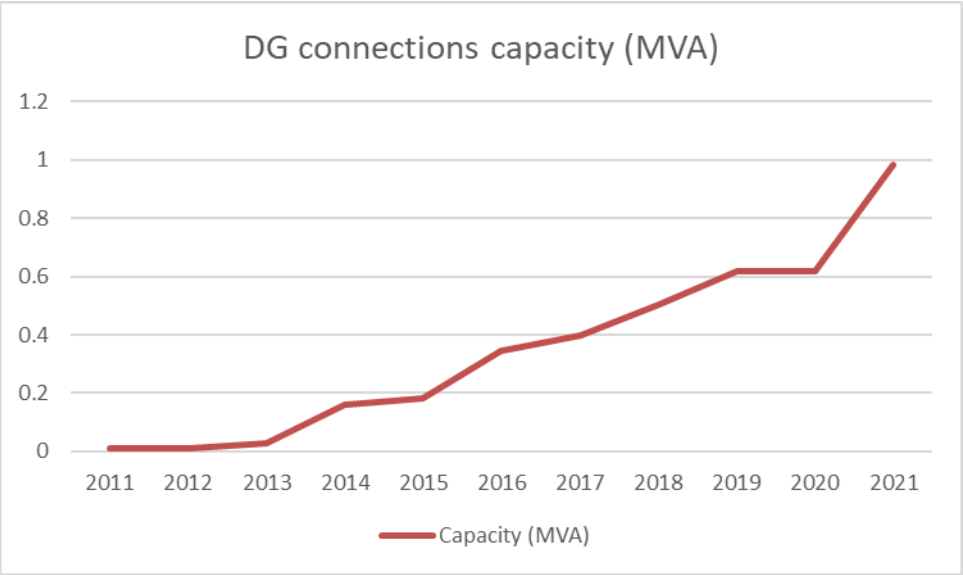


Figure 8: DG installed capacity per year

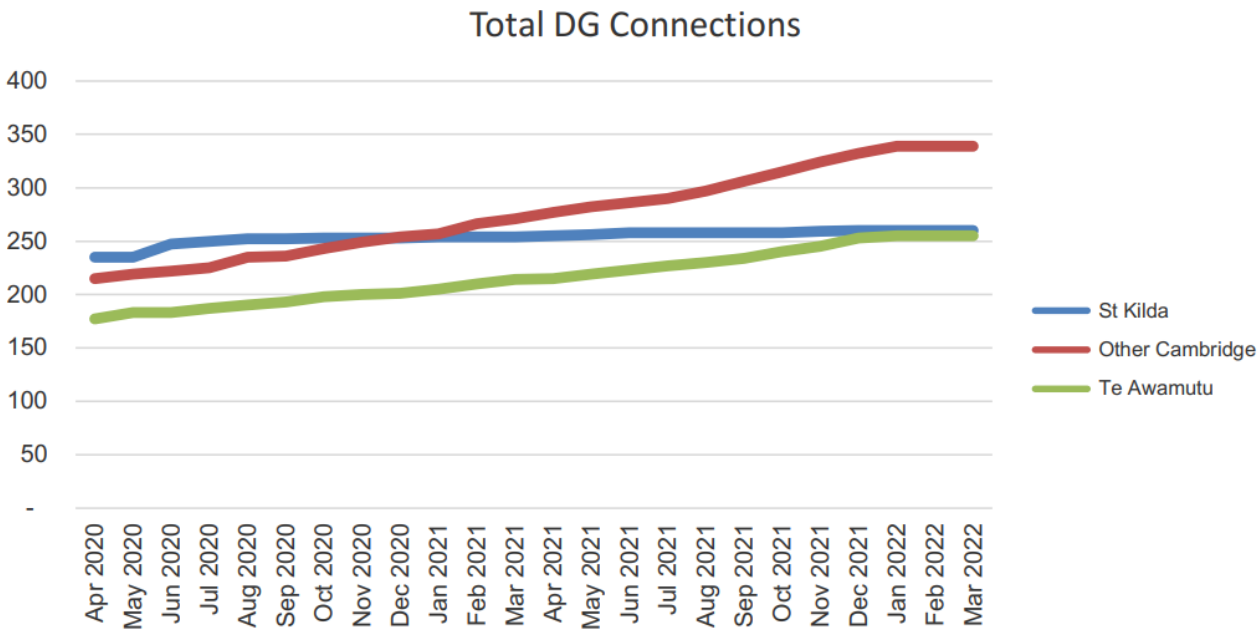


Figure 9: DG connections by location

As at 31 January 2022, Waipa is aware of the following distributed energy resources connected to its network:

- 818 small scale DG installations (<10kW).
- 38 large-scale DG installations.

A number of consumers with large or sensitive loads also have standby generation available for back-up purposes and/or demand management. These are typically diesel generators ranging from

10kW up to 1MW. Notable examples include communications sites, District Council water infrastructure and the Waikeria Prison.

Waipa Generation

On some occasions a small amount of electricity is exported at 11kV by the embedded co-generator at the Fonterra dairy factory in Te Awamutu, but typically the site imports approximately 1-2 MW and generates the balance of the site load.

The implications of distributed generation (DG) on Waipa's asset management and network operation are ensuring the network voltage regulation is properly managed due to voltage rise particularly on low voltage networks; that the effects of the generation on the line protection arrangements are properly considered; that maintenance/fault work on the associated lines can be undertaken safely; and that Waipa does not become unduly constrained in its ability to manage its network.

Distribution system

Waipa operates an 11kV distribution network which is largely radial with interconnections in urban and higher density rural areas. Approximately 11% of the 11kV (by line length) is underground. The total length of cable and conductor operating at 11kV is approximately 1,395km.

Generally, underground cable is considerably more expensive to purchase and install than overhead line. The decision whether underground cable is more appropriate than overhead conductor involves several factors, for example surrounding land use, safety, public amenity, risk avoidance and economic considerations.

Some other key features of the 11kV system include:

- Lightning protection is generally installed on all underground to overhead transitions and in areas prone to lightning.
- Distribution substations are installed to step down the voltage from 11kV to 400V/230V in locations appropriate to service consumers' needs.
- Protection devices are installed across the network. The selection of locations for protection devices involves consideration of several factors such as downstream consumers, location and cost.

Distribution substations

In rural areas, the distance between consumers and voltage typically limits the utilisation of low voltage lines. Also, 11kV lines are generally built with a pole spacing of 80m to 100m on the flat and a greater distance depending on the terrain. in many rural areas, pole spacing and consumer locations result in consumers having individual transformers with less use of an LV conductor.

Low voltage network

Waipa operates a 400V (LV) reticulation network totalling approximately 837km. There is some meshing in urban business district areas. About 41% (by length) of the LV is underground.

The LV network supplies the bulk of the ICPs, the majority of which are domestic consumers (i.e., residential properties) in urban areas. Typically, LV supply to ICPs in most cases is single or two phase but can be three phase depending on the supply for the area and the needs of the consumer.

Ripple control, SCADA and communications

Waipa's ripple control system is utilised for the management of loads such as water heating and the control of streetlights.

Whilst Waipa's network is generally not constrained, the ripple control system is used to minimise the transmission charges resulting from peak loads at the Transpower GXPs. The ripple control system also continues to make a valuable contribution managing load within the network to avoid network constraints on peaks.

Waipa owns and operates two ripple injection plants located at Cambridge GXP and Te Awamutu GXP respectively. The Cambridge ripple injection plant is located in Waipa Networks' building at the GXP, which was refurbished and seismically strengthened in 2016. The Te Awamutu ripple injection plant is located in a separate room within Transpower's Te Awamutu GXP switch room. Ripple injection signals are initiated by the SCADA system via these plants to control load, street lighting and metering tariffs. Waipa also owns the receiving relays in consumers' installations.

SCADA

SCADA covers all of the distribution feeders. This system allows monitoring and control of the network remotely. Communication for SCADA consists of dedicated radio equipment, as well as use of internet and cell phones and including voice radio.

Major asset groups

Table 4 presents a summary of Waipa's major asset groups.

Table 4: Waipa's major asset classes (RAB values from 20201 Information Disclosure)

Type		Number	Average remaining age (years)	RAB $000
110kV transmission lines (km)		36	52	18,883
Distribution and LV lines (km)		1,733	28	28,076
Distribution and LV cables (km)		498	28	23,646
Distribution transformers		3,620	27	30,186
Distribution switchgear		5,585	22	17,750
Other network assets		-	20	5,450
Non network assets		-	17	3,038
Total				126,979

4. Stakeholder interests and objectives alignment

This section of the AMP sets out the various stakeholder interests and the alignment of those interests with Waipa's asset management objectives.

4.1 Stakeholder interests

Waipa defines its stakeholders as any person or class of persons that:

- Has a financial interest in Waipa (equity or debt).
- Pays money to Waipa (either directly or through an intermediary) for delivering service levels.
- Is physically connected to the network.
- Uses the network for conveying electricity.
- Has an interest in land on which Waipa's assets are located.
- Has an interest in land that provides access to Waipa's assets.
- Supplies Waipa with goods or services.
- Is affected by the existence, nature or condition of the network (especially if it is in an unsafe condition).
- Has a statutory obligation to perform an activity in relation to the network's existence or operation such as: request disclosure data, regulate prices, investigate accidents, investigate consumer complaints, operate infrastructure dependent on the network, prepare for and manage emergency situations, include in a District Plan, protect archaeological sites, Wahi Tapu sites, etc.
- Has an interest in the safety of the network.
- Is employed by Waipa.

Table 5 highlights Waipa's key internal and external stakeholder groups as well as the nature of their relationships with Waipa.

Table 5: Our key internal and external stakeholders

Stakeholders	Relationship / Interface	Nature of Interest
Electricity consumers	Beneficiaries of Waipa Networks Trust Independent surveys Consultation meetings Daily direct and indirect feedback	Fault services, Network reliability Quality of supply, Controlled supply New connections, Safety disconnects Service requests, Bi-annual discount Cost of supply
Fonterra Architectural Profiles Limited (APL) Aotearoa Developments Department of Corrections Major subdivision developers	Conveyance agreements where applicable Ad-hoc meetings	Future demand plans, Network capacity, Network reliability, Quality of supply, Cost of supply
Waipa Networks Trust	Shareholder Six monthly meetings	Return on investment Bi-annual discount Sustainable business Responsible corporate behaviour KPIs
Electricity Retailers	Interposed use-of-system agreements Ad-hoc meetings	Line charges and methodology Line losses, Revenue protection Billing accuracy and timeliness Retailer services Quality of supply and reliability

Waipa, Otorohanga, Waikato & Waitomo District Councils, Waikato Regional Council	Utility service provider Road requirements Regular meetings RMA / Planning	District & Regional planning Traffic management Utility services locations Co-ordinated street openings
Waka Kotahi/NZTA, KiwiRail	Road user requirements Rail asset owner requirements Correspondence, ad-hoc meetings	Traffic management Street lighting Utility services locations Electrical interference & safety clearances
Other utility operators	Road user requirements Ad-hoc meetings	Utility services locations
Transpower	Transmission Pricing Agreement Customer Investment Contracts Quarterly meetings System Operator regarding operation of HTI-TMU 110kV line	Capacity, reliability and maintenance of grid transmission and connection assets including HTI-TMU 110kV line Security of transmission lines Code compliance at GXP interface
Electricity Authority Commerce Commission MBIE Auditor General Inland Revenue	Electricity Distribution Business Legal operating framework Ad-hoc meetings, discussions and correspondence	Information Disclosure compliance Threshold compliance Compliant business practices Submissions on proposals
Industry Suppliers	Goods & services provider	Products and services
Iwi	Network developments and resource consenting applications in the network area, via meetings as required	Tangata whenua consultation regarding resource consents, network developments and works affecting wai tapu. Network service to iwi constituents.
Waipa Employees	In house Company work force	Zero injuries Healthy employment environment Remuneration Individual training plans Personal growth opportunities
Contractors	Working on the Waipa Networks assets or for customers on assets that connect to the network	Providing services and getting access to the network for connections, inspections etc.
Utility Disputes (formerly the Electricity & Gas Complaints Commission)	Customer complaints	Customer complaints
Ultrafast Fibre	Shared use of Assets	Attachment of ADSS fibre cable to Waipa poles
Chorus	Shared use of Assets	Attachment of copper and fibre cables to Waipa poles. Attachment of electricity lines to Chorus network poles.
National Emergency Management Agency	Lifeline utility emergency preparedness Waikato Lifeline Utility Group meetings	Emergency preparedness and risk management related to maintaining electricity supply during natural disasters.

Table 6 also gives a general indication of the most significant interests of various stakeholders. Most stakeholders generally have an interest in all aspects of the business.

Table 6: Summary of Waipa's stakeholders with respect to the interests shown

Stakeholder	Interests					
	Viability	**Price**	**Supply Quality /Reliability**	**Safety**	**Compliance**	**Energy Efficiency**
Waipa Networks Trust	✓	✓	✓	✓	✓	✓
Bankers	✓	✓		✓	✓	
Connected Consumers	✓	✓	✓	✓	✓	✓
Energy Retailers	✓	✓	✓	✓	✓	✓
Mass-market Rep Groups	✓	✓	✓	✓	✓	✓
Industry Rep Groups	✓	✓	✓	✓	✓	
Employees and Contractors	✓	✓	✓	✓	✓	✓
Goods and Services Suppliers	✓	✓	✓	✓	✓	✓
Contractors	✓	✓		✓	✓	
Public			✓	✓	✓	
Iwi		✓	✓	✓	✓	
Landowners				✓	✓	
Councils (as regulators)				✓	✓	✓
NZTA (Waipa's Roads)				✓	✓	
MBIE	✓	✓	✓	✓	✓	✓
Energy Safety/WorkSafe				✓	✓	
EECA					✓	✓
Commerce Commission	✓	✓	✓	✓	✓	✓
Electricity Authority	✓	✓	✓	✓	✓	✓
Utilities Disputes		✓	✓		✓	

4.2 Stakeholder engagement

Table 7 sets out those stakeholders that Waipa's typically engages with, and the ways in which it engages to formulate business objectives that meet varied and numerous requirements.

Table 7: Summary of Waipa's stakeholder engagements

Stakeholder	How Expectations are Identified
Waipa Networks Trust	By its approval or amendment of the SCI. Regular meetings between the Waipa Networks directors and the Waipa Networks Trust trustees.
Bankers	Regular meetings between the bankers and Waipa's staff. Adherence to Waipa's Treasury policy.
Connected Consumers	Discussions with large industrial consumers. Consumer satisfaction surveys. Public disclosure documents including this AMP. Connection newsletters. Website.
District Councils	Consultation with regard to Council development plans and long-term plan Engagement with regard to AMP and network development
Energy Retailers	Annual consultation with retailers, regular contact and discussion.
Mass-market Representative Groups	Informal contact with group representatives.
Industry Representative Groups	Informal contact with group representatives. WorkSafe website. Safety bulletins from Electricity Engineers Association. Exchange and contribution towards industry best practice.
Employees and Contractors	Employee briefings and meetings with contractors.
Suppliers of Goods and Services	Regular supply meetings. Written communication.
Public (as distinct from consumers)	Informal talk and contact. Feedback from public meetings. Information made available on Waipa's website and social media channels (including how to stay safe and how to report network damage). Press releases and articles in local newspapers.
Landowners	Individual discussions as required.
Councils (as regulators)	Formally, as necessary, to discuss issues such as assets on Council land.
Iwi Ngāti Hauā, Ngāti Korokī Kahukura, Raukawa, Maniapoto, Waikato	Formally, informally and as required.
Waka Kotahi/NZTA, Kiwirail	Formally, and as required.
MBIE	Regular bulletins on various matters. Release of discussion papers. Analysis of submissions on discussion papers.
Energy Safety/WorkSafe	Promulgated regulations and codes of practice. WorkSafe website. Audits of Waipa's activities. Audit reports from other EDBs.
Commerce Commission	Regular bulletins on various matters. Release of discussion papers and direct communications. Analysis of submissions on discussion papers. Conferences following submission process.
Electricity Authority	Weekly update. Release of discussion papers.

	Briefing sessions. Analysis of submissions on discussion papers. Conferences following submission process. Information on Electricity Authority's website.
Utilities Disputes	Reviewing their decisions in regard to other EDBs. Assistance with any complaint investigations.

This stakeholder engagement, both formal and informal, underpins Waipa's response in setting its objectives as discussed subsequently. Waipa is a Trust-owned business and the consumers directly elect the Trustees. In turn the Trustees appoint the Directors, approve the annual Statement of Corporate Intent (SCI) and receive Waipa's Annual Report and accounts.

Waipa Networks will issue this AMP to and consult with the following stakeholders on an annual basis as a consultation and feedback mechanism:

- Waipa District Council
- Waikato District Council
- Otorohanga District Council
- Waitomo District Council
- Waikato Regional Council
- Fonterra
- Architectural Profiles Limited (APL)
- Aotearoa Developments
- Major subdivision developers
- Transpower
- National Emergency Management Agency

4.3 Business and planning response

Waipa's AMP is the key document that translates Waipa's data, analysis, procedures, policies and strategic aims into planned actions and defines performance criteria and timeframes. It is also used as a means of communicating Waipa's intentions to stakeholders.

Waipa, as a supplier of electricity lines services, is included within Part 4 of the Commerce Act 1986. The Commerce Commission has regulatory oversight of the Waipa network through Waipa being subject to information disclosure regulation, including monitoring levels of return on investment. However, as a Trust-owned business, Waipa is exempt from the default price/quality path requirements of the Commerce Commission.

The Statement of Corporate Intent (SCI) is derived from the AMP, Annual Plan and full financial budgets. The SCI sets agreed KPIs for Waipa's key physical and financial performance targets. The SCI is approved and adopted by the Waipa Networks Trust (Waipa's shareholder) by 31 May each year.

Company Directors report to Waipa Networks Trust in June and December on Waipa's actual physical and financial performance against the SCI targets. A gap analysis on significant variances provides an important input for Directors and Executive Management in reviewing strategic direction of the company.

Strategic Planning Documents

Waipa's key strategic planning documents are constructed around its purpose and mission statements.

Our purpose:

- **To actively deliver better energy outcomes for our community and businesses.**

Our mission:

- **To improve the lives of our connected customers through emerging and existing energy network-related solutions.**

Our objectives:

- Deliver power safely all day every day.
- Facilitating energy use not just a connection.
- Building a sustainable business by establishing energy communities in the Waipa region.
- Extend the availability of existing and new energy products from pilot projects to the broader community.

The primary objective of Waipa is to be a successful business. It will do this by:

- Providing customers with outstanding service and solutions.
- Providing value for money.
- Operating in an environmentally friendly and sustainable fashion.
- Being aware of technological changes which could impact the business model.
- Pricing Line Function Services to ensure connected consumers are charged equitably to achieve sustainable profit levels.
- Having regard to the efficient use of energy.

Waipa seeks to be a high performing lines company exercising a philosophy appropriate to its ownership structure, a safe and good employer, and a good corporate citizen.

The Strategic Plan has identified Asset Management as a fundamental component for achieving this. Specifically, the strategic vision that the asset management team is responsible for delivering includes:

- **Keep abreast of technology with the ability to impact on our business, develop strategies to respond appropriately to these challenges and exploit the opportunities they present.**
- **Ensure the appropriate addition of new distribution capacity matched to actual and forecast market demand.**
- **Incorporate consideration of non-network solutions, demand management and developing technologies when formulating network development plans..**
- **Focus on reducing operating costs and optimising use of capital to achieve commercial efficiency and effectiveness while at all times providing outstanding service and solutions.**
- **Prudently manage assets, liabilities, risks and costs.**

The orange bullet points items above are specific items that the Board needs to see demonstrated for commercial outcomes in the AMP. Waipa Networks' principal focus remains delivering safe,

reliable and efficient electricity lines services. The regulatory construct that bounds Waipa Networks' largest asset dictates that this remains so. However, this underpins a strategic direction targeted at establishing true energy communities with Waipa Networks connected customers and exploring the possibilities afforded by the changing technology landscape in the electricity distribution industry.

To successfully deliver our Network Performance Targets there are four broad elements of our strategy that direct the activities of the organisation:

Our Customer Strategy – a customer's direct experience with the organisation is often as a result of an outage or when they want to make a change to their level of service. Our strategy is to where possible manage our customer's expectations and communicate with them in a timely manner, as it is difficult to create a positive experience when power is out to a community and we rely on the goodwill we create prior to such events occurring.

As per our strategy we will continue to engage with the community through a variety of media on areas of interest such as outages, public safety, and pricing. In addition, we are investing in information systems to improve our ability to manage interactions with our customers.

Our Assets Life Cycle Strategy - we seek to proactively manage the lifecycle of assets on the Network to manage the risk to public and staff, maximise their utility and minimise costs/outages. We do this by installing new assets when growth and/or network security concerns justify it. We refurbish or replace assets when they approach end of life or represent unacceptable safety or security risk.

Our maintenance activities are designed to maintain the usefulness of our assets for as long as possible, to maximise their reliability, utilisation and life.

We design and maintain our networks to minimise any disruption to our customers and to be as resilient as possible to storms and other disruptive events. We manage asset risks by systematically assessing probability and consequences of failure. We are investing in improved asset management systems to assist in optimal management of assets. This also helps us prepare budgets and prioritise our expenditure.

Our Delivery Strategy – is to work closely with our internal contracting group who understand the local community and network geography to deliver value to our customers and stakeholders. Where we lack the expertise, we will utilise reputable third parties who understand our needs and place a similar value on health and safety and service.

We periodically review how we manage works activities for maximum efficiency and what spares inventories we need to hold. We are investing in mobile technology to assist our field crews to best deliver services in the field.

Our Enablers Strategy – we recognise that our people are our greatest asset and continue to foster innovation and improvement through involvement in various industry working groups by individuals across the organisation, training, empowerment and recognition of achievement.

We seek to leverage off-the-shelf technology compliant with international standards where practical.

We continue to investigate areas of our information management systems and other non-network assets such as computers, vehicles and buildings for opportunities to standardise or benefit from scale.

Asset Management Plan

The 2020 Strategic Planning Meeting of the Executive Management and a selection of team members contributed to updating the strategic direction of Waipa Networks. Company review of the AMP by management and Company Directors takes into account that strategic direction and past network physical and financial performance, the current SCI and information affecting future network performance and expenditure.

This AMP is predicated on one of Waipa's objectives:

Deliver power safely all day every day

Additionally, this AMP is part of the process of delivering on Waipa Networks' health and safety objective:

Keeping our people safe

This AMP maintains a high-level focus on Waipa's Beliefs:

Building and maintaining community network assets and wealth

Our community is part of us

Provision of value for money

Life improvement through energy and network related business

This AMP focuses on network asset management related matters. It does not discuss business or financial matters related to the non-network asset management aspects of Waipa.

Annual Business Plan and Budgets

The Annual Business Plan and Budgets are informed by the AMP and provide implementation details and the financial ability to achieve the outcomes of the AMP. The Annual Business Plan, Network Capital and Operational Budgets are approved by Directors at Waipa's March Board meeting.

Statement of Corporate Intent

Waipa's SCI is a requirement under section 39 of the Energy Companies Act 1992 and forms the principal accountability mechanism between Waipa's Board and its shareholder. The SCI includes, *inter alia*, financial and performance targets, which form the heart of the asset management activity. It is reviewed and republished on Waipa's website annually.

Section 36 of the Energy Companies Act 1992 establishes that the principal objective of an energy company is to operate as a successful business and to have regard to the desirability of ensuring

the efficient use of energy. The directors and the shareholder of Waipa, as an energy company, believe that a "successful" electricity business is one which earns a commercially realistic rate of return, while providing a safe and reliable service that meets consumer expectations.

Interaction between Planning Documents

The interaction between Waipa's major planning documents and processes is depicted in Figure 10. These plans are compiled annually and are subject to regular review during the financial year.

The vision statement guides Waipa's mission statement. These documents provide an overall direction to the Waipa's key planning documents, the SCI and this AMP. Business plans and annual budgets are then developed from this AMP.

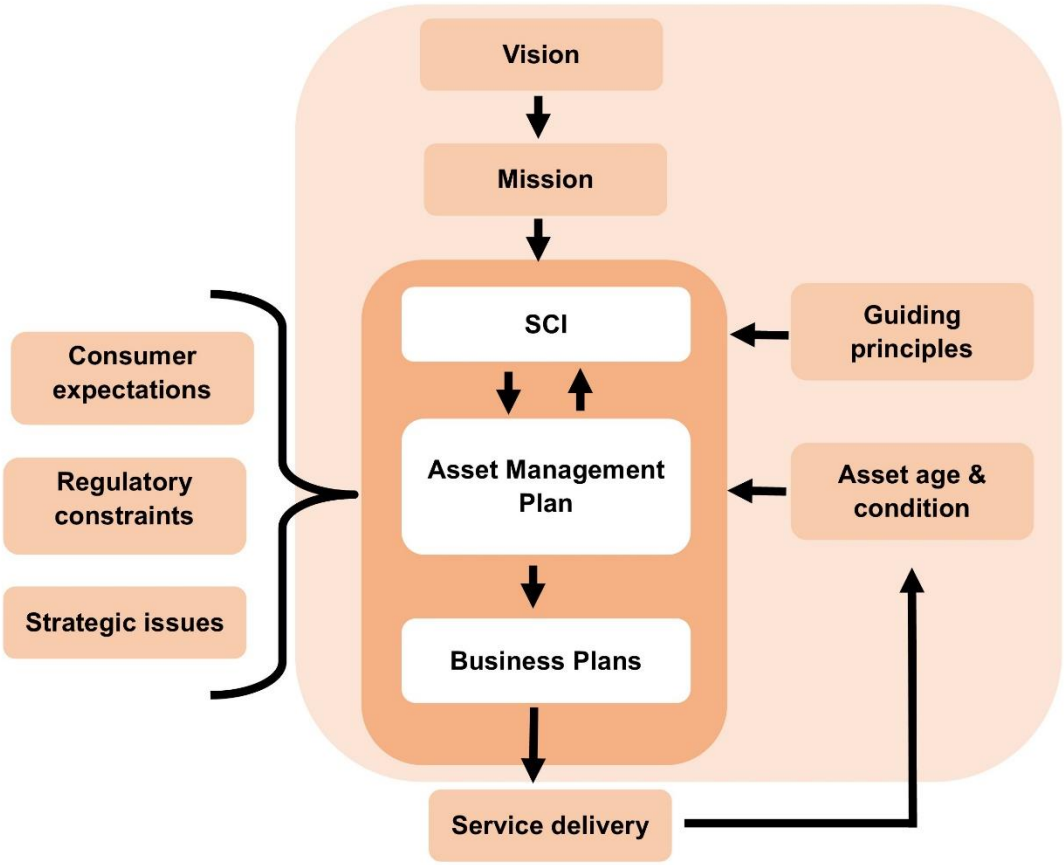


Figure 10: Overview of the key documents and the interaction between them

Guiding principles

The guiding principles within which stakeholder interests are accommodated are broadly set out in Table 8.

Table 8: Further detail on stakeholders' interests

Interest	Description	How Interests are Accommodated	Asset Management Actions
Viability	Viability is necessary to ensure that shareholders (and if required, other providers of finance, such as a bank), have sufficient reason to keep investing in, or provide funding for, Waipa and for the shareholder to retain ownership.	Waipa will accommodate stakeholders' need for long- term viability by delivering earnings that are sustainable and reflect a realistic commercial rate of return (broadly in keeping with the Commerce Commission's allowable rates of return for non-exempt EDBs)	Ensure expenditure is appropriate to maintain or enhance the viability of network, subject to consumer requirements.
Price	Pricing is a means of gathering the revenue required to operate the business and signal underlying costs. Setting prices correctly is important for both the consumers and Waipa. The pricing methodology adopted by Waipa sets an appropriate total target revenue and then sets tariff structures for different categories of consumers. As only a portion of network assets is dedicated to individual ICPs, this process involves elements of cost sharing between consumer groups, an approach commonly taken by most electricity network companies. The low fixed charge regulations require tariffs to be set at a level for some consumers that means that their service is subsidised by other consumers on the network.	Target revenue is set at a level which ensures Waipa is sustainable in the long term and ensures there are sufficient funds to provide reliable assets. Waipa takes a medium-term view of revenue requirements so as to avoid price shocks from year to year. The pricing methodology is expected to be cost reflective and pricing signals reflect the cost of services and supply where possible. The low fixed charge regulations cause distortions between consumer groups.	Although not subject to the Price Control mechanism in the default price quality path, Waipa's revenue is quite consistent from year to year. Waipa aims to fund its expenditure through its annual revenues and therefore plans relatively smooth expenditure from one year to the next.
Supply Quality	Emphasis on continuity of supply of regulatory voltage, restoration of supply and preventing voltage flicker is essential to minimising interruptions to consumer's homes and businesses. Ensure that ICP supply is not subject to interference by other network users.	Waipa will accommodate stakeholders needs for supply quality by focussing resources on continuity and the capacity of supply and restoration through ensuring assets are of a quality and standard to meet consumer requirements. Require all ICPs to meet appropriate standards relative to power factor, harmonics and utilisation of supply.	Waipa has a strong community mandate to maintain/improve reliability and power quality. Waipa adheres to regulatory requirements in the provision of electricity supply and has connection criteria which must be met by all ICPs. Waipa also undertakes monitoring of the quality of supply to ICPs.

Health and Safety	Staff and contractors must be able to work on the network in total safety. The general public must be able to move safely around network assets.	Waipa will minimise the risk to the safety of the public by ensuring that all assets are structurally sound, live conductors comply with regulatory clearances, all enclosures are kept locked, all exposed metal is securely earthed and assets are built and maintained in accordance with legislative requirements and best practice. Waipa will prioritise the safety of staff and contractors by providing all necessary equipment, training, improving safe working practices, and ensuring that workers are stood down in unsafe conditions. Waipa will work to and in accordance with applicable industry standards and codes of practice.	All work is subject to rigorous safety standards with safety given the highest priority for expenditure. The Public Safety Management System (PSMS) documents Waipa's procedures for ensuring safety of the public. Waipa is continuing to improve safety procedures for all employees. All team members are encouraged to stop any work if it is considered unsafe.
Compliance	Waipa must comply with many statutory requirements ranging from safety to disclosing information.	Waipa will document all safety issues and make them available for inspection by authorised agencies. Waipa will disclose performance information in a timely and compliant fashion.	Undertake sufficient monitoring and inspection for maintaining compliance, documented as appropriate.
Energy Efficiency	Consistent with the provisions of the Energy Companies Act 1992 and as a good corporate citizen, Waipa endeavours to maximise energy efficiency within its own operations and promote energy efficiency to consumers connected to the network.	Waipa will consider losses within its system and minimise where practical. Waipa will assist consumers by providing advice and assistance on energy efficiency.	Comparative assessment of network losses and setting of appropriate loss targets. Energy efficiency is an integral component in the consideration of the purchase and design of network assets and operation of the network.

Translation into objective and performance targets

As the higher document, the SCI sets out Waipa's primary objectives. The current SCI was published in April 2021 and covers the financial year (FY) ending March 2022. The performance targets are set out below.

Table 9: Performance targets for 2021/22

Key Performance Indicator	Forecast 2020/21	Target 2021/22	How we will be measured
Financial			
We will generate a sustainable Return on Total Assets	4.9%	4.9%	Net surplus before interest and tax as a percentage of Total Assets
We will generate a sustainable Return on Equity	5.0%	4.6%	Net Surplus after tax as a percentage of Equity
We will meet all expectations under the Discount Policy	$4.98m	$4.70m	We will report on the discount paid to beneficiary customers during the year.
Network Performance			
Reliability - SAIDI	259	244	Calculation aligned to Default Price Path Compliance regulations (minutes per customer, target from 2021 AMP)
Reliability - SAIFI	1.74	2.68	Calculation aligned to Default Price Path Compliance regulations (interruptions per customer, target from 2021 AMP)
Network sustainability	n/a	We will investigate a meaningful measure (or activity)	Implementing measures that show that long-term network condition is being preserved.
Customer, Community and Environment			
Cambridge network resilience	n/a	We will secure and consent a site for the new Cambridge GXP	
Deliver a community energy project	n/a	Deliver a community energy project	
Climate Impact	n/a	We will develop measures of the Company's Carbon Footprint	We will measure and seek to reduce our contribution to Climate Change
People			
Nil serious harm injuries[1]	0	Nil	We will measure how many incidents resulted in serious harm
Incidents related to critical risks to be reduced by 10%	n/a	We will establish a measure of our critical risk related injuries (through the new H&S application)	We will measure and report incidents against each critical risk as a basis for future trend reporting

[1] Serious harm is defined as a notifiable event under the Health and Safety at Work Act guidelines published by WorkSafe NZ.

These SCI business targets are integral to this Plan which accordingly sets strategies to achieve them. The performance targets are further detailed and expanded in the performance evaluation and service levels section of this Plan.

The interests of stakeholders are recognised and conveyed to Waipa by the Waipa Networks Trust, Waipa Networks Board of Directors and by Waipa's customers, connected consumers and employees.

From an asset management perspective, the interests of Waipa's stakeholders are addressed by ensuring the following:

- Creation and maintenance of a safe and reliable distribution network.
- Quality of supply performance meeting consumers' needs.
- Optimisation of capital and operational expenditure.
- Maintaining a sustainable business that caters for consumer's growth requirements.
- Comprehensive risk management strategies and planning for contingencies.
- Due consideration to the environmental impact of Waipa's operations.
- Regulatory and legal compliance.
- Economically efficient pricing methodologies.
- Technically efficient selection of network equipment to optimise electrical losses.
- Security standards reflecting consumers' needs.
- Robust network growth and development plans are prepared.
- Comprehensive asset replacement strategies are developed.
- Surveying and monitoring asset condition to maintain a reliable network.
- Identifying critical assets.
- Maintaining network assets in good, fit for purpose condition.

Conflicting interests

Most activities result in a need to balance a number of different factors, e.g., quality, cost, time. Finding a balance acceptable to all stakeholders requires that various solutions are carefully considered, and priorities evaluated according to specific circumstances and environment. The general priorities, in order of highest to lowest, for managing conflicting stakeholder expectations and interests are given below:

1. **Safety**: Waipa gives top priority to safety. Even if budgets are exceeded or non-compliance arises relative to interruption of supply, Waipa will not compromise the safety of its team, contractors and/or the public. Safety is fundamental to the way Waipa undertakes any activity.
2. **Compliance:** Waipa gives priority to compliance, noting that compliance which is safety-related is given highest priority.
3. **Viability:** Waipa gives high priority to viability.
4. **Return:** Waipa recognises the need to operate as a successful business and earn a realistic commercial rate of return. This ensures that funding will be available for future activities and ongoing supply continues to be available to consumers.
5. **Customers'** Reasonable expectations are met.
6. **Supply Quality:** This is important to consumers to allow them to utilise electricity in a reliable and safe manner. An unreliable supply may drive consumers to consider alternatives to network supply.
7. **Environment:** As a socially responsible organisation, Waipa respects the environment and ensures that its operations are based on sustainable practices. Waipa considers environmental issues in all aspects of its operations and whenever practicable seeks to eliminate or mitigate the impact of Waipa's operations on the environment.

8. **Energy Efficiency:** Waipa considers maximising energy efficiency in all aspects of its operations.
9. **Solution** is in compliance with best EDB practice**.**

Aside from safety, the priority given to these issues may vary slightly from that outlined, according to the issue or issues, their respective magnitudes and the affected stakeholders. In practical terms, the general priorities set out above are not mutually exclusive and are factored into the decision process.

Consumer service lines

Waipa's assets extend to the point of supply, which (in most cases) is the property boundary line crossed by a consumer's service line. This means that the majority of a consumer's service line is owned by the property owner, not Waipa.

Waipa has observed some privately-owned assets in poor condition with associated safety and/or reliability of supply risks. Management of these assets is outside Waipa's jurisdiction and has therefore been excluded from this AMP.

Where privately-owned assets in poor condition are identified by Waipa, the property owner is duly notified of the risk and their obligations as the asset owner.

Accountabilities and responsibilities for asset management

Waipa's accountabilities and accountability mechanisms related to asset management are described in section 6.2.

5. Network performance and service levels

This section of the AMP sets out and discusses the relative performance of the network and business against a number of measures including quality of supply, cost performance, network continuance (essentially, the adequacy of replacement levels), and losses and utilisation.

In concert with the assessment of relative performance against other businesses, this section also measures performance against Waipa's internal targets for network and consumer satisfaction as notified through its annual SCI, specifically quality of supply, consumer engagement and satisfaction, and performance against other objective targets.

This analysis provides the framework for setting the consumer-oriented performance targets that, together with Waipa's wider business goals, this plan then sets out to achieve.

In overview, Waipa's performance can be described as:

- Has low line charges.
- Has low total costs.
- Is in the best quartile for cost and close to average reliability.
- Is achieving its targets in consumer engagement and consumer satisfaction.
- Is performing at expectation levels for network losses and transformer utilisation.
- Has set capital replacement levels in keeping with good industry practice relative to Waipa's asset quantities and age profiles.

- Does not have an over-aged network.
- Is operating as a profitable business.

A comparative performance analysis has been completed based on a number of metrics, with Waipa Networks compared to both the whole industry and a Medium/Mixed cohort of distribution businesses of a comparable medium size and mixed urban and rural coverage area. The Medium/Mixed cohort is as follows:

- Alpine Energy
- Counties Power
- Electra
- EA Networks
- Horizon Energy Distribution
- Mainpower New Zealand
- Marlborough Lines
- Network Tasman
- Network Waitaki
- Northpower
- Powerco
- Unison Networks
- Waipa Networks
- WEL Networks

5.1 Revenue

The Net Revenue per ICP chart below (net of Transpower charges) shows Waipa Networks (EDB26) has a flat trend and it has a lower revenue (line charges per customer) than the industry or other cohort distribution businesses. This indicates that Waipa Networks has been able to minimise the line charges to their connected customers, in comparison to other electricity lines businesses. This is in part due to the simple 11kV distribution architecture of our network compared to networks with sub-transmission networks.

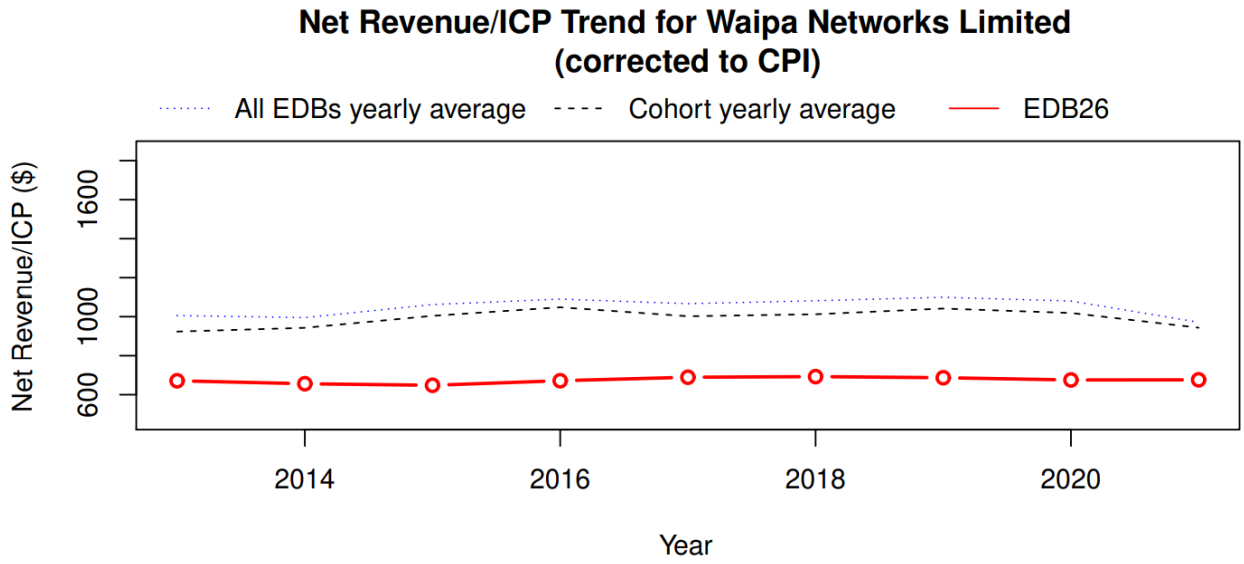


Figure 11: Net revenue per ICP

5.2 Cost performance

The comparison of the relative costs of EDBs needs careful consideration. By way of example, comparison needs to take into account network age, condition, environment, level of reliability and the reasonableness of capital and maintenance expenditure. Postponement of prudent capital and maintenance expenditure is not a measure of efficiency but is instead deferment of a likely greater cost to a future date.

Total opex cost

The total network opex in Figure 12 below shows Waipa Networks (coloured dots) as having a lower operating cost, below the trend evident from other industry players. The red dot is the latest year.

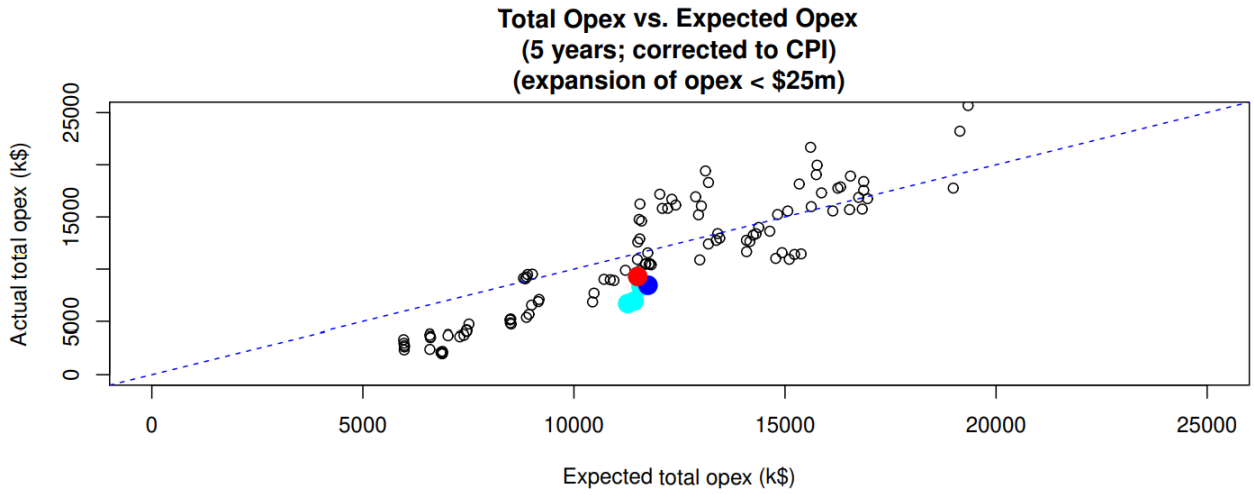


Figure 12: Comparative opex analysis

Figure 13 below shows that Waipa is in the best quartile of cost but average in reliability. The high SAIDI in FY2020 (the immediately preceding result) arises from relatively high unplanned outages caused by third party interference, adverse weather and vegetation. In addition, planned SAIDI was at record levels due to high impact planned shutdowns for network renewal. The blue line shows the locus of performance since 2013. Waipa could improve its position by focusing on further improving reliability. SAIDI performance in recent years has been adversely affected by planned outages related to network maintenance, overhead renewal and significant re-conductoring projects like the Waikeria Project.

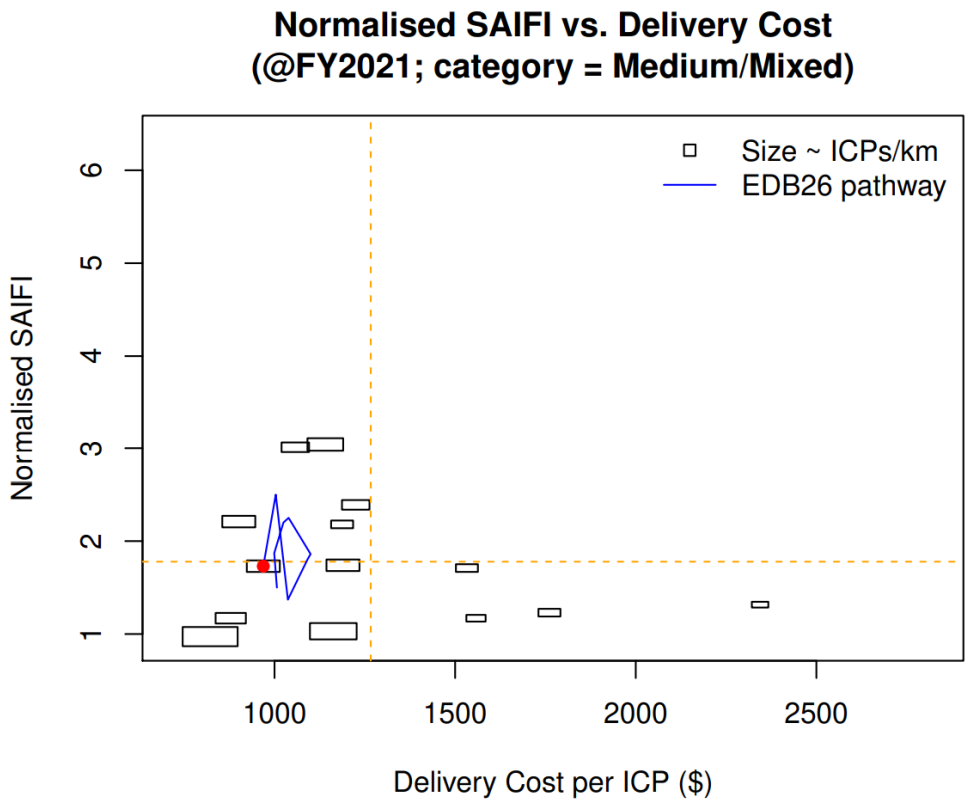


Figure 13: Comparative cost and reliability quartiles

5.3 Expenditure vs. budget

Actual expenditure for financial year to March 2020 is set out in Table 10 and is compared to the expenditure projected in the AMP budget for the FY2020/21 year.

Table 10: Summary of FY2019/20 expenditure vs forecast

Item	Actual FY2020/21 ($000)	Budget for RY2021 ($000)	Variance as % of forecast
Capex: Consumer Connection	3,098	3,738	-17%
Capex: System Growth	2,526	3,138	-19%
Capex: Quality of Supply	109	1,474	-93%
Capex: Other Reliability, Safety and Environment	802	588	36%
Capex: Asset Replacement and Renewal	3,061	4,541	-33%
Capex: Asset Relocations	69	178	-61%
Subtotal - Capex on network assets	**9,665**	**13,657**	**-29%**
Opex: Service interruptions and emergencies	1,451	1,003	45%
Opex: Vegetation management	1,013	1060	-4%
Opex: Routine and corrective maintenance and inspection	966	1,478	-35%
Opex: Asset replacement and renewal	578	621	-7%
Subtotal - Opex on network assets	**4,009**	**4,162**	**-4%**
Total direct expenditure on distribution network	**13,674**	**17,819**	**-23%**

This shows an overall outcome of a 23% under expenditure comprising 29% under-expenditure on network capital and a 4% under- expenditure on direct opex. Reasons for the more significant expenditure variance against forecast in Table 10 include:

- Below budget spending on customer connections, system growth (due to delayed projects) and asset replacement and renewal, in part to Covid lockdowns impacting productivity.
- Increase in Service interruptions and emergencies due to recognising historical unrecoverable vehicle accidents that had been carried as debtors.

5.4 Reliability Target

Network supply reliability is measured using:

- SAIDI – the system average interruption duration index (minutes).
- SAIFI – the system average interruption frequency index.
- Faults per 100km of 11kV line.

from which CAIDI the consumer average interruption duration index is calculated, where CAIDI = SAIDI / SAIFI.

SAIFI comparative performance

SAIFI is charted over time below, showing Waipa Networks (EDB26) to have an average number of faults per customer. Variations year to year are generally related to weather in that year. Waipa's SAIFI trend is flat in keeping with the industry and cohort trends.

The chart below shows Waipa Networks as having higher vegetation and third-party faults than the cohort. In proportion Waipa Networks has somewhat lower levels of defective equipment faults, potentially indicating better network condition. Waipa Networks has increased vegetation maintenance expenditure to address the level of tree faults, and more recent reliability data indicates that this is having a positive effect.

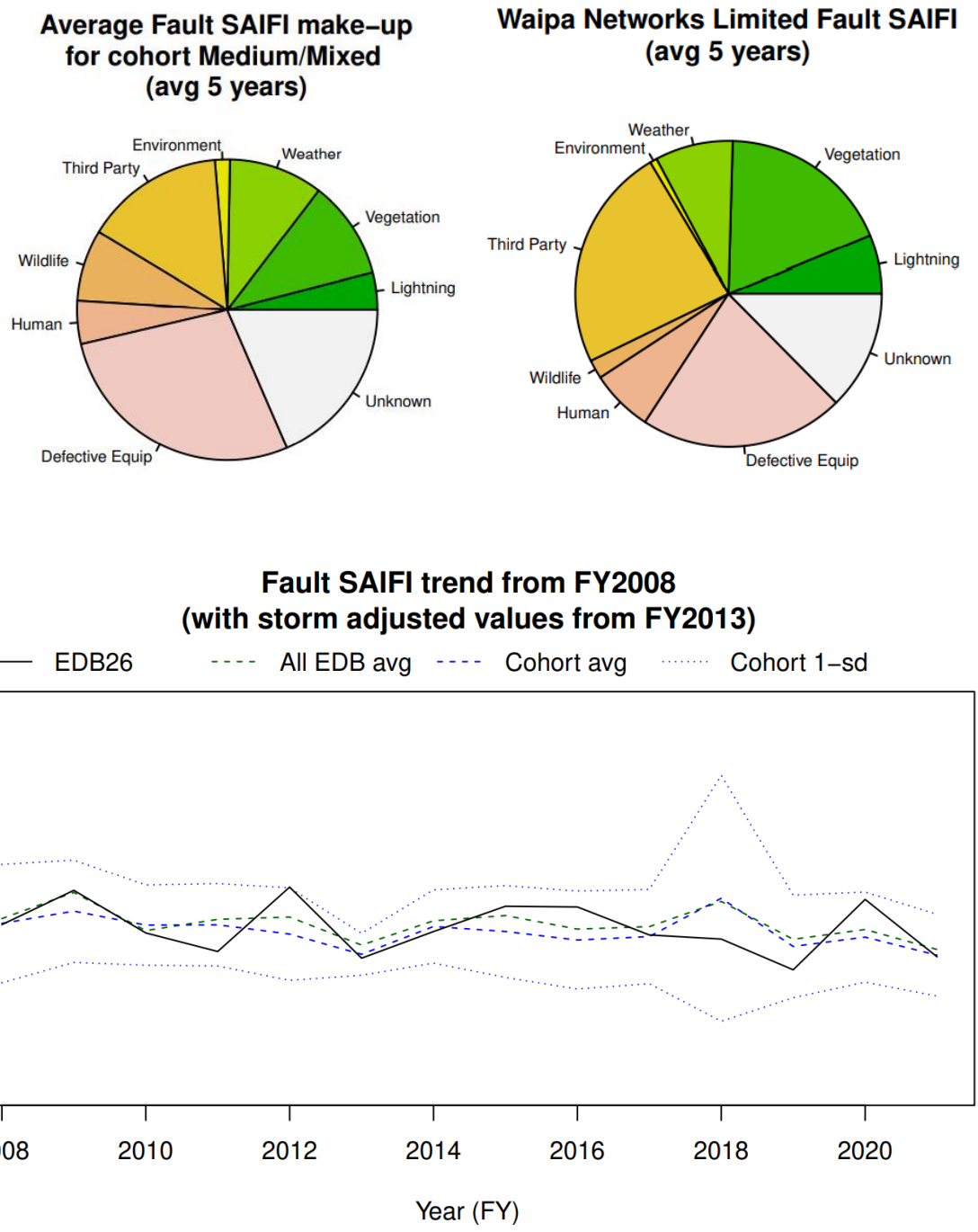


Figure 14: Waipa's SAIFI trend

Faults per km

The number of faults on a network tends to indicate the effectiveness of the underlying maintenance and replacement processes. If additional switching devices are installed on the network SAIFI may not show trends in performance due to maintenance and replacement over time. The chart below in Figure 15 for the overhead network shows that the cohort has steadily increasing faults over time while Waipa Networks has a slightly decreasing trend over recent years with an increased result in 2020 but a markedly lower result for 2021. This indicates that the Waipa network maintenance and renewal processes appear to be functioning effectively.

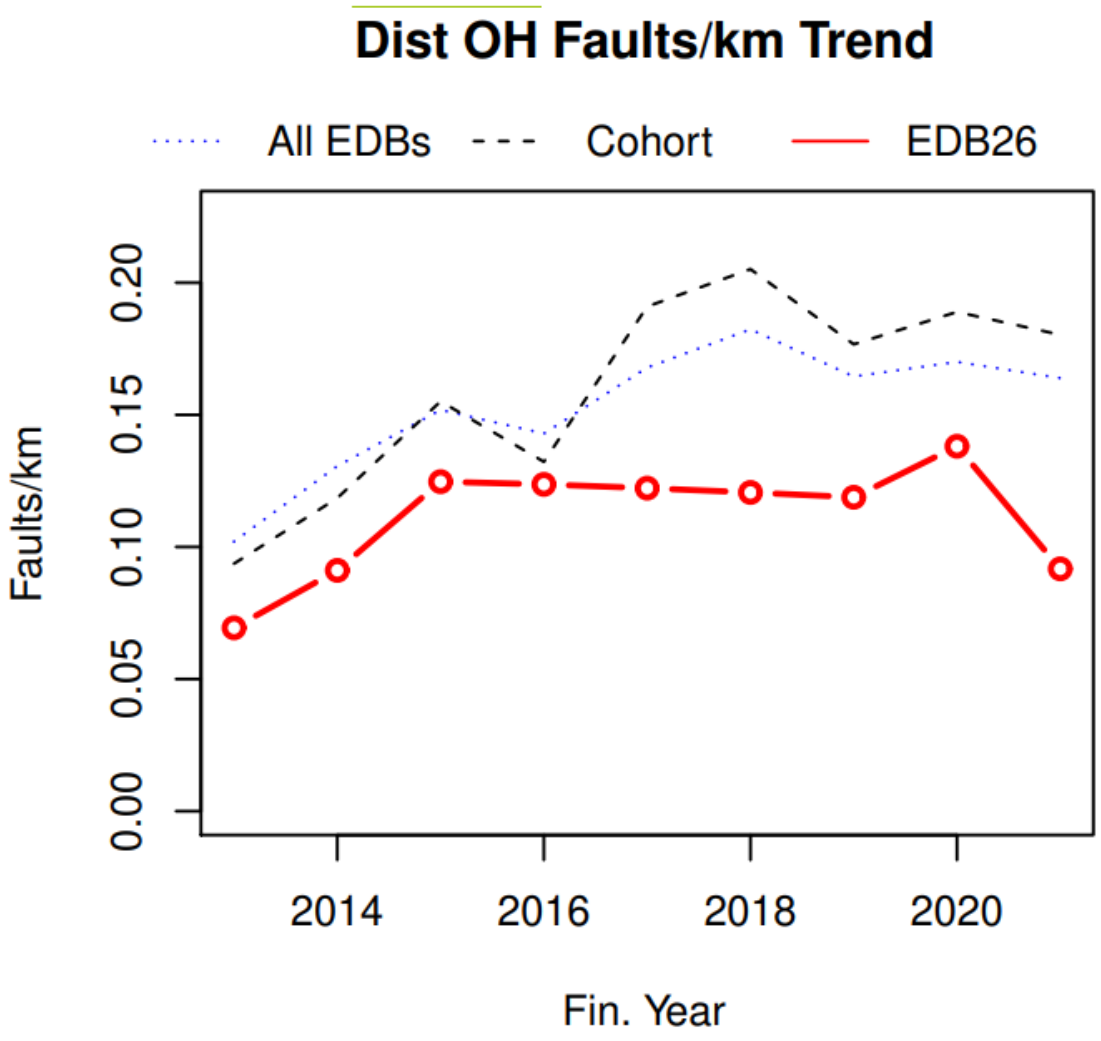


Figure 15: Fault rate trend

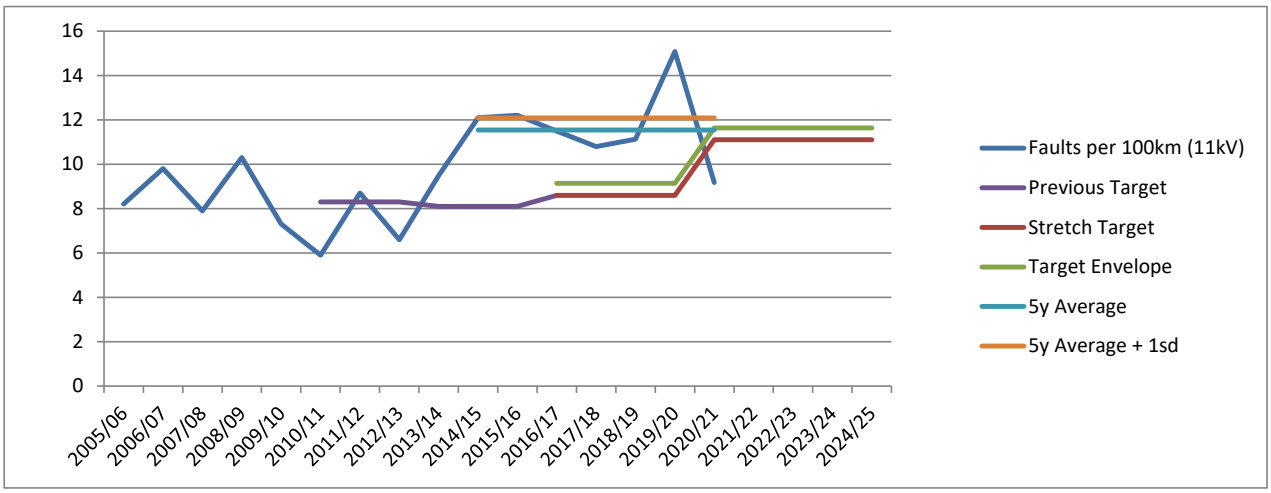


Figure 16: Faults per 100km (11kV) target

Waipa's target (Figure 16) is to continually improve network reliability related to fault rate over the ten-year planning horizon of this AMP. The following table shows the targets based on the Commerce Commission's DPP3 approach to regulated reliability targets and extrapolated for the AMP horizon of 10 years for reliability. According to the new DPP3 approach, planned SAIDI and SAIFI targets are calculated based on the three times historical average targets whereas unplanned targets are capped at the historical average plus two standard deviations.

The graphs below (Figure 17-20) show both the historical raw SAIDI and SAIFI actual performance and the DPP3 normalised actual performance vs the DPP3 normalised targets as per the DDP3 approach. Note that it is only the normalised actual performance that should be compared to the target in all cases. It clearly shows that the DPP3 target is below the historical normalised unplanned SAIDI and SAIFI in 2018/19 and 2020/21. Therefore, there is an expectation that over the five-year DDP3 period, Waipa Networks' unplanned SAIDI and SAIFI will be within the quality target set. In the coming years, the current relatively high levels of planned outages for asset renewal is expected to continue. Therefore both planned SAIDI and planned SAIFI performance will remain at the current relatively high levels compared to circa five years ago. Work to increase the use of network loop automation and the automation of isolation points is expected to drive improvement in the unplanned SAIDI and SAIFI performance in the medium term.

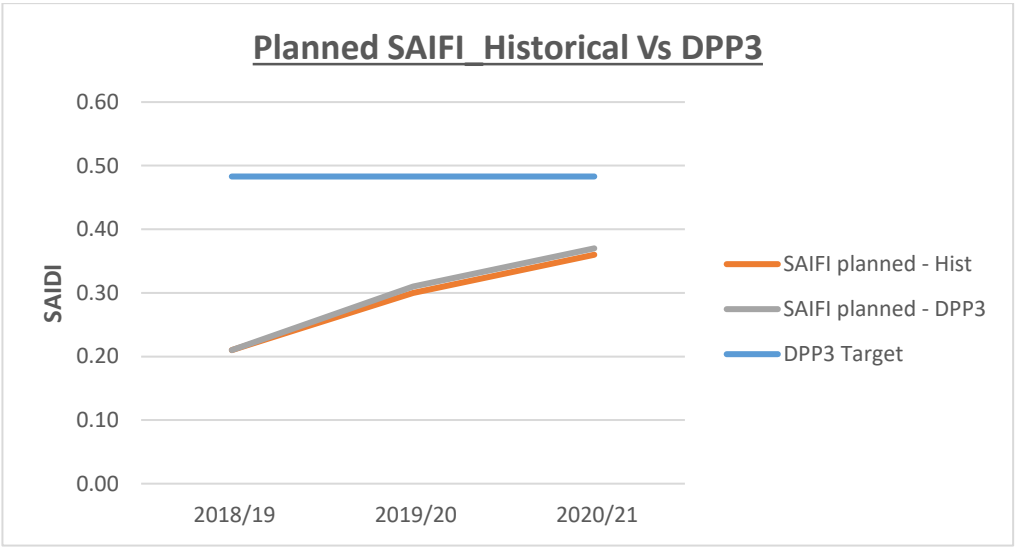


Figure 17: Planned SAIFI

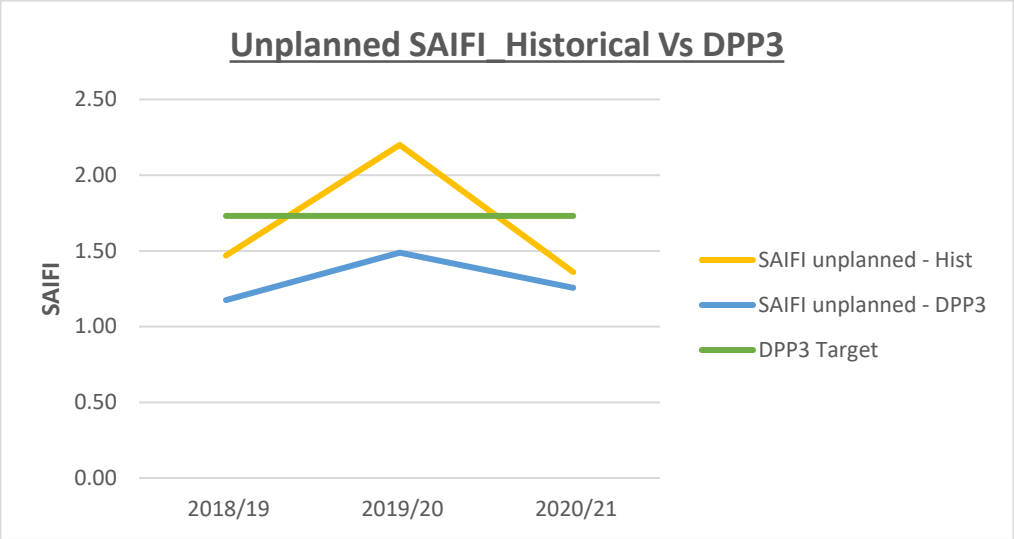


Figure 18: Unplanned SAIFI

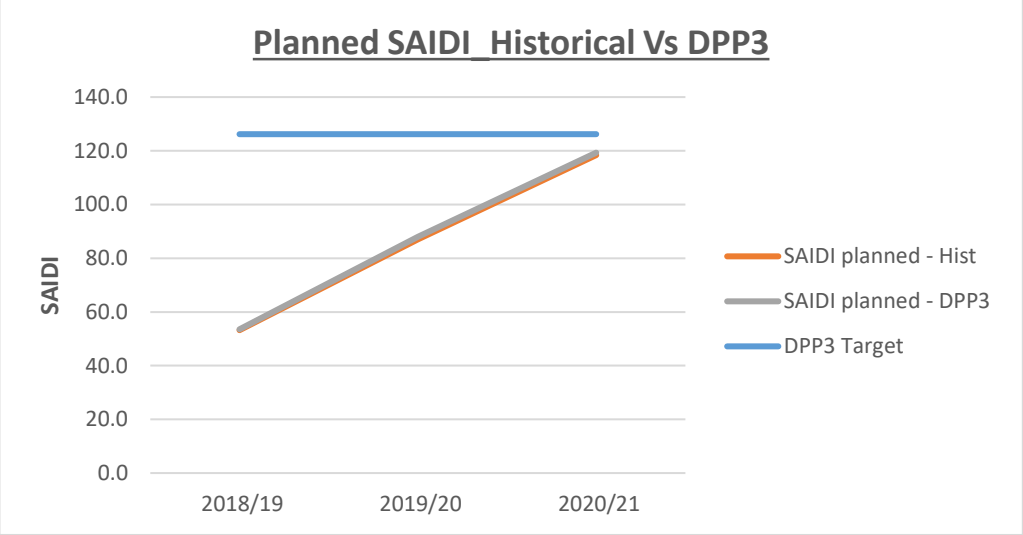


Figure 19: Planned SAIDI

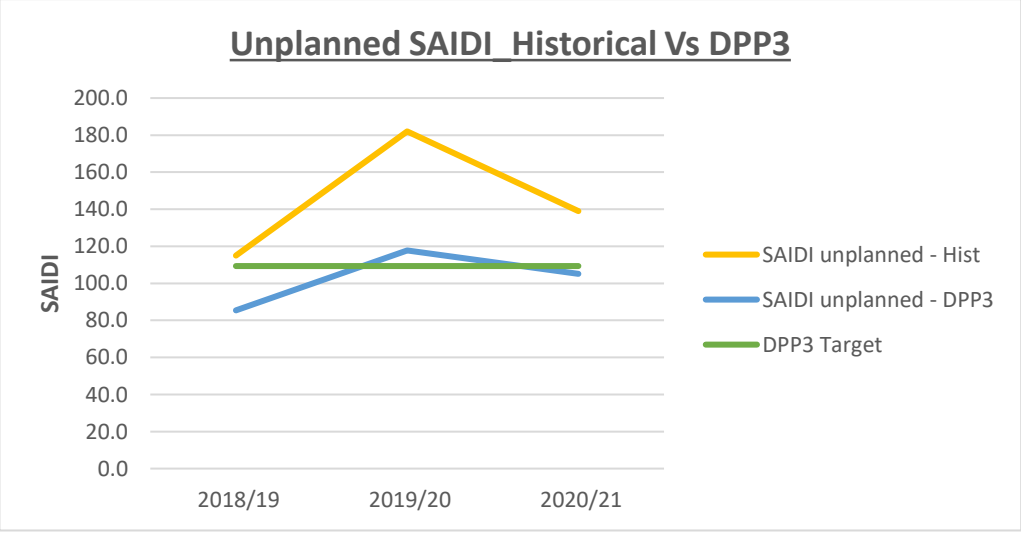


Figure 20: Unplanned SAIDI

Table 11: Waipa's DPP3 per annum reliability targets

Network Reliability Performance Indices	Target 2022/23	Target 2023/24	Target 2024/25	Target 2025/26	Target 2026/27	Target 2027/28	Target 2028/29	Target 2029/30	Target 2030/31	Target 2031/32
SAIDI planned	126.2	126.2	126.2	126.2	126.2	126.2	126.2	126.2	126.2	126.2
SAIFI planned	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
CAIDI planned	261.3	261.3	261.3	261.3	261.3	261.3	261.3	261.3	261.3	261.3
SAIDI unplanned	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
SAIFI unplanned	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73
CAIDI unplanned	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2
Faults/100km 11kV Stretch Target	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
Faults/100km 11kV Target Envelope	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0

Targets for the number of planned and unplanned outages are presented in the table below. With regard to planned targets, a higher level of planned outages to resolve defects is expected. The target for unplanned outages is 160, being the average of the last four years plus the annualised forecast for 2019/20.

Table 12: Waipa's planned and unplanned interruption targets

	Target 2022/23	Target 2023/24	Target 2024/25	Target 2025/26	Target 2026/27
No. planned outages	**90**	**90**	**90**	**90**	**90**
No. unplanned outages	**160**	**160**	**160**	**160**	**160**

Extended Duration Interruptions

This section presents the investigation of the underlying causes for an apparent deteriorating trend in relation to extended duration interruptions Extended duration interruptions are classified as service interruptions longer than three hours. Deteriorating trends in extended duration interruptions may indicate changes to restoration practices, declining network asset health in general, or a reduction in available post-contingent network capacity.

The following metrics (based on 2013-19 ID data) were analysed to identify any potential issues with Waipa Networks' practices in relation to extended duration interruptions that may justify further review:

- Interruption duration
- Emergency expenditure

The following graphs illustrate the trends related to interruptions with durations greater than 3 hours and the opex expenditure category. Budgets have been increased to improve this situation.

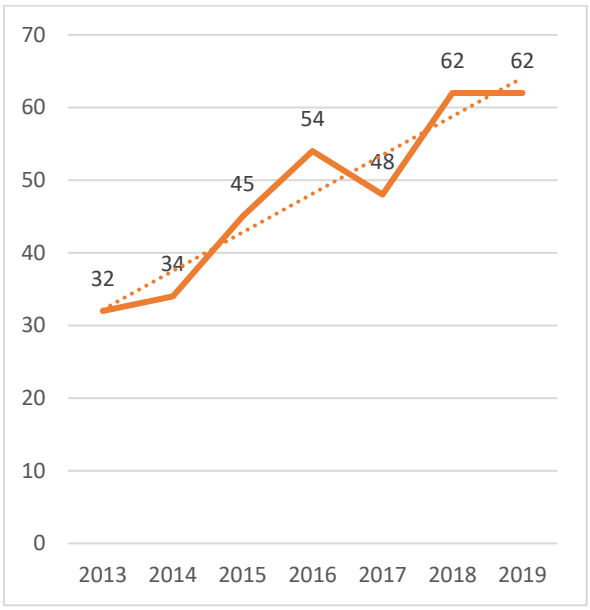


Figure 21: Number of interruptions greater than 3 hours:

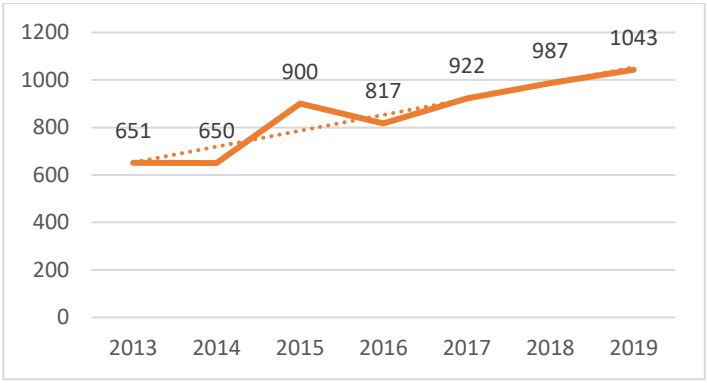


Figure 22: Service Interruption and emergency expenditure ($000'S)

Explanation of Past Trend

The data in Table 13 provides a breakdown of the causes of the unplanned outages of greater than three hours duration (referred to as long duration outages).

Table 13: Unplanned outages > 3 hours duration by cause

	Lightning	Vegetation	Human Error	Defective Equipment	Adverse Weather	Adverse Environment	3rd Party	Wildlife	Unknown
	Outages Over 3 Hours								
2010	-	2	-	6	9	-	9	3	-
2011	-	-	-	5	10	1	8	-	-
2012	-	3	-	5	19	1	9	3	-
2013	-	7	-	5	1	-	13	4	2
2014	4	4	1	13	1	-	8	-	3
2015	1	18	1	12	2	-	9	2	2
2016	1	7	1	19	-	-	22	1	3
2017	3	7	1	12	5	2	18	1	-
2018	5	14	1	13	7	-	21	1	-
2019	1	9	1	13	6	-	31	-	1

The three main drivers of long outages that show an increase over the 10-year period are:

- Third party interference – this is largely car versus pole incidents.
- Vegetation – long duration outages are typically out-of-zone trees falling through the lines, so not controlled by expenditure trimming trees out of the D1 and D2 growth limit zones under the Tree Regulations.
- Defective Equipment. Refer to table below.

Defective equipment causing long duration outages is presented in the table below. There is no clear pattern of a particular class of equipment causing more long duration outages. There was a spate of insulator failures in the period 2014 to 2016 caused by a poor batch of insulators and this has since reverted to a similar rate as the beginning of the ten-year period. There may be a trend in the failure of 11kV conductor/cable but given the small number of occurrences it is not possible to say if there is any more than random variation.

Table 14: Defective equipment unplanned outages > 3 hours duration by cause>3

	Insulator / Binder	LV Fuse	X-arm, arm Brace	11kV Conductor / Cable	Pole, stay pole, stay wire	Fuses DDO	Switchgear, ABS, Reclosers	Surge Arrestors	Transformer
	Outages Over 3 Hours								
2010	2	-	1	1	-	-	1	1	-
2011	2	-	1	1	-	-	1	-	-
2012	-	-	-	3	-	-	-	2	-
2013	-	-	-	2	-	-	-	2	1
2014	4	-	2	3	-	2	2	-	-
2015	6	-	2	-	-	1	1	1	1
2016	6	-	-	5	1	-	4	2	1
2017	2	-	-	3	-	2	2	1	2
2018	2	-	2	3	-	-	1	1	4
2019	3	-	3	3	-	-	2	-	2

Current Activities to Address Deteriorating Trend in Interruption Duration

Third party interference via car versus pole incidents is in general a random event where preventative measures such as barriers or undergrounding is often not cost effective. Waipa Networks has a process of geographically mapping all car versus pole incidents, and identifying any repeat pole strikes for review. The review considers if the location is inherently hazardous and if remedial measures would be justified. There is a case where repeated pole strikes on a section of State Highway 39 led to the line being relocated further from the road. In the vast majority of cases however, the pole strike was a random event and often relocations or barriers cannot be justified. Figure 23 below shows as blue dots all of the repeat car versus pole incidents on our network since circa 2006.

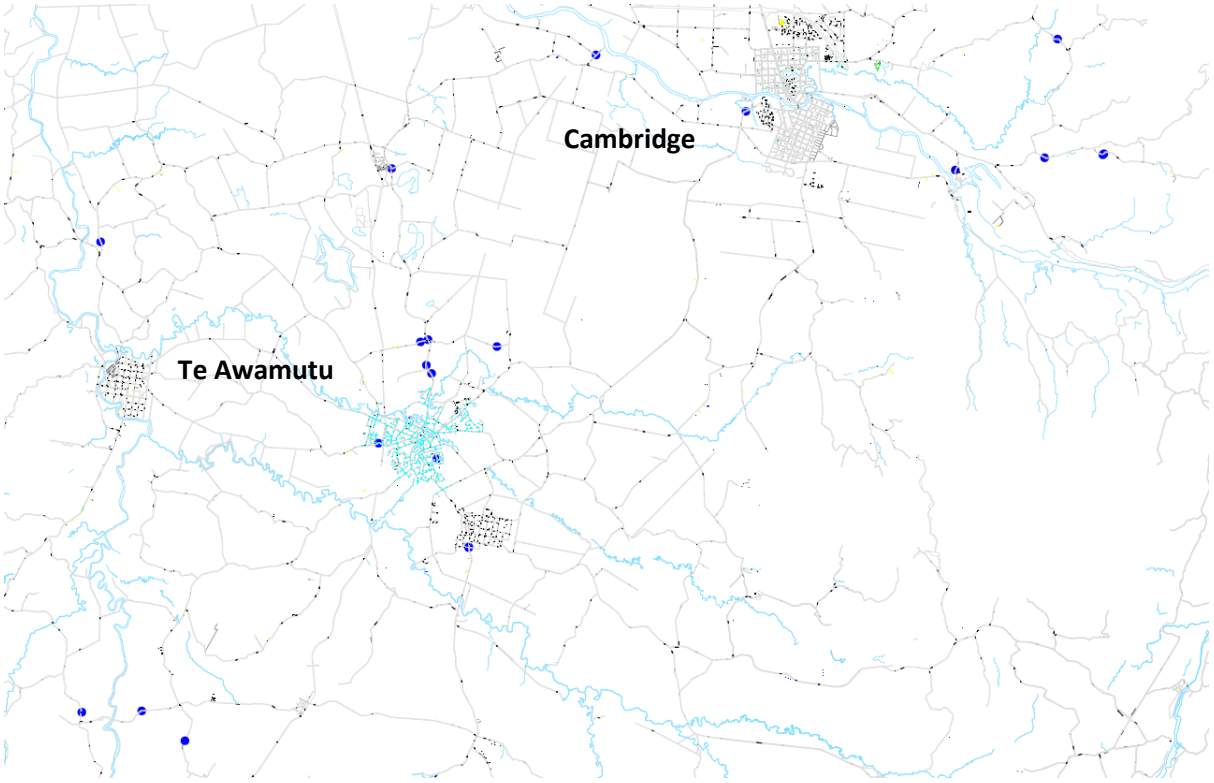


Figure 23: Repeat car vs. pole incidents map

Waipa does not have evidence to indicate why more car versus pole incidents are occurring on our network. It is probable that traffic flows have increased, with strong population growth in Cambridge and Te Awamutu and people traveling to Hamilton for their work.

In December 2021 Orbica was engaged to complete a geospatial risk analysis of car versus pole incidents on the network. This considered the Waka Kotahi 20-year crash statistics, road characteristics such as width, posted speed, elevation changes and the location of poles in relation to the road corridor. The data produced provides granular analysis of the risk of car versus pole incidents for all the road corridors in our network and for all pole locations. This will allow potential accident and public safety risk hotspots to be identified and potential mitigations such as network relocation, roadside barriers or other roading interventions to be considered. The strength of this analysis is that it provides a structured and analytical approach to determining risk of vehicle versus pole incidents and allows interventions to be prioritised in a logical way. During 2022/23 Waipa Networks will further analyse the findings of this analysis and discuss opportunities for improvement with the local district councils and Waka Kotahi to improve public safety to the benefit of our community and the reliability of the network for customers.

Vegetation maintenance budget was increased in 2016/17 from $700k to $1m per annum, with an increase in the number of arborists and trucks to service this higher level of spend. The increased vegetation maintenance expenditure has been effective in reducing the number of “in-zone” vegetation faults. The increased budget has allowed more trees to be removed completely instead of just being trimmed, reducing repeat faults and reducing “out of zone” tree faults from branches or trees failing through the lines. The increased level of spending per km of network compares well with other EDBs, but is not sufficient to remove all trees that pose an “out of zone” tree fall risk to the network.

Waipa does not have evidence to indicate why more vegetation long duration outages are occurring. It is possible that warmer weather is increasing tree growth, and more intense weather events (e.g., rainfall or wind) is stressing the trees and leading to more destructive “out of zone” tree faults.

Defective Equipment shows no clear pattern of a particular class of equipment causing more long duration outages. We continue with our programme of network asset condition surveys and resolving the defects that arise from the inspections. We have a backlog of network defects arising from our asset inspections, so we are increasing our budget to spend more on resolving defects in the coming years to address the backlog.

Planned Activities to Address Deteriorating Trend in Interruption Duration

Third party interference via car versus pole incidents. Further analysis of the risk of car vs. poles is planned, combining NZTA accident data and risk factors related to road configuration and posted speed limits with pole location data. This may provide more information on locations where proactive interventions to prevent car versus pole incidents may be justified.

Vegetation maintenance practices and budget is not intended to change related to long duration outages, because the “out of zone” tree faults cannot be completely eliminated due to budgetary constraints and feasibility related to public views around the amenity value of trees near our network. Our current risk assessment approach of removing trees completely instead of trimming will continue. In early 2021 a LiDAR (laser range finding) survey will be completed of the rural overhead network, and vegetation encroachments will be reported, allowing fully prioritised maintenance of the highest impact and risk vegetation.

Defective Equipment is a fault cause that we continue to monitor to identify trends with equipment types that may have an increasing failure trajectory. If a trend is identified, we would instigate a renewal replacement or maintenance programme within our AMP planning phase to address the issue. The 2021 LiDAR survey will be combined with high resolution photographs of the network poles and pole top hardware, allowing defective equipment for the rural overhead network to be identified and prioritised rectification completed. This is expected to improve the defective equipment fault rate.

Changes to Expenditure Forecasts

The budget for service interruption and emergency has been increased. The higher expenditure on service interruption and emergencies is expected to continue for the foreseeable future.

The budget for defects arising out of the network asset condition survey has been increased, in both capital and operational expenditure. We are unsure if there will be a need to expend at this higher level for the entire 10-year period, until we have more information on the defects trend. There is an extensive population of wooden crossarms that will require replacement over this period.

Changes to Planned SAIDI Targets

With a focus on catching up the backlog in the network asset survey, and resolving the resulting maintenance defects, the planned SAIDI and SAIFI performance has been higher than target, due to the outages required to repair defects. This has been particularly the case with outages in Leamington, where the high ICP counts per transformer have resulted in significant SAIDI counts for planned outages. As a result of adopting the DDP3 methodology to set performance targets, the planned SAIDI and SAIFI targets have been reset at a higher level (based on three times the historical average). The situation of increased outages for network renewal is expected to continue for the entire ten-year period of this AMP, with an increase in the total planned plus unplanned target as a result.

Live-Line Techniques

The overriding objective in selecting the use of live-line techniques is that safety is maintained. Live line work offers advantages in reducing the safety impact of switching for planned outages, reducing impacts on sensitive customers and widespread disruption of shutdowns on customers more generally. If more live-line work was to be attempted in order to restrict the impact of maintenance shutdowns on planned SAIDI, the inherently lower productivity of live-line work would restrict the volume of work that could be completed within the year. Hence provided that safety is maintained, live line techniques are selected where this is a more efficient approach and may avoid the disruption of a shutdown to customers. To ensure that safety is maintained in all cases, a risk assessment tool has been produced to evaluate the justification for live line work over de-energised work, and thoroughly assess the safety of all proposed jobs before permission to apply for a live line permit is obtained. This justification process follows the EEA guideline and industry best practice.

The current approach to deenergised work is to cluster planned work that requires a shutdown into modules and complete all work within a single module shutdown if resources allow. This minimises SAIDI and customer inconvenience. An initial target of 80 SAIDI minutes per year of planned outages for asset renewal, refurbishment and maintenance has been set, reflecting the higher volume of network work occurring as discussed above.

5.5 Targets for Asset and Business Performance

Waipa Networks Objectives

Waipa intends to build on its good relationship with its customers and other stakeholders by continually improving the network performance costs and efficiency consistent with Waipa's objectives:

- **Deliver power safely all day every day**
- **Facilitating energy use not just a connection**
- **Building a sustainable business by establishing energy communities in the Waipa region**
- **Extend the availability of existing and new energy products from pilot projects to the broader community.**

Security Targets

Security of supply is assessed by reference to a level of in-built asset redundancy.

An "n" security level implies no alternative means of supply. If a component fails then supply is lost until the repair or replacement or the component.

An “n-1” security level is one in which supply is not lost in the event of any single component failure. An “n-1 switched” security level is one in which supply is lost until the faulty asset is isolated. Power is restored by closing interconnecting switches between feeders. Waipa’s system is not operated in a “closed ring” manner. Therefore, the best distribution feeder security level offered is n-1 switched.

The security of supply for Transpower’s transmission and grid connection assets will be retained as a n-1 security of supply standard. When upgrading transmission connection assets, the Grid Reliability Standard (GRS) economic test will be applied by Transpower for the short-list selection of preferred options. This includes comparing the costs and benefits of transmission upgrades to the costs and benefits of the status quo option, where load shedding is required for transmission outages. All costs and benefits are compared on a time value of money basis.

Waipa’s network security objective is to strive for the following security levels to be achieved for Transpower’s Transmission Grid and GXP assets and specific parts of Waipa’s distribution network.

Table 15: Security of supply levels by asset

Transpower / Waipa Asset	Security Level
Transpower transmission lines supplying GXPs	n-1, economic test for selection of options
Transpower GXP transformers	n-1, economic test for selection of options
Sub-transmission circuits and zone substation transformers	n-1
11kV urban lines	n-1 switched
Other 11kV lines	n-1 switched where interconnection is economic
Remote rural 11kV lines	n
All 400V lines	n

Voltage complaints

Waipa records approximately 100 voltage complaints per annum, mostly in the rural network and associated with a variety of causes, including overloaded transformers, long low voltage lines (network or service mains) and exporting solar PV DG installations. These are treated on a case-by-case basis, often being rectified through simply adjusting the voltage tap of the associated distribution transformer. In cases where the 11kV feeder voltage variation is excessive other solutions are investigated, including voltage regulators or switched distribution capacitors for voltage support.

Other forms of voltage disturbance (e.g., flicker) are rare on the network and so no specific target or strategy is applied other than the usual consideration of voltage regulation that is routinely applied in network design and upgrade.

5.6 Consumer responsiveness

The Waipa Networks annual customer survey is the predominant method by which Waipa Networks consults with customers. The purpose of this survey is to gauge the general consumer’s reaction to Waipa’s performance during the year. The independent survey by Key Research covers a wide range of operational and public relations aspects of Waipa’s work with a particular focus on overall satisfaction, reliability, image and reputation, value for money and communication.

The survey results as shown in the table below shows that Waipa Networks is performing well in some areas such as value for money and reliability however the overall satisfaction is below the

average benchmark score and improvements are required in image and reputation and communication.

Table 16: Annual customer survey results

Target	Waipa score	Average benchmark score	Proposed target
Overall satisfaction	58%	70%	70%
Reliability	78%	71%	78%
Image & reputation	55%	60%	60%
Value for money	54%	48%	54%
Communication	46%	56%	56%

The annual customer survey is used as the means of assessing performance with regards to Consumer Oriented Performance Targets.

5.7 Price Quality Expectations

Waipa has employed a number of mediums to consult with customers:

- Annual customer survey
- Public meetings
- Customer Helpdesk and Website feedback forms, and
- Complaints Resolution Process

Annual Customer Survey

The primary method of consultation with customers is our annual customer survey. Key Research has been engaged to produce an independent survey to understand customer satisfaction and experience with the services provided by electricity distribution businesses. The survey is completed on The Lines Company, Top Energy, Counties Energy, Northpower, Network Waitaki and Waipa Networks, allowing key performance indicators to be benchmarked against other electricity distribution businesses. The survey takes place midyear and consists of circa 400 telephone interviews with randomly selected customers. The overall results have a margin of error of +/- 4.8% at the 95% confidence level.

For analysis, each customer/ICP is assigned a category from each of the four customer groups:

- Grid Exit Point (Te Awamutu, Cambridge)
- Feeder Type (Urban Te Awamutu, Rural Te Awamutu, Urban Cambridge, Rural Cambridge)
- Tariff Type (Residential, General)
- GXP / Feeder Type have been identified as the key indicators and so quotas are enforced for the survey to ensure the survey sample reflects the population mix.

Some key results from the surveys:

- Customers' overall perceptions of Waipa Networks' performance is relatively high at 58%.
- The main driver of overall satisfaction is value for money (42%), followed by communication (21%) and image and reputation (19%). Key opportunities for Waipa Networks to improve its performance are in the following areas; line charges being good value, how well they keep customers informed about power supply maters, how well they communicate about things they are doing and demonstrating that they care about community.

- Reliability of supply is the highest performing area with 78% of customers satisfied. However, communication is the area with the lowest perception among customers (46%). Based on driver analysis and comments from the respondents, improving the frequency and the quality of communication with customers will significantly improve overall perception of the organisation.

Public Meetings

Waipa Networks organises public meetings on an 'as required' basis. Examples in recent years have been for:

- Planned Transpower maintenance affecting over half the customers on our network and explaining Waipa's rationale and route selection process for the second 110kV line from Te Awamutu to Hangatiki.
- Tamahere community meeting to explain network performance, the network supply characteristics for their area and tree trimming and feeder splitting initiatives to improve network reliability.
- St Kilda community meeting to offer Power Genius home energy management systems to assist consumers in understanding their energy use and how best to optimise the energy self-consumption from their solar Photo Voltaic (PV) systems.

Customer Helpdesk and Website Feedback Forms

Waipa maintains toll free numbers for customers to contact us regarding any issue of our operations. We also maintain e-mail contact details of key staff on our corporate website, and a feedback form for customers to use.

Fault calls and their resolution are recorded in the Waipa database. Network faults are analysed and reported to the Board.

Complaints Resolution Process

Waipa operates a Complaints Resolution Process in accordance with Utilities Disputes (formerly the Electricity & Gas Complaints Commissioner) requirements. All complaints are assigned a case manager and complainants are fully involved and informed on the progress of their complaint.

Complaints are analysed by complaint type and customer type. Waipa receives very few complaints. For the 3 years ending 31 March 2021, the average number of complaints registered per year represented only 0.05% of the total ICPs. Of the complaints received, 98% were able to be resolved using our in-house Complaints Resolution Process. Any feedback provided is used to improve the quality of our service going forward.

More lately, customer connections growth has placed greater load on our customer connection design resource and significant delays in providing new connection quotes has caused increased complaints. Increased design and administration resource has been allocated to this area to better serve our customers.

Customer Price/Quality Expectations & Waipa Networks Pricing

The results of consultation suggest Waipa's strategy of providing a good level of service and low lines charges should continue. With customers supporting price parity, there is little mandate to offer a pricing structure more diverse than we already offer.

The one project where customers have expressed a need for increased quality and a willingness to pay for it is the Te Awamutu 110kV reinforcement project and we have used the feedback received when incorporating the Hangatiki – Te Awamutu 110kV line in our distribution pricing.

5.8 Customer Consultation

Waipa Networks has two types of consultation: Customer-initiated and Company-initiated.

Customer-Initiated

Customer-initiated consultation usually occurs due to a specific need of a customer, or after a Network event affecting one or more customers. This is summarised in the following table.

Table 17: Customer-initiated consultation

Customer Need or Event	Method of Consultation	Desired Planning Outcome
New connection to Network or upgrade of existing connection	Network Connection Application and capital contributions processes	Approvals take network load and growth into consideration. Trends in new connections help plan network income and investment.
Vegetation management	Processes under the Electricity (Hazards From Trees) Regulations 2003	Vegetation management programme addresses all geographic areas according to their specific species growth rates.
Faults	Customer faults number, call centre and field service	Immediate response to resolve fault. Faults individually and collectively analysed to identify medium and long-term investment needs.
Complaints	Use of the customer Disputes Resolution Process	Registered complaints are analysed for trends. Service trends are used to assist network investment decisions.

Company-Initiated

Waipa consults with the following groups regarding significant projects and medium/long term network planning.

Table 18: Company-initiated consultation

Customer Group	Method of Consultation	Desired Planning Outcome
Large Customers	Individual meetings /correspondence as required.	Consideration of larger customers given for key network investments.
Customer Advocacy / Interest Groups	Public meetings/individual meetings /correspondence as required.	Consideration of customer advocacy / interest groups given for key network investments.
Customer Groups (Residential/ Commercial / Urban / Rural)	Annual Customer Survey	Refer below.

Local District Councils, Regional Council & National Regulatory Bodies	Local Council planning cycles and District Plan updates. Meetings with Council officers as required for specific projects. Public meetings / correspondence as required.	Consideration of local and national regulatory bodies given for key network investments.
All	Public and Stakeholder meetings	Consultation with regard to large network development projects that affect all consumers.

5.9 Consumer Oriented Performance Targets

The following Table 19 indicates the Consumer Oriented Performance categories and targets based on customer feedback conducted by Key Research. The % target figures listed are the results expected to be returned in each category for the respective customer survey year and it is based on the higher of the average benchmark score (from other EDBs from the same survey) and Waipa's current performance. In the second five years of the period, the performance target ramps up so that Waipa is aiming for performance at the top end of the EDB performance in the current survey by year ten.

Table 19: Customer orientated performance targets

Performance Indices	Target 2022/23	Target 2023/24	Target 2024/25	Target 2025/26	Target 2026/27	Target 2027/28	Target 2028/29	Target 2029/30	Target 2030/31	Target 2031/32
Overall satisfaction	70%	70%	70%	70%	70%	73%	76%	79%	82%	86%
Reliability	78%	78%	78%	78%	78%	80%	82%	84%	86%	88%
Image & reputation	60%	60%	60%	60%	60%	63%	67%	71%	75%	79%
Value for money	54%	54%	54%	54%	54%	56%	59%	62%	65%	68%
Communication	56%	56%	56%	56%	56%	57%	59%	61%	63%	65%

Waipa recognises achievement of these satisfaction performance targets is dependent upon fulfilling our Vision, Mission and Objectives and seeking continued improvement in the Waipa's security and reliability targets.

5.10 Network continuance

To provide a safe and reliable electricity distribution service, the network must be managed such that its condition is not allowed to unduly deteriorate. General assessments on whether the network is being properly managed in this regard may be seen in:

- The distribution of Asset Health Indicators (AHIs) applicable to each asset category.
- The expected lives and the consumption of those lives in the regulatory accounts.
- The age profiles in relation to the average industry age profiles.
- The replacement capital forecast in relation to an age-based model forecast.

Asset Health Indicators are measures of asset health based on a set of criteria developed for a number of network asset categories. Waipa has adopted the AHI criteria developed by the NZ Electricity Engineers Association (EEA). AHI charts are provided in the fleet management section of this AMP and the Commerce Commission's condition grade scores are provided in Schedule 12A in Section 12 Schedules. These show no issues of concern, with the majority of the network showing health indicators commensurate with the asset ages and their expected lives.

Other measures of network continuance are discussed within this section and demonstrate that, in overview, Waipa does not have an over-aged network, has an expectation for lives of its network

assets in keeping with general industry practice and the level of replacement expenditure is broadly in keeping with the capital that would be spent by an average distribution business given the number, type and ages of Waipa's assets.

Expected lives and comparative age profiles

The chart of Figure 25 describes the spread of cost-weighted depreciation-based lives (in years) amongst the different EDBs; that is the average accounting-based life expected for these asset classes. Figure 24 describes the spread of the percentage consumption of those lives consumed (refer to the next paragraph for a definition). Waipa's expected life and percentage consumption of that life is represented by the red dot points in the charts. Waipa's assets are mostly within the +/- 50 percentile boxes for expected lives indicating that Waipa intends to achieve the asset lives commonly anticipated within the industry. In the comparison of consumption of life, Waipa is at or below 50% consumed life (against its own life expectation) apart from distribution lines, which are becoming marginally over-aged in average.

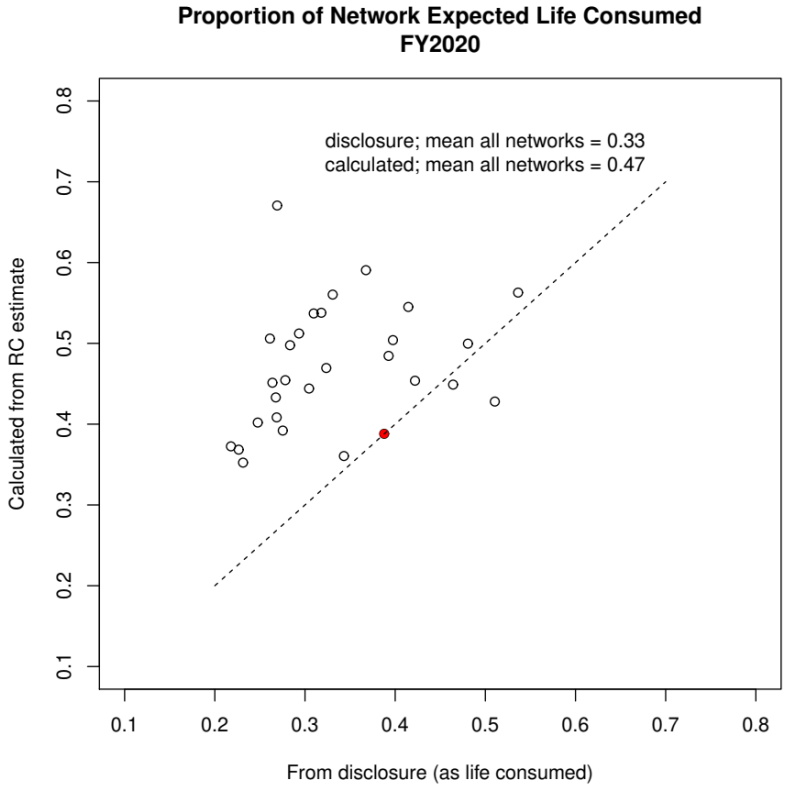
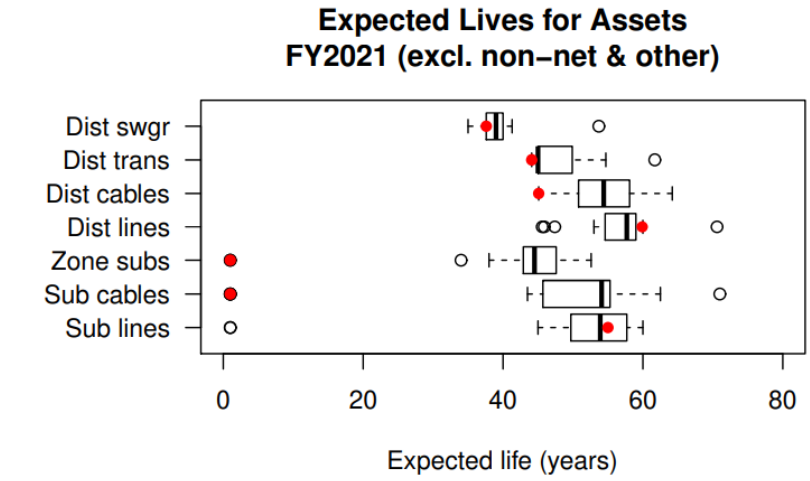


Figure 24: Consumption of asset lives

We have used a calculation of life consumed based on the component depreciation and its depreciated life as there are issues with the regulatory disclosure values in their calculation. These are box-and-whisker charts; the boxes represent the 25th to 75th percentile bounds; the whiskers either the maximum or 1.5 x the inter-quartile length; and the chart circles the outlier points beyond that. Data is from RY2021 Information Disclosure Schedules. The graph below shows that the consumption of life for distribution transformers and distribution switchgear appears relatively high but this is against a low expectation for the life of this equipment. The life expected for distribution cables is particularly low compared to other businesses. The consumption of life for distribution lines seems to be relatively high against life expectation given its zero replacement capex forecast but it is expected this will probably change over the years as these assets come to end of their life or replaced to provide more capacity as network growth continues to increase.



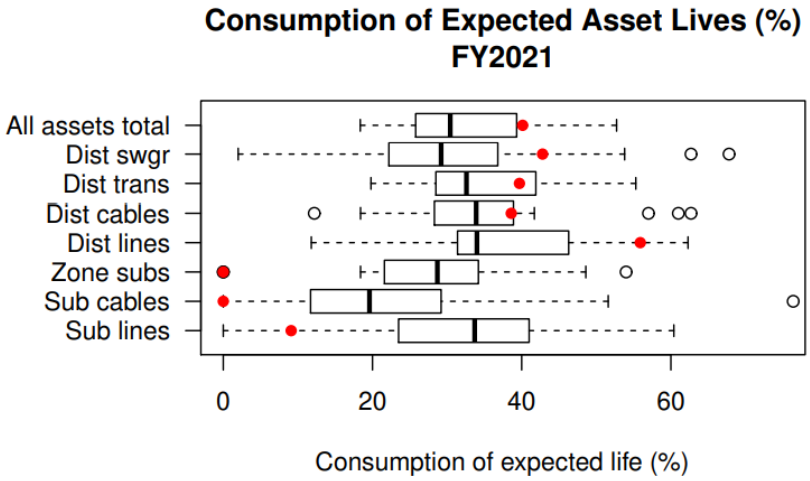


Figure 25: Comparison of consumption of expected asset lives

Further age information is depicted in the charts of Figure 26 (concrete poles) and Figure 27 (wood poles) which Waipa's concrete poles show a proportion of the population in excess of the NZ average age profile and indeed Waipa does have a significant number of reinforced concrete poles approaching 90 years of age (as described later in the fleet strategy section). However, these poles are typically in reasonable condition and the final life expectation of concrete poles (pre-stressed poles in particular) is not yet determined as even the NZ average age profile continues to advance in age almost year-for-year. In Waipa's case, it is possible that replacement of many of these older concrete poles will be co-incident with conductor replacements due to the increased conductor weight and the reconstructed line design code requirements.

To interpret the following graphs, age in years is on the x-axis and age distribution density on the y-axis. Density is used as the charts show the relative proportionality of asset quantities by age between Waipa (red line) and all NZ EDBs summed together (blue dashed line). The expected asset life is the yellow dashed line.

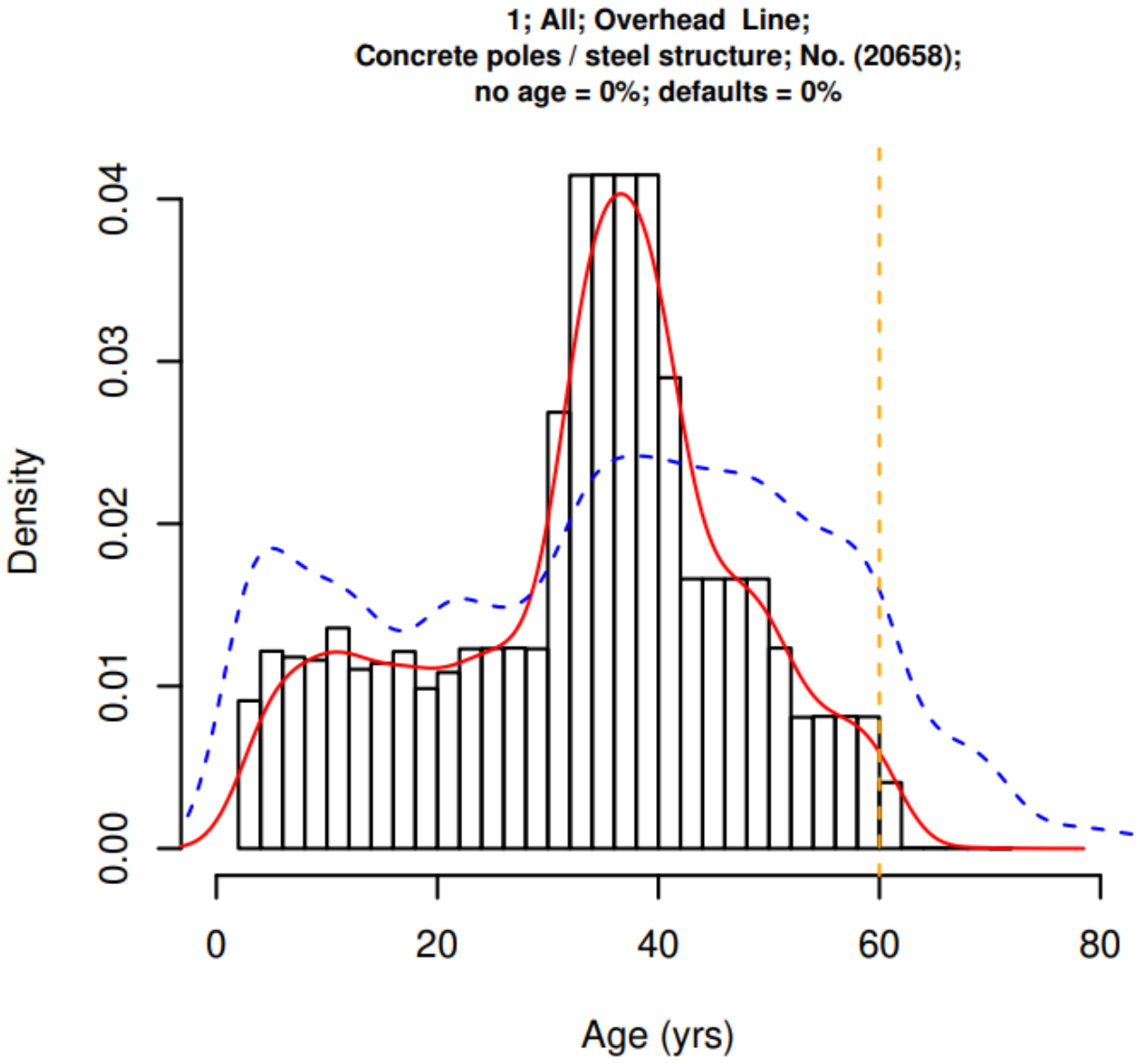


Figure 26: Comparison of Waipa's concrete and steel poles vs New Zealand EDBs average

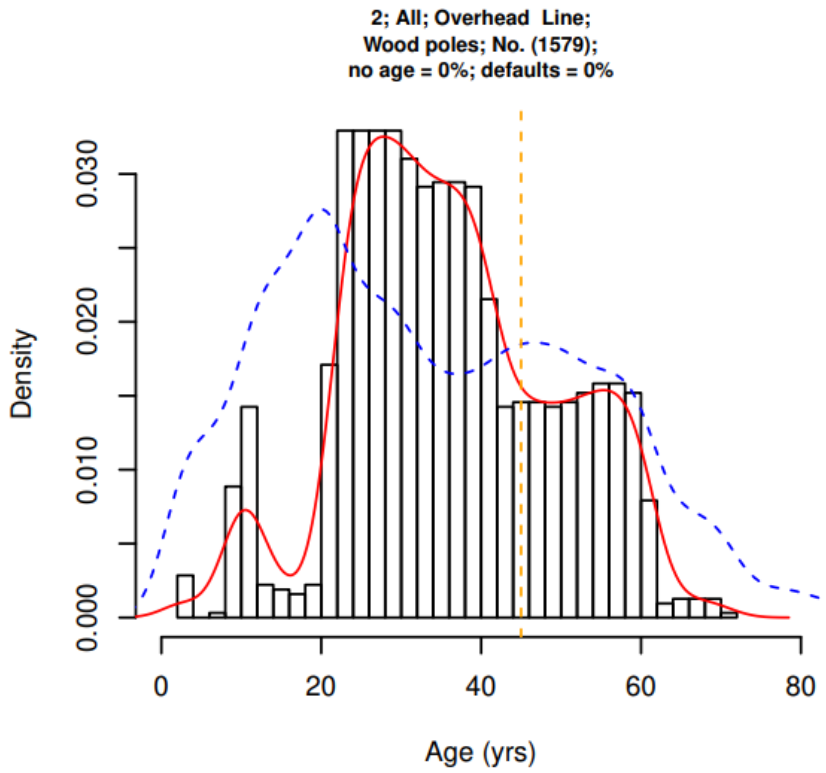


Figure 27: Comparison of Waipa's wood poles vs New Zealand EDBs average

Whilst Waipa does not have a large population of very old wood poles, its wood pole age profile is extending above 40 years. Wood poles in particular are considered to have increasing condition deterioration between 40 years and 60 years of age. Waipa is therefore preparing for increasing wood pole replacements on its network and the strategic enhancement of its condition inspection processes, described later in this plan, is part of that forward thinking. The upcoming pole imagery survey together with a five-year ground inspection of the wood pole fleet will further inform Waipa's replacement capital forecasts.

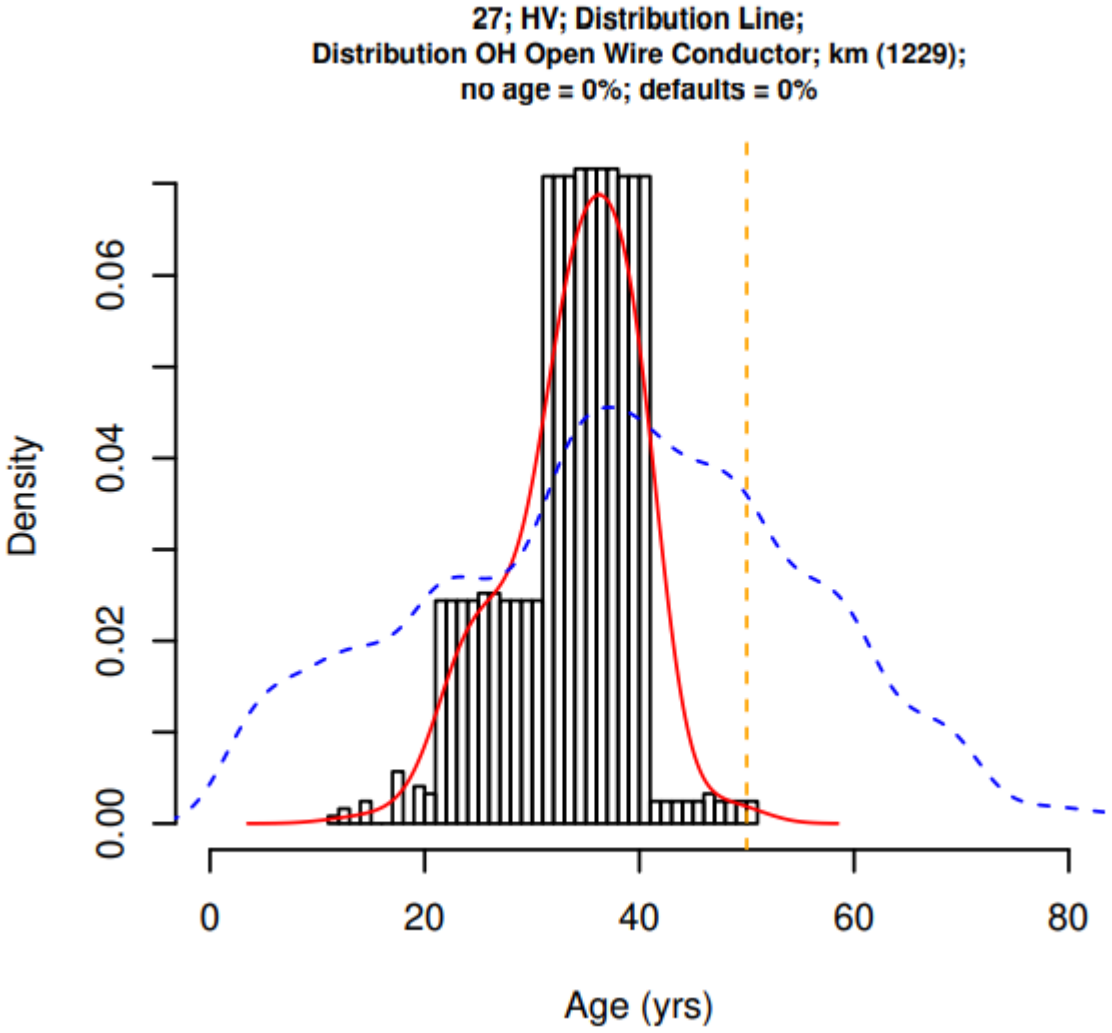


Figure 28: Waipa's vs all NZ EDBs HV conductor age profile

Of note, however, is the HV conductor age profile which now exceeds the boundary of the NZ average age profile for HV distribution conductor in the 30 to 40 year band. Further aging will lead to an age profile "overhang" under this comparative measure. This is illustrated in Figure 28 with the red plotted line being the Waipa's HV conductor age profile and the blue dash line being the all-New Zealand age profile for this asset class. In approximately ten years' time this conductor will approach the expected asset life (yellow line in Figure 28). While replacement will be condition based or network capacity driven, this indicates that expenditure for conductor replacement will increase in circa that timeframe.

Waipa currently identifies and implements conductor replacements of its older and at-risk conductor types such as galvanised steel based mainly on the risk assessments it has undertaken. However, this strategy is also supported in principle by this comparative age assessment as it shows Waipa's conductor replacement programme commencement is neither too early nor too late in relation to the experiences of other businesses. Whilst age is a useful proxy, replacement of network components needs prudent assessment relative to condition, location and importance, and not age alone.

5.11 Asset Delivery Efficiency Targets

Waipa uses the performance indicator of Loss Ratio to measure network asset delivery efficiency.

Loss Ratio

Loss Ratio measures the ratio of kWh lost on the distribution network to kWh conveyed per year. Lost units are the difference between metered sales to consumers and metered purchases at each Transpower GXP and distributed generation supplied to the network.

Losses are composed of physical losses due to the heating of distribution assets, un-metered supply and theft. Losses are difficult to measure accurately because all unit sales through retailers' meters would need to be read instantaneously at year-end to calculate the difference between conveyed and sold energy. Currently only Time-of-Use meters in consumers' installations can supply the required accuracy for sales. The loss ratio target has been reduced from 6.5% to 5.7% due to recent historical performance at approximately that level. Increased levels of smart meter installations appear to be reducing the level of losses, as reconciliation accuracy trends up as a result.

Load Factor

Load Factor measures the ratio of kWh conveyed per year to the kW maximum demand (MD) multiplied by the number of hours in a year. Improvement in this performance indicator requires minimisation of MDs via a fully functional load management system whilst delivering contracted service levels. Load Factor can also be improved by increasing the kWh conveyed over the distribution network. Because network assets are built to meet MD a good load factor is essential to obtain economic use of assets.

Load control is used to control MDs to:

- Defer capital investment in larger assets.
- Reduce Transpower charges.
- Reduce network losses.

In the short term the dominant reason to minimise the MD of a network is to minimise Transpower charges. In the medium term it is to defer capital investment. Its impact on losses is minor and ignored in all practical respects.

When Transpower's charging methodology changed from being based on a network's 12 highest anytime MDs to its contribution to a region's 100 anytime MDs there was no reason to manage a networks MD at times of low regional demand. From 2010/2011 Waipa's practice changed from the former to the latter and Load Factor is no longer used as a key performance measure for the network.

Asset Delivery Efficiency Targets

Table 20: Asset delivery efficiency targets

Asset Delivery Efficiency Performance %	Target 2022/23	Target 2023/24	Target 2024/25	Target 2025/26	Target 2026/27	Target 2027/28	Target 2028/29	Target 2029/30	Target 2030/31	Target 2031/32
Loss Ratio	<5.7	<5.7	<5.7	<5.7	<5.7	<5.7	<5.7	<5.7	<5.7	<5.7

5.12 Business Financial Targets

Waipa uses the following financial performance indicators as a measure of Waipa's financial performance. The following table shows the targets that have been set in the SCI.

Table 21: Business efficiency financial targets

Key Performance Indicator	Target 2021/22	How we will be measured
We will generate a sustainable Return on Total Assets	4.9%	Net surplus before interest and tax as a percentage of Total Assets
We will generate a sustainable Return on Equity	4.6%	Net Surplus after tax as a percentage of Equity
We will meet all expectations under the Discount Policy	$4.70m	We will report on the discount paid to beneficiary customers during the year.

These targets are consistent with Waipa's objective below, by maintaining sufficient spending to maintain a sustainable business with effective performance of company functions:

Building a sustainable business by establishing energy communities in the Waipa region

5.13 Public Safety, Amenity Values and EDB Performance Goals

Waipa will take all practicable steps to eliminate the risk of injury to people, animals and damage to property by ensuring that:

- All electrified assets are secure from inadvertent or accidental contact by the public.
- All equipment earthing complies with industry standards.
- All network assets are maintained in good, safe working order.
- All faults are detected and disconnected from supply automatically and made safe.

These objectives are consistent with the first element of Waipa's objectives:

Deliver power safely all day every day

Waipa will be cognisant of the requirements of the Resource Management Act, Waipa District Council Plans, Waikato District Council Plans, Otorohanga District Council Plans, Waitomo District Council Plans, Waka Kotahi/New Zealand Transport Agency requirements and On Track requirements when constructing new lines.

These objectives are consistent with Waipa's principle of operating in an environmentally friendly and sustainable fashion.

5.14 Objective commitments

Through its SCI, Waipa also sets other objective targets for its network business including:

- Financial performance.
- Network reliability performance.
- Customer, community and environment.
- Staff safety.

The performance against these objectives is included in the Waipa's annual reports published against an accounting year ending 31 March and is available on Waipa's website.

5.15 Performance summary and response

Customer Satisfaction Performance

The July 2021 consumer survey indicated an overall satisfaction rating of 58% (Target 70%). The results for the other key performance indicators are:

- Reliability 78% (Target 78%, achieved).
- Image and reputation 55% (Target 60%).
- Value for money 54% (Target 54%, achieved).
- Communication 46% (Target 56%).

Waipa achieved two out of five of the customer satisfaction targets.

Reliability Performance

Waipa's actual SAIDI and SAIFI performance over the past three years compared with the Commerce Commission DPP3 reliability threshold levels is shown in the following table:

- 126.19 Planned SAIDI minutes and 0.48 Planned SAIFI
- 103.32 Unplanned SAIDI minutes and 1.73 Unplanned SAIFI.

Table 22: Network reliability performance

Network Reliability Performance Indices	2018/19	2019/20	2020/21
SAIDI planned - Historical	53.2	87.0	118.4
SAIDI planned - DPP3	53.21	87.00	118.40
DPP3 Target	126.19	126.19	126.19
SAIDI unplanned - Historical	115.0	182.0	139.0
SAIDI unplanned - DPP3	85.41	117.73	105.17
DPP3 Target	109.32	109.32	109.32
SAIFI planned - Historical	0.21	0.30	0.36
SAIFI planned - DPP3	0.21	0.30	0.36
DPP3 Target	0.48	0.48	0.48
SAIFI unplanned - Historical	1.47	2.20	1.36
SAIFI unplanned - DPP3	1.17	1.49	1.26
DPP3 Target	1.73	1.73	1.73

Network Reliability Performance Indices	Actual 2018/19	Actual 2019/20	Actual 2020/21	Target 2020/21
Faults per 100km (11kV)	11.1	15.1	9.2	11.6
No. of planned outages	98	163	148	90
No. unplanned outages	148	176	133	120

Assessing performance against the new DDP3 targets, Waipa achieved the planned reliability target for SAIDI in 2018/19, 2019/20 and 2020/21. Waipa achieved the unplanned SAIDI target in 2018/19 and 2020/21 but not in 2019/20. Planned and unplanned SAIFI targets were achieved in all three years. The 2020/21 faults per 100km target was achieved and the number of unplanned and planned outages targets were not achieved for 2020/21. The Waikeria Project and other renewal work heavily influenced the high number of planned outages, resulting in the number of planned outages not being achieved.

Asset Delivery Performance

The following table shows actual asset delivery performance over the past three years compared to Statement of Corporate Intent target of <6.5% set for 2019/20.

Table 23: Asset delivery performance

Asset Delivery Efficiency Performance %	Actual 2018/19	Actual 2019/20	Actual 2020/21
Loss Ratio	5.48%	5.40%	4.70%

Waipa's loss ratio asset delivery KPI was achieved in 2020/21.

Security

Waipa's objective of establishing n-1 security of supply for Te Awamutu GXP set in AMP 2013 was achieved in July 2016.

Waipa's objective of establishing n-1 security of supply for Cambridge GXP is forecast to be achieved in 2024. The strategic project Cambridge GXP Capacity Solution is intended to achieve this objective.

Non-Network Solutions

The Cambridge Non-Network Capacity Support project is forecast to support Cambridge GXP capacity from 2020 to 2025.

Asset Defects

Re-evaluation of the approach to the network survey has selected a new method to survey the entire overhead network, via a LiDAR (Light Detection And Ranging) and high-resolution photo aerial survey. This has obtained an overall view on overhead asset defects, conductor clearances and asset health indicators for poles, cross arms and pole mounted transformers. The LiDAR data also provides vegetation clearance data for the network, allowing risk prioritised vegetation management. There is also a synergy with the new Geographical Information System (GIS) project, as the survey will provide highly accurate and up to date information as an input to the GIS.

The aerial survey commenced in February 2021 to cover the entire network for LiDAR and rural poles for photos. The results for asset condition (asset health indicators) for poles, cross arms and pole mounted transformers were incorporated into AMP 2022. Defect counts for the overhead network were high, but the assessed urgency of the defect resolutions appears conservative (more urgent replacement) when the number of defects identified is compared to the fault rate of the network. It is therefore expected that the renewal of defects can be phased out over future years without an undue effect on network fault rate, reliability and safety.

Photo surveys of urban areas will be scheduled once the outcomes of the rural survey are known. Ground mount transformers and ring main units will be inspected every three years and wood poles will continue to be surveyed from the ground.

Earth Testing and Repair

Waipa completed 48% of its earth testing and repair program for 2020/21, with focus on completing repair works to resolved known poor test results and catching up on past years testing. Expenditure was 41% of annual budget. Greater focus will be required in 2021/22 and 2022/23 to regain ground on this work.

Vegetation Management

Waipa completed only 37% of its vegetation management program for 2020/21 due to the budget being insufficient to trim the entire programme. Spending on vegetation management was 99% of the annual budget.

Financial Performance

The following table shows actual financial performance KPIs compared to Statement of Corporate Intent targets set for 2020/21.

Table 24: Business efficiency performance

	Actual 2020/21	Target 2020/21
Return on Total Assets	4.92%	4.9%
Return on Equity	5%	20.68%
Expectations achieved under the Discount Policy	$5.75m	$4.70m

Waipa's financial KPIs were achieved in 2020/21, with the exceptional return on equity being associated with the sale of the Ultra Fast Fibre shares.

Constraints

Waipa's objective of eliminating predicted feeder constraints were achieved by the timely implementation of network feeder enhancements identified in the network development projects of previous AMPs.

Quality of Supply

Voltage

Waipa's obligation to ensure regulatory voltage can be delivered was achieved by the timely implementation of network feeder enhancements identified in the network development programme of previous AMPs and the timely installation of voltage regulators. Waipa also acts promptly to resolve proven voltage complaints received from consumers.

Power Factor

Waipa's network power factor has been greater than 0.95 (lagging) at times when Transpower has experienced its 100 Lower North Island peaks and when Waipa has incurred its 12 anytime maximum demands.

Interference

No complaints regarding interference have been received in 2020/21.

Summary

The service level targets that Waipa has described and set within this Plan have been derived from a combination of consumer engagement, comparative assessment and a commitment to continuous improvement recognising the practical limits of a mostly radial network covering a mix of urban, rural and remote areas.

Consumer engagement arises from planned periodic focus group engagement, particularly with key stakeholders, and through annual satisfaction surveys on the consumer base. Whilst the latter cannot, by its nature, provide specific direction, it does support the network reliability and faults response that is being achieved driven through the internal performance targets that have been set.

Comparative assessment shows the network is achieving close to average reliability while managing costs within expectation levels. The network is not over-aged and will not become so provided Waipa manages its asset fleets through condition inspection and targeted replacement and through executing the renewal works set out in this plan.

System losses are of less interest to consumers than reliability although they ultimately impact on the cost of supply. To a large extent, this performance measure is a direct consequence of design standards and previous decisions on system configuration. Comparative assessment shows this measure to be consistent with expectations given the characteristics of Waipa's network.

This performance analysis reveals the following key directives:

1. To achieve its reliability targets, Waipa needs to maintain its vegetation management programme as this has a significant impact on faults. Because of the limitations of the Tree Regulations a network company is only mandated to cut or trim a tree when it is within the prescribed growth limit zone, limiting the degree of proactive management that can be undertaken.
2. Waipa is entering a period requiring increasing replacement of aging assets, in particular wooden cross arms. The aerial survey of the network will assist in quantifying this replacement programme.
3. Further analysis of reliability initiatives is planned to identify avenues for greater use of automation and technology to improve network restoration times.
4. No change in strategy is indicated as being necessary to achieve other performance targets such as line losses etc.

5.16 Conclusion

Waipa believes its asset management process, predictions on load growth, procedures to identify future network constraints and network assets surveys will enable Waipa to make informed asset management decisions regarding existing assets, non-asset solutions, procuring new assets and retiring assets.

Waipa believes that further development of asset management systems and asset data will assist in making future asset management decisions. In particular, further work is required in developing asset condition data, asset health indicators and forecasts of network equipment renewal expenditure. Planning to implement these asset management process improvements will continue in 2022/23. Waipa has reviewed the adequacy of the asset management information systems and has formed the Information Systems Strategic Plan to action enhancing and updating these systems in future.

Waipa is confident that over the next 10 years it is able to preserve the value of the network for Waipa's shareholders and will provide our connected consumers and public with a network which has capacity for growth, is secure, reliable and safe via the following:

- A commitment to provide appropriate levels of security of supply to Cambridge and Te Awamutu.
- A commitment to continually improve network reliability.
- Implementing proposed network development plans.
- Efficient life cycle management of existing assets.

6. Asset management strategy

This section sets out the underpinning strategies that Waipa will employ to realise the asset management objectives it has set, and the performance targets it endeavours to meet.

6.1 Overarching asset strategy

Asset management policy

Waipa Networks Limited is committed to maintaining, operating and developing its electrical distribution system and supporting management structures to convey electricity to connected customers in a safe, reliable, efficient and sustainable manner.

This will be achieved through the regular review, continuous development and application of an Asset Management Plan.

The Asset Management Plan provides a governance and management framework that ensures Waipa Networks Limited:

- Sets service levels for its electricity network that reflect safety, customer, community and regulatory requirements.
- Understands what network capacity, reliability, power quality and security of supply will be required both now, and in the future, based on those expected service levels and what issues drive these requirements.
- Has a robust and transparent process in place for managing all phases of the network lifecycle from concept to disposal.
- Has adequately considered the classes of risk implicit in all of the network lifecycle activities and that it has systematic processes in place to mitigate identified risks.
- Has made adequate provision for funding and resourcing all phases of the network lifecycle for incorporating into Waipa Networks Limited's annual and ten-year budgeting cycles.
- Makes decisions within systematic and structured frameworks at each level within the business eliminating ad-hoc decisions.
- Has an ever-increasing knowledge of its asset locations, ages, conditions, criticality and the networks likely future performance and characteristics as it ages or is required to perform at different levels. This will be supported by asset management systems and processes.

The secondary purpose of this AMP is to inform Waipa Networks Limited' stakeholders of the Company's:

- Policies for investment in construction, maintenance and retirement of assets.
- Policies for operating the network in a safe and prudent manner.
- Security of supply and network reliability targets for different consumer segments.
- Areas of asset management where improvements are required.
- Major network developments and enhancements over the next 10 years.
- Annual capital and maintenance expenditure forecasts.

This AMP meets the legislative requirements of the Electricity Distribution Disclosure Determination 2012.

Service levels

Waipa Networks will:

- Provide a safe environment for the public and staff through efficient and effective management of its network.
- Continue meeting the service levels described in the performance analysis and service levels section of this plan.
- Meet the minimum of statutory levels or agreed terms for supply voltage.
- Follow its security of supply standards unless the required investment levels are inconsistent with good engineering practice and/or commercial criteria.
- Endeavour to limit flicker to levels specified by AS/NZS 61000.3.7:2001, by educating and encouraging consumers to comply with this standard.
- Endeavour to limit harmonics to levels specified in ECP 36:1993 and AS/NZS 61000.3.2:2013 by educating and encouraging consumers to comply with these standards.
- Target an overall power factor of greater than or equal to 0.95 lagging at times of high load on the network and require that all ICPs meet this requirement.
- Facilitate connection of distributed generation where it does not compromise safety, network operation, quality of supply to other consumers, or power factor. Waipa may require a distributed generator to pay the economic costs of connection, including reactive power compensation, where these costs are consistent with Part 6 of the Electricity Industry Participation Code.
- Interrupt supply to domestic consumers before interrupting supply to hospitals, industrial and commercial consumers for purposes of emergency demand management.
- Encourage and facilitate energy efficiency.

Asset configuration

Waipa Networks will:

- Work with Transpower to minimise its fixed asset requirements commensurate with providing a reliable and secure supply to consumers.
- Take a long-term view of asset requirements.
- Consider non-network solutions including demand-side management and distributed generation.
- Seek opportunities to improve the network interconnection for security and reliability where it is both feasible and economic to do so.

Resourcing

Waipa Networks will:

- Identify the required skill sets on a timeframe equal to this AMP and ensure that recruitment and training plans are consistent with its needs and, where appropriate, use relevant contractors.
- Endeavour to procure resources locally, where and when appropriate.
- Retain its current field services staff for fault restoration, inspections, maintenance and capital work.
- Use contractors/consultants where its staff do not have the required skill sets, where resources are inadequate for its works programmes or where it is more cost effective to do so, e.g., specialist work such as civil engineering design and radio equipment installation and maintenance.

Materials

Waipa Networks will:

- Make safety the primary consideration in all purchases.
- Only use, or allow onto its network, materials and equipment which meet recognised industry standards approved by its own internal standards and policies.
- Endeavour to procure materials locally, where and when appropriate.
- Relative to cost and other considerations consider the total lifecycle costs of network components when assessing offers.
- Recycle materials where practical, taking into account the total lifecycle costs and overall risk.
- Purchase timber products such as poles from sustainable and renewable resources.
- Consider all environmental impacts in the purchase and utilisation of all items in its operations.

Risk

Waipa Networks will:

- Adopt a conservative risk position, especially with regard to worker and public safety.
- Regularly review its risk position using the prevailing standard ISO 31000:2019.
- Bias on the side of over-investment in network capacity, recognising that under-investment can lead to supply interruption and that the overall economic cost suffered by consumers can be markedly greater than the cost of prudent investment taken before it is required. Within the network industry, waiting until the demand exists is too late.

6.2 Accountabilities and Responsibilities for Asset Management

Waipa's Network Assets team determines the network enhancement and asset maintenance programmes, the various security of supply levels and the standards for automation and system operations that will improve network reliability and technical and economic efficiency.

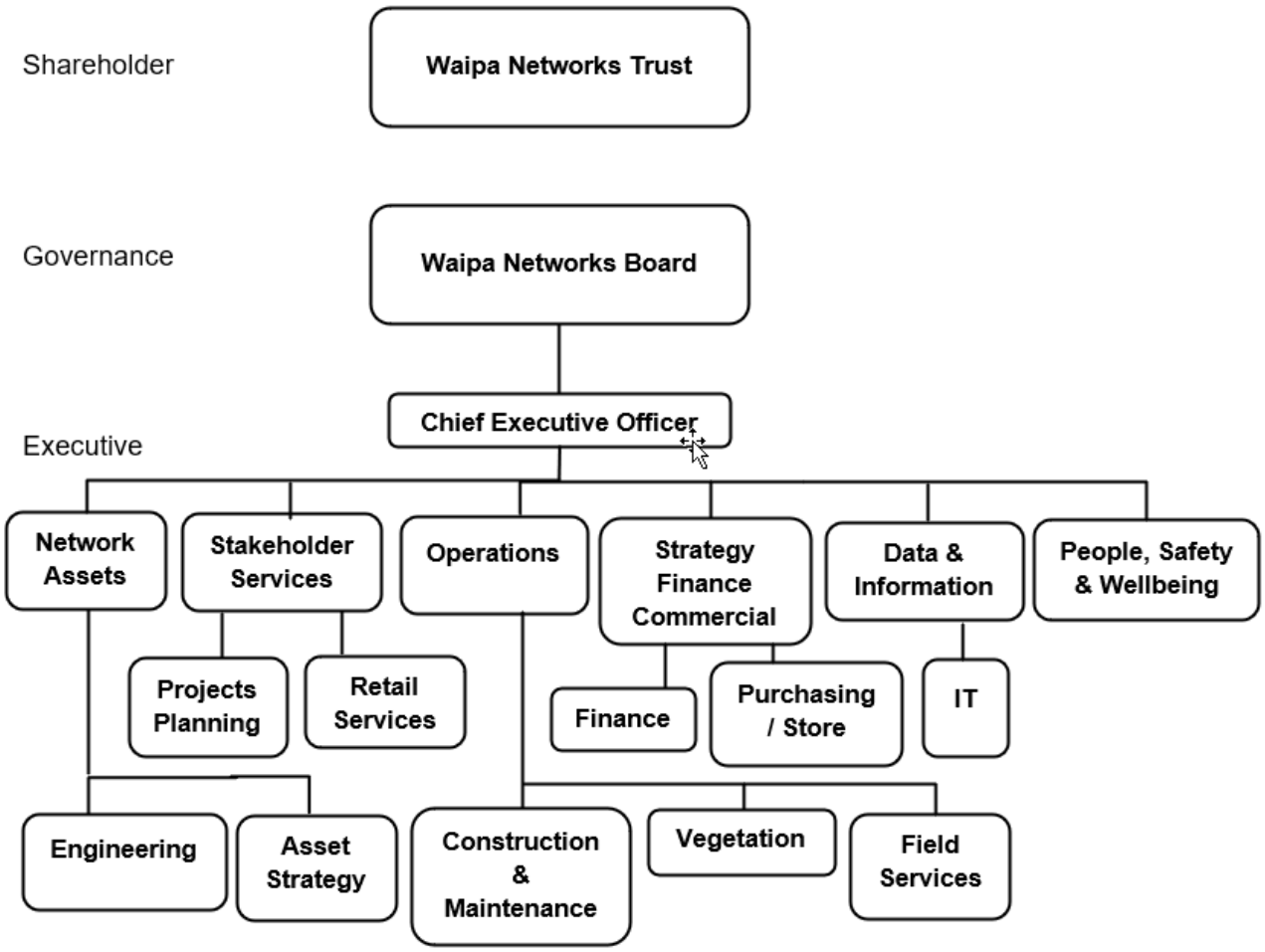
Major network capital works identified by the Network Assets team with indicative budgets are tabled at appropriate Board meetings for Director's information, evaluation and appropriate approval.

The AMP is prepared by the Asset Strategy Manager, reviewed by the Head of Network Assets, recommended for approval by the Chief Executive and approved and certified by Waipa's Directors the following March.

Waipa's Head of Network Assets provides monthly reports to Waipa's Directors on progress against targets of the annual capital and maintenance plans, system reliability and performance targets.

Waipa's Board reports to Waipa Networks Trust bi-annually on progress against the targets and plans agreed in the SCI.

An organisation chart depicting Waipa Networks Trust, Waipa's Board of Directors, Executive Management and Operational positions responsible for asset management planning and disclosure is shown below.



The Head of Network Assets holds the prime responsibility for the disclosure of the AMP and associated schedules.

The head of Network Assets chairs Waipa's Network, Operations & Engineering Team comprising; Head of Operations, Field Services Manager, Engineering Manager, Projects Planning Manager, Line Mechanic and Live Line Managers, Vegetation Manager, Health & Safety Facilitator, Purchasing & Stores Manager, all of whom have a significant input into the AMP by identifying the required capital projects and operational works.

The Network Information Specialists are responsible for managing records of network assets.

The Head of Strategy, Finance and Commercial is responsible for assembling the budgets and reporting expenditure, and compilation of information disclosure schedules. The Head of Data and Information is responsible for corporate business systems and IT functions within Waipa Networks. The People, Safety & Wellbeing Manager is responsible for human resources, recruitment, training, liaison with WorkSafe NZ, industry compliance and Waipa's Public Safety Management System and Workplace Safety Management Practices accreditation.

The Head of Network Assets, Asset Strategy Manager and Network Development and Engineering Manager have significant input into the AMMAT assessment, with consultation with other areas of the business as required.

Waipa's AMP is produced within the Company and all information used in it is determined by Waipa's management team. The CEO recommends the AMP for approval and the Board approve and certify it.

Resourcing Asset Management

Waipa currently can carry out the majority of all planned and unplanned cable and pole line work and vegetation management. Waipa continually reviews the performance and cost effectiveness of its field crew services by contracting in external service providers when workload exceeds our internal resource to ensure construction and maintenance costs remain competitive. Contracting out Waipa Networks' field crews has occurred for street light installation and maintenance and cable jointing and this remains an option where necessary to ensure productive use of our internal field crews.

Waipa uses independent contractors as required to carry out thermal surveys, drone camera inspections of overhead assets, earth testing and repairs, partial discharge surveys and acoustic monitoring surveys. This information is used by Waipa's Network Assets team for condition-based maintenance and replacement of electricity assets and network enhancements.

Waipa has contracted out Control Room and Call Centre services, aspects of SCADA and communication work, cable directional drilling and traffic management on State Highways and for most roadside lines and vegetation management works.

Waipa has also contracted out the condition assessment and maintenance of the new Hangatiki to Te Awamutu 110kV line because Waipa does not have these skill sets internally. Waipa will use its own fault staff to carry out fault patrols of the line as required.

6.3 Systems and information management

Business management processes and standards

Waipa recognises the importance of adopting best practice in its business management practices to undertake its work safely, efficiently and to achieve its objectives. It also recognises it is important to provide confidence and transparency to its stakeholders that its various management practices are consistent with required standards and best practice.

Information systems

Information systems are key to the performance of almost all modern organisations and therefore need to be planned and managed. Waipa has a suite of information systems which have all been configured and developed for its needs. The systems are primarily used to house and manage asset data and are then used to drive many of the network activities. Table 25 highlights Waipa's key systems, their roles within the organisation, some of the more significant data that they hold and how these systems integrate together.

Table 25: Overview of Asset Management Information Systems

Asset Management System	Uses
Abbey SCADA Supervisory Control & Data Acquisition	• System control • Load control • Operational status • Network loading data • Voltage data • Alarm and fault data • Reliability data
Geographic Information System AutoCAD	• Asset geographical location data • System schematics and reticulation plans • System operations • Construction plans • Design standards • Owner, road and property boundary data
MagiQ Integrated Data Warehouse	• Installation Control Point data • Call centre enquiries • Planned outage notification • Outage (planned and unplanned) data • Asset data (type, number/length, age, asset value) • Network condition and vegetation data • Financial applications (General Ledger, Creditors Ledger, Debtors Ledger, Banking Transaction processing, Payroll, Human Resources, Stores, Purchase Orders, Asset Register (Financial and taxation) • Disclosure statistics and information
MATLAB Network Data Management System	Data extraction for: • Electrical network modelling • Load flow analysis • Electrical network planning and design
ETAP Network Modelling Software	• Electrical network modelling • Load flow analysis • Short circuit fault current analysis • Electrical network planning and design • Electrical cable capacity calculations • Arc flash energy calculations
Assura	• Health and safety management and reporting system

The asset management systems are employed for the following functions:

- Asset creation, modification and deletion.
- Asset attribution and attribution history.
- Management of Waipa's capex projects (creation and management of project

records and information).

- Management of Waipa's opex works (creation and management of opex tasks and information), including planned maintenance tasks; whereby inspection programmes are pre-determined and managed.
- Integration with Waipa's financial system.
- GIS (map viewer) with limited integration to asset information.

Waipa operates three primary asset management systems to manage its existing assets, plan network development and measure network performance. These systems comprise an Abbey SCADA system for network supervisory control and data acquisition, an AutoCAD system for geographic asset information and a MagiQ System which provides an integrated data warehouse.

Waipa also uses a network modelling tool, ETAP, to predict current and future network performance under steady state and fault conditions and model the impact of proposed system enhancements and future demand. Assisting with this is the MATLAB Network Data Management System, to extract data for modelling purposes.

Supervisory Control and Data Acquisition System

The prime function of SCADA is to provide a real time interface with the network which enables the safe operation and management of network assets, reliability of supply and system peaks. Data and alarms from field assets are brought back via Waipa's radio communication links to the Control Centre and displayed for the System Operators to remotely monitor and control equipment for optimal network performance.

The data collected includes feeder currents, voltages, real and reactive power, power factor and asset operational status. Relevant data is archived in the Integrated Data Warehouse. This information is used to establish network asset maintenance programs, plan network developments and measure and disclose network performance.

The SCADA system manages ripple injection plants at both Te Awamutu and Cambridge to control the load over peak times at GXP and/or feeder level.

Communication Systems

Waipa Networks has a legacy analogue communication system for its voice and data requirements. Data is used for SCADA system to monitor and control automated devices whereas voice is used to talk to the control room for the purpose of operating or switching network devices. Both of these networks need to be have good availability and reliability. However, with the additions of a number of automated devices, the bandwidth for both voice and data through the analogue channels is getting narrower and Waipa Networks is currently evaluating the option of migrating analogue communication to digital.

Some repeater channels have exceeded the maximum recommended RTUs per line, having an impact on overall SCADA system performance. The existing SCADA is not able to be expanded significantly because it is constrained by the bandwidth between the Waipa Depot and the repeater sites and between repeater sites. Although in the interim, it may be possible to install additional SCADA repeaters to try and alleviate the overload by reducing the number of RTUs per line to enable more devices to be connected, overall SCADA system speed will not be improved by these measures.

The need to go to a digital platform is recognised. While a new network could be designed for the minimum requirements to meet current needs, Waipa recognise the advantage in future-proofing the new network. There would be little cost advantage in installing a medium capacity UHF network without a ring configuration, as opposed to installing a high-capacity microwave network with a ring topology. A ring topology allows for diversity of access to each repeater to enhance availability. Such a topology provides more robust protection against a failure of a site or circuit and access to healthy sites will remain even though there may be a complete failure of a site or radio link. With the installation of a microwave backbone between repeater sites, this also offers the opportunity to upgrade the mobile voice network with IP circuits between Tier 2 DMR repeater terminals. This is an important aspect to the project as Waipa advise that the current analogue mobile voice network has issues with poor quality voice between field staff and WEL and between operators in the field. This has the potential of both operational security and safety consequences. A digital mobile voice network will provide better clarity in communication due to considerably less background noise.

The microwave ring network options are determined by what radio paths are possible and the coverage that needs to be achieved by the SCADA and mobile voice repeaters. Ultimately, however, a desk study can never determine the end solution. Marginal paths must always be examined with a visual survey. Waipa Networks is able to narrow down the possible network configurations to three main options, with confirmation provided by initial visual path surveys.

Cost estimates were calculated for the two preferred microwave ring network options. Cost estimates include the following components:

- Microwave backbone network
- SCADA radio repeaters
- Mobile voice DMR repeaters
- Repeater site SCADA gateways
- Remote site radio equipment
- First year OPEX for leased circuit and site co-location estimated costs

Costs are summarised as follows:

Option 1 (with Rangitoto)

CAPEX	$2,115,000
Year 1 OPEX	$246,000
Option 1 Total	$2,361,000

Of the $2,115,000 CAPEX, $1,196,000 is associated with establishing the microwave network ring and repeaters and $919,000 is associated with the SCADA remote sites.

Option 2 (with direct Wharepuhunga-Waipa Depot link)

CAPEX	$2,110,000
Year 1 OPEX	$224,000
Option 2 Total	$2,334,000

Of the $2,110,000 CAPEX, $1,191,000 is associated with establishing the microwave network ring and repeaters and $919,000 is associated with the SCADA remote sites.

As a reality check, the cost of installing a 'thin' medium capacity UHF backhaul network with a topology that doesn't include a closed ring was also calculated. With a total cost estimate of $2,201,000, there is little cost advantage in installing such a thin network with its inherent performance penalties.

The costs of microwave ring network Options 1 and 2 are very similar and the selection of a preferred option can be determined purely by its merit rather than cost. Both options provide a similar potential for radio coverage for SCADA and voice repeaters. However, with the addition of Rangitoto, Option 1 coverage will be marginally better in the southern parts of WNL's distribution network. The addition of Te Puroa for better VHF voice coverage into WEL, as detailed for Option 2, offers no other strategic advantage.
The long radio path between Wharepuhunga and Waipa in Option 2 requires careful engineering to maintain path clearances at the Te Awamutu end, whereas there appear to be no difficult issues with radio path clearances in Option 1. In consideration of these factors, Option 1 (incorporating Rangitoto) would be recommended over Option 2.

Allied with the upgrade works is a need to secure the optimum locations for repeater equipment. Because microwave antennas need to be supported by secure structures and equipment and antennas need to be located in optimal positions at a site, at Wharepuhunga, Pukekura and Sanitorium Hill, it is recommended that WNL re-locate into the Chorus building. New site leases will also be required to co-locate in the NZART building at Rangitoto and in the Radio Tainui building at Oue, where it has been proposed WNL become the head leasee. A lease agreement will also be required for a roadside cabinet and antenna pole at the WDC Frontier Road Reservoir site.

The initial phase of the project should entail the construction of the microwave backhaul scheme over a period of one year. Subsequent years could be used to install SCADA remote radios and migrate sites to the digital network. Of the $2,361,000 (Option 1) budget, $250,000 would be allocated to the network build in Year 1 to get the project underway and $1,250,000 would be allocated for build and migration in Year 2 and $861,000 in Year 3. The phasing of the project will be revisited at the design stage and updated as required.

Waipa see this project as a long duration upgrade project and therefore, it may be necessary in the short term to alleviate the pressure on the SCADA system by installing additional Motorola analogue VHF repeaters at Pukekura and Te Rauamoa and additional mobile (base stations) at the Waipa depot. The existing Pukekura VHF repeater, with 96 RTUs, and Te Rauamoa VHF Repeater, with 59 RTUs, could then be split between the existing and additional VHF repeaters with only a channel change required at the remote RTU sites. These measures will 'buy time' to be able to make a thorough and sound investment in the future network without investing too much on interim measures.

The project requires consistent and coordinated project management throughout its lifetime, whether this be internal or via an external consultant. Design input should also be sought from incumbent contractors Mobicomm (for radio) and AD Riley (for SCADA). Apart from frontline maintenance, it may not be economic for WNL to resource the expertise and equipment spares required for full maintenance of the microwave backhaul scheme. The criteria for equipment selection should therefore include a strong bias towards suppliers who can also offer rapid fault response and spares holding as part of a sound service agreement.

Currently Waipa Networks is also investigating an alternative option to utilise the high bandwidth Lightwire network to resolve the increasing congestion and communication failures. As per this technology, the remote sites will communicate to the SCADA systems via either the base stations or via the extensive Lightwire network. During 2022/23, an investigation of the alternative and

cost/benefit analysis of the alternative versus the above Waipa owned communications network will be determined before making a decision on one of the two options.

Geographic Information System

The prime function of the Geographic Information System is to provide the physical location and electrical connectivity of all Waipa's network assets so that they are safely operated by the System Operators and field crews and effectively managed by the Network Information Officer and Planners. All of Waipa's assets have been surveyed. The data collected included asset locations, their physical and electrical attributes and condition (serviceable/defected/asset health condition). The spatial information has been overlaid with property boundaries within the geographic information system.

The electrical connectivity from each ICP through to the Transpower GXP has been proven. The asset physical and electrical attributes and equipment defect condition status (where applicable) is archived in the Integrated Data Warehouse. The on-going focus of the Network Information Officer is to ensure that network asset information is updated in a timely manner in the Geographic Information System and Integrated Data Warehouse System. Asset geographical, physical and electrical attribute data is used for network development, design and consumer connections. The asset condition information is used to establish prioritised network asset maintenance programs.

The use of an AutoCAD system to act as the GIS is low cost but relatively ineffective for asset management purposes. It provides the primary function of presenting asset positions and connectivity. However, more advanced asset management functions related to (for example) reporting on volumes of assets in specific areas, displaying asset attributes and defect or condition data on a geographical basis for analysis is not possible. There is also a significant barrier to providing GIS information for field use under the AutoCAD system. The use of Google Earth for mapping asset positions to assist with network surveying and planning is being used as a stop-gap measure, while a project to provide a fully functioning ESRI Arcview GIS during 2022/23 is progressed as part of the Advanced Distribution Management System (ADMS) roadmap.

Integrated Data Warehouse System

The key function of the Integrated Data Warehouse System is to provide a single repository for all data which is held in specific data bases and all the necessary applications for Waipa to operate and manage its EDB. All the data bases and applications can be accessed through a web browser.

The salient databases are:

- ICP
- Call Centre Enquiry
- Outages (Planned and Unplanned)
- Asset Equipment including Substation and Site
- Asset Condition
- Financials

ICP Database

The ICP database is used by the Call Centre for their daily operations and to provide information to the Outage database for the calculation of network reliability performance. The ICP database contains a complete history of all outages and recorded customer comments.

ICP data comes from the customer, retailers, electrical inspectors and Waipa itself. Some of the data transferred between these parties relies on manual processes and routine checks are in place to ensure data integrity. The ICP database is continually updated with new and disconnected customers.

Call Centre Database

Waipa has contracted its call answering and dispatch activities to a remotely located Call Centre. The Call Centre logs all incoming and outgoing dispatch calls in the Call Centre database. The Call Centre relies on the ICP Database information for its operation.

SCADA information is used in an Avalanche Outage Communication Platform which updates customers with known outage information and expected restoration times. This information is also posted on the Waipa Networks website and Twitter account.

Outage Database

Waipa operates a manual planned and unplanned Outage Database.

For planned outages switching instruction sheets are prepared identifying areas of the network affected. These are used to prepare shutdown advertising sheets to notify retailers and customers of the planned outage. The details of the intended shutdown are recorded in the Outage database. Actual switching times on the switching instruction sheets are used to update the Outage database.

For unplanned outages the details are recorded on an emergency switching instruction sheet by the System Operator. This information is used to compile an unplanned outage report. These reports are checked by engineering staff before the details are entered into the Outage database. Customer numbers for both planned and unplanned outages are sourced from the ICP database. Customer numbers can be obtained by feeder, module (section of network between 11kV switching points) or individual transformer level. The ICP database is continually updated with new and disconnected customers.

This data enables the calculation of SAIDI and SAIFI for each outage. The impact of each outage is summed to generate the outage statistics for measuring network performance for disclosure purposes. This information is also used to identify potential problems on the network and is used in the planning process.

Asset Equipment Database

Waipa's Asset Equipment Database comprises a number of subset databases which contain comprehensive physical, electrical, location and valuation information on substations, transformers, switchgear, voltage regulators and sites.

This Asset information is used for network design, asset valuation and disclosure.

Asset Condition Database

The asset condition survey information (primarily defects but also with asset health indictors for limited asset types) is linked to the Asset databases and is used to establish and prioritise Waipa's preventive maintenance program.

Financial Systems

Waipa has the following interlinked financial applications within the Integrated Data Warehouse essential for the operation of an EDB:

- General Ledger.
- Creditors Ledger.
- Debtors Ledger.
- Banking Transaction processing.
- Payroll.
- Human Resources.
- Stores.
- Purchase Orders.
- Asset Register (Financial and taxation).

Asset Management Process

Waipa's asset management process covers the activity associated with the management of:

- Existing assets through their life cycle.
- Non-asset solutions to address network issues.
- The creation of new assets.
- Disposal of surplus or end of life assets.

Waipa's desired outcomes of these asset management activities are:

- Increased asset longevity.
- Improved network reliability.
- Improved network safety.
- Improved power quality.
- Technically efficient equipment to optimise electrical losses.
- Improved financial performance.
- Business growth.

The components of the asset management process are shown in the following diagram.

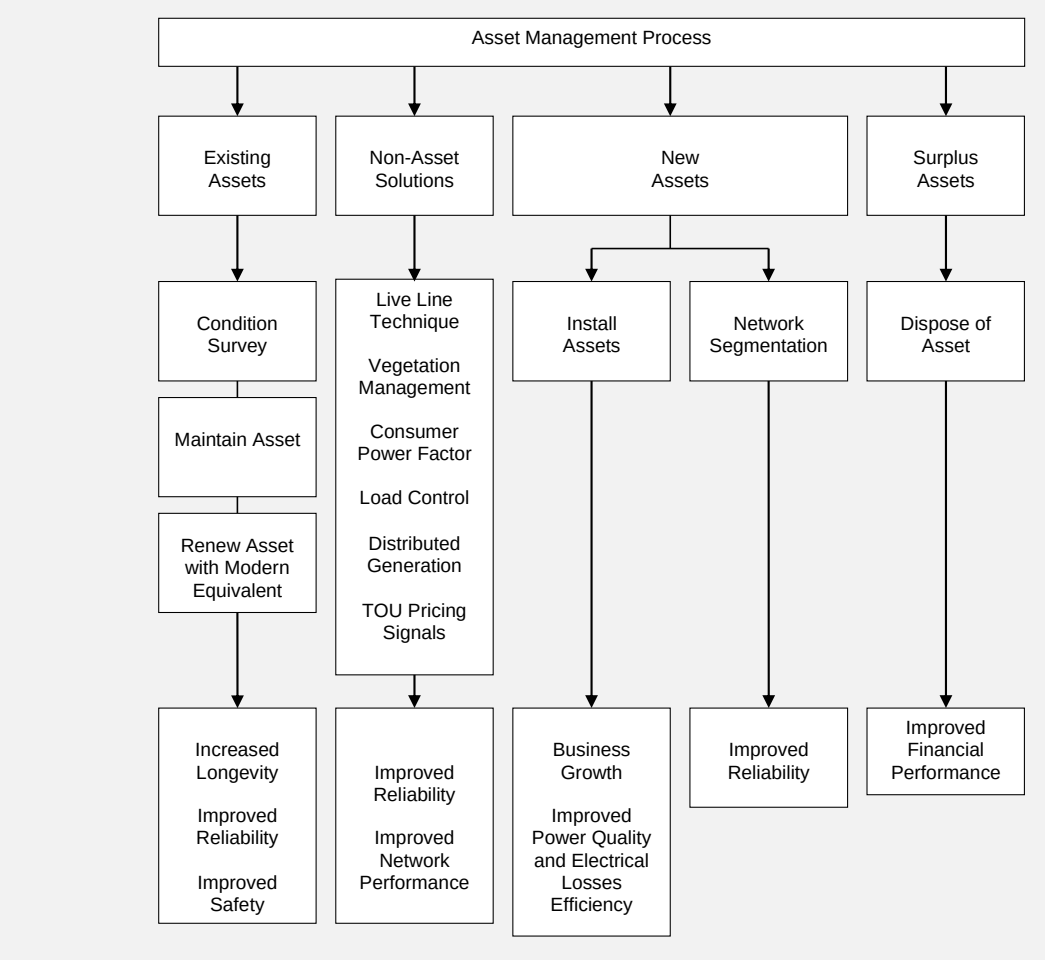


Figure 29: Waipa's asset management process

Asset Management Information

Waipa's network surveys provide Waipa with comprehensive information on all of its assets' locations, physical and electrical attributes and their condition at the time of survey.

This initial data obtained during the first survey completed in 2006 has been supported by subsequent asset condition surveys and construction, equipment replacement and upgrade records. In 2019 Waipa Networks completed the second asset condition survey on all feeders and has commenced the third asset condition survey of all overhead and ground mounted network assets. In 2021 an aerial survey using LiDAR and high-resolution photos added to the overhead asset information available for asset management.

Waipa has developed and operates asset management information systems appropriate for:

- The size of the network and number and type of distribution assets.
- Waipa's financial and administrative business needs.
- Consumer needs.
- Other stakeholders' requirements.

However, improvements in asset management systems to improve integration and reduce the need for staff intervention to integrate between data sources is required. The Information Systems

Strategic Plan (ISSP) has developed a ADMS roadmap to identify and prioritise the required enhancement of asset management systems.

MATLAB Network Data Management System

Waipa invested in MATLAB software for network data management in 2019. The system was developed internally to extract data for network management purposes, including electrical network modelling, load flow analysis and electrical network planning and design.

ETAP Network Modelling Software

Waipa invested in ETAP network modelling software in 2011 and the initial data input by the Network Information Officer with the assistance of the Planners began in 2012. Completing data models of feeders has continued, with models produced when required to understand the effects of emerging voltage issues or demand from new connections or increased demands.

The software can be utilised to model the network electrically, perform load flow analysis, calculate short circuit current flows, aid electrical network design, complete electricity cable rating calculations and arc flash energy calculations.

Waipa can position more accurately the locations for voltage regulators, automatic reclosers and their settings and required conductor upgrades and model their effect on the network. Network development studies to plan connection of new loads to the network and to test the back-feed performance of feeders can be completed.

Asset data and data quality

Asset management at Waipa is heavily dependent on accurate asset data. The storage and management of asset records, including various asset attributes, is fundamental in ensuring that appropriate asset management decisions are made. This pertains to the operations of the assets, maintenance regimes for various asset classes, and assessing renewal of assets based on factors such as age, condition and risk.

Asset data

Waipa holds records for electrical assets and non-electrical equipment such as plant, vehicles, office furniture and equipment, and field tools and instruments, all of which are recorded and managed. The assets are separated into distinct classes, such as poles, and then categories, such as concrete or wooden. The attributes held by assets varies by class.

The information that is recorded and managed by Waipa is based upon the following requirements and purposes:

- Safety. Having knowledge of assets location and their condition is imperative in facilitating the safe operation of the network.
- Reliability. Knowing the types of assets (including the manufacturer, for example), their location, condition, their relationship (including connectivity) operating on the network allows the assets to be managed effectively to assist in minimising failures which can result in network outages.
- Regulatory. Waipa is required to disclose certain information (age and condition for example) under specified asset categories.
- Expenditure. Managing asset records allows for analysis of cost trends and determining internal cost rates and therefore the effective better planning of maintenance and/or renewal activities.

Asset information is managed by engineering, network information and administrative staff in Waipa's office. Changes to assets (and some asset components in the field) are recorded by field crews, then passed back to Waipa's network information team to update the asset management system(s) as appropriate.

Waipa reviews and updates the information held through adding attributes for various assets when and where it becomes apparent that there would be benefit in holding that information. Waipa manages relatively high volumes of low value assets which are geographically dispersed making invasive inspection techniques uneconomic. This lessens the scope for data collection to mostly visual inspection records and high-volume aerial survey techniques.

Whilst each asset type has unique attributes, Waipa generally determines the data it collects from a framework of failure modes and consequence assessment. For example, spalling on a reinforced concrete pole generally has to be extensive for the pole strength to be affected, but even a small exposure of steel within a pre-stressed concrete pole is considered cause for repair or replacement. Waipa's inspection criteria reflect these different asset-specific risk assessments.

Waipa also utilises information disseminated from organisations such as Electricity Engineers Association (EEA) and Electricity Networks Association (ENA) to identify particular asset types that may exhibit specific failure modes or symptoms, as experienced by other businesses.

Data limitations

While Waipa endeavours to maintain its asset data as complete and correct as possible, there are general limitations (gaps) to this. These include:

- The occasional challenge in getting accurate and consistent asset information data following fault events. There is the potential for this information to be overlooked when the physical works themselves (including making sites safe and the restoration of supply from outages) is the primary focus.
- Legacy data. Waipa's network was first established approximately 100 years ago. It is unreasonable to expect that data has always been captured in the manner required by current standards. Records have been lost at times, or during the transfer from one asset system to another, data may have been compromised or lost, meaning that asset records today are not always entirely complete and accurate. Whilst the existence of visible assets is known, for a proportion of assets, the installation date (for example) may be unknown. Waipa believes it has a good understanding of the asset information that is not complete or accurate. Waipa does not have a programme of retro- populating this data as, in most cases, there is no viable way to determine it or the costs of doing so are prohibitive.

More specifically, known data limitations include the following:

- Aerial conductor condition data. There is no practical means of assessing conductor condition other than by visual observation (which does not always provide sufficient information). As such, conductor condition is generally assumed based on type, age (where known), location and operational experience. This limitation may result in the risk-based rather than a condition-based renewal of conductor where renewal is based on type, age and location (and hence deterioration risk) along with the condition of the supporting poles. The installation age of Waipa's low voltage (network) overhead conductor is not detailed in records, although this is a common issue across the whole sector for this particular asset class.
- Underground cable condition. Condition assessment of cable can only be undertaken through cable testing. However, some types of cable testing are known

to prematurely age cables and results can be uncertain, so for the purposes of assessing condition alone, cable testing of distribution cables is generally not undertaken by Waipa. As such, cable renewal is largely based on age, failure consequence and operating history of the cable sections.

- Underground cable location. Historically there are cables whose plotted location is less accurate that the current requirements under the Utilities Code.
- Pole condition. Pole condition is assessed during routine inspections/condition assessments. Conservatively assessing the condition of poles may result in their risk-based rather than their true condition-based replacement. However, a risk-based approach in assessment is deemed more appropriate than the alternative from a public safety perspective and is in keeping with Waipa's approach to prioritise safety. Waipa monitors industry practice and pole testing innovations and will review its practice should the situation change.
- Timeliness of inspections. Due to the rapid expansion of Waipa's network delays have occurred in inspection and this is being rectified. Waipa periodically reviews its data management systems and processes to evaluate where improvements could be made in data quality and data management that are both useful and cost effective.

Communication and participation processes

Waipa's asset management practices are communicated internally to staff and externally to other stakeholders through Waipa's policy and standards and this AMP.

Waipa has a suite of documentation relating to asset management practices which sit within Waipa's asset management system. Some of the key documentation is summarised in Table 26. Figure 10 in Section 4.3 highlights the interaction of the asset management system with other key components of Waipa's business such as the SCI and the annual works plan.

Table 26: Summary of communication asset management processes/documentation

Processes/systems/ plans within asset management system	Description and purpose	Stakeholders and communication of processes/systems/ plans	Management of processes/systems /plans
Waipa's Policies, Procedures and Plans	Waipa has a system of controlled documents, including a number of policies and procedures relating to asset management held and available through the intranet.	Some policies and procedures contain content about the engagement and management of Consultants and Contractors working on the network. Waipa's team participate in periodic reviews of Policy/Procedures. Senior management have oversight of issues arising from policies and/or procedures within the system.	Each Policy/ Procedure within the system is internally reviewed on a periodic basis. The external Public Safety Management System audit is undertaken on relevant parts of the system annually.
Waipa's Network Design Manual	Waipa has its own network Design Manual which is driven by safety and recognised good industry practice, and is used by Waipa's staff primarily in designing infrastructure (assets) for	Internal design team, in-house Contracting department, external Consultants engaged by Waipa. Network Design Manual made available through the intranet.	The Manual is reviewed and updated internally on an as-needed basis.

	and on the network.		
Waipa's Maintenance Standard	Waipa has its own Planned Maintenance Standards and network inspection criteria. These are used to specify processes and procedures relating to the maintenance of assets on Waipa's network. This includes inspection requirements and frequency.	The document is communicated to relevant team members by the Engineering Manager.	In-house management of the maintenance standards by Waipa's Network Development and Engineering Manager.
Waipa's Construction Manual	Waipa has its own Construction Manual which its own internal contracting company use for constructing (installing) and maintaining equipment on the network. This standard is disseminated to external contracting staff also, as appropriate.	Internal design team, in-house Contracting department, external Contractors engaged by Waipa. Waipa will instruct external contractors as part of the procurement process that works are to be undertaken in accordance with applicable elements of Waipa's manual.	The Manual is reviewed and updated internally on an as-needed basis.
Other relevant industry Standards	Designs should be undertaken in accordance with relevant industry best practice (i.e., following current applicable standards). Examples of this are the construction of new switch room buildings, or foundations supporting sub-transmission poles in soft ground. Consultant engineers engaged by Waipa are required to undertake design in accordance with relevant industry standards, such as AS/NZS 1170.5: 2004 – Structural design actions, Part 5: Earthquake actions. Another example is AS/NZS 7000: 2010 – Overhead line design: Detailed procedures.	Waipa's staff work to applicable standards. The internal standards are formulated on the basis of applicable national/international standards.	Waipa is a subscriber to Standards New Zealand. Waipa receives electronic notification when relevant standards are updated.
Asset Management Plan (including AMMAT)	Summary of assets and their management for the next ten- year period.	Numerous stakeholders. AMP is publicly disclosed.	Regulated by the Commerce Commission. Internally reviewed and updated and signed off by the Board.

6.4 Compliance

One of the key drivers of Waipa's asset management strategy is the need to comply with legislative requirements. The following list is a selection of some of the key statutory instrument (Acts and Regulations) relating to Waipa's asset management activities:

- Health and Safety at Work Act 2015
- Electricity Act 1992 (including subsequent amendments)
- Commerce Act 1986
- Utilities Access Act 2010
- Energy Companies Act 1992
- Companies Act 1993
- Electricity (Safety) Regulations 2010 (and subsequent amendments)
- Electricity (Hazards from Trees) Regulations 2003
- Various Electrical Codes of Practice (tied to the Electricity (Safety) Regulations)
- Resource Management Act 1991

There is other legislation and/or regulations pertaining to Waipa's activities (for example, the Employment Relations Act 2000). They are not included here for the sake of brevity.

Waipa's procedures and policies are written to comply with legislative requirements and codes and are updated as and when revisions come into effect.

Waipa's senior management regularly review Waipa's legislative compliance via a company-wide assessment using ComplyWith. Reports are provided to the CEO and the Board on a six-monthly basis. Legislative breaches are reported to the Waipa Board as they occur.

6.5 Risk management

Risk management process

Risks can be variable in their nature and scale. The conveyance of electricity (Waipa's core function) potentially involves significant health and safety hazards the risks of which must be mitigated. But Waipa is also exposed to considerable business related and other forms of risk. To manage that risk and to keep exposure within acceptable levels, Waipa has adopted a systemic approach to risk management through following the Australian/New Zealand standards ISO 31000:2019 *Risk Management* and NZS 7901:2014 *Electricity and gas industries – Safety management systems for public safety.*

Figure 30 shows the risk management process suggested by ISO 31000 and adopted by Waipa:

Figure 30: Risk management process

Risk context

The above process allows for better management of risk types affecting Waipa. The definition of risk based on ISO 31000 is the effect of uncertainty on objectives. When considering risk and risk management at Waipa, it is important to place these in relation to the organisation's objectives expressed through its Vision and Mission statements and its Statement of Corporate Intent, all as described in section 4 of this AMP.

The risk management process considers risks relative to the operations of Waipa, which are broadly grouped into the following risk category types:

- Health and safety including Public safety
- Quality;
- Environmental;
- Financial;
- Reputational;
- Business interruption; and
- Regulatory compliance.

Risk identification

At Waipa, risks are identified by a variety of methods including (but not limited to):

- On site checklists, prior to starting work (tailgates).
- Re-assessments during the day as the work environment changes.
- Regular visual hazard inspections of work areas.
- Analysis of accidents/incidents or near misses.
- Internal and external feedback.
- Condition assessment of the network to identify public safety risks.
- External information from specialists.
- Risk workshops and management review.
- External risk reviews.
- Industry information.

Risk analysis

Once risks have been identified, they are analysed to:

- Identify the source and cause of the risk.
- Assess current controls and their effectiveness and identify any gaps.
- Consider how likely the risk is of occurring and what the impacts are (likelihood and consequences).
- Determine the risk rating (likelihood x consequence).

Waipa uses the risk criteria and matrix described in Section 11.10 Appendix J to analyse risks. This categorises likelihood into five categories (from rare to almost certain) and consequence also into five categories (from low to critical). This analysis is performed on the inherent (uncontrolled) risk, and then again on the residual (controlled) risk.

Waipa's risk profile is then mapped onto the matrix described in Appendix J, which allows Waipa to identify which risks its needs to focus the most attention on (e.g., risks that fall into the High (Red) and Serious (Amber) categories).

Risk evaluation

Once a risk has been analysed, it is then evaluated based on the outcome of the analysis and against the risk assessment criteria to:

- Escalate to the necessary reporting levels.
- Prioritise risks.
- Consider options for managing risks.
- Decide what action is required.
- Identify resources required to manage the risks and allocate responsibilities.

Risk treatment

Risks are treated either through elimination, or the application of controls to reduce the likelihood and/or the consequences of the risk occurring. Waipa seeks to put controls in place that will reduce risk to a tolerable level. Ongoing monitoring and review is undertaken to verify that.

For non-health and safety related risks, treatments may avoid, transfer, reduce, remove or modify (or in rare instances, accept) the likelihood and/or consequence of risk(s). Non-health and safety risks may be treated in a variety of ways. Some examples of controls include (but are not limited to):

- Changing policies, systems and processes.
- Changing plant and equipment.
- Redesign.
- New or different technology.
- Training and education.
- Inspections or increased inspection frequency.
- Testing.
- Insurance.

In accordance with the Health and Safety at Work Act 2015, when determining the appropriate control to effectively manage a health and safety related risk, a specified sequence of controls is followed to conform to Waipa Networks' health and safety policy. Detail in relation to health and safety risk management is included in Waipa's Risk Management Manual.

Risk register

Health, safety, and environmental risks and corporate/organisational risks (including financial, reputational, business interruption and regulatory compliance risks) and risks related to the network and operations are held in a single risk register. A common format, structure and methodology are used, as set out in Waipa's Risk Management Manual.

Risk monitoring and review

Waipa has a proactive approach to public safety, safety to its staff, contractors and consumers. Regular surveillance and monitoring relative to safety is undertaken in respect of network assets, e.g., ongoing measurement of line heights, inspections of substations, inspections of pillar boxes, and aerial and ground surveillance of lines and vegetation in proximity to the lines. Network inspection criteria and planned maintenance procedures prescribe the standards to be followed in respect of network survey activities.

Serious incidents and near misses are investigated in accord with the recognised incident cause analysis method (ICAM) procedure to identify the cause and better enable their prevention in the future.

The importance of both lead and lag indicators relative to safety is recognised within Waipa with an emphasis on proactivity.

The performance of the network and the effectiveness of work programmes relative to health and safety are regularly reviewed by Waipa's senior management and where appropriate change is made. These reviews focus on ensuring that the controls in place are effective and efficient. For business wide risks that fall into the priority categories, a report is generated and circulated for review and discussion.

Communication and consultation

Risk evaluation and communication is integrated within Waipa's daily operations and processes including Board meetings, Health and Safety Committee meetings, team meetings, training, visitor and employee induction, inspections, etc. Where appropriate specific meetings are held with industry groups e.g., Fonterra.

Key risks Natural Hazard Risk Management Assessment

Waipa is an active participant in the Waikato Lifeline Utilities Group as required by the National Emergency Management Agency (NEMA). Through consultation with other members of the group Waipa has assessed the potential physical threats to its network assets posed by naturally occurring hazards of wind, lightning, floods, land erosion, earthquakes, volcanic eruptions, geothermal activity and adverse weather. The methods used to assess the risk of each natural hazard are listed in their respective sections.

Wind

Waipa's network is in an area of New Zealand that has one of the lowest recorded average wind speeds. However, there are seasonal storms with winds that blow debris into the 11kV pole lines from time to time. Because of this, trees tend to be weak and easily damaged by stronger winds. Waipa's vegetation management programme is intended to reduce the number of the incidents caused by wind-blown vegetation. Waipa concludes that wind presents a high threat to network assets when significant storms are considered. While damage caused by wind borne debris is easily fixed under normal circumstances, a significant tropical cyclone could result in widespread network damage from downed trees, requiring a long period of time to reinstate and restore supply. Access to the network is likely to be complicated by wet ground conditions, further complicating supply restoration.

Waipa Networks is aware of the lessons learnt during the severe storm that affected Counties Power and Vector during 2018. The impact of climate change in terms of intensification and increased frequency of weather events is expected to increase this risk over time.

Lightning

Waipa's network assets are regularly subjected to lightning strike. The majority of network assets affected by lightning are rural 11kV pole lines on which normal 11kV lightning protection devices are used to localise and minimise lightning damage. Installation of surge arrestors on pole mounted distribution transformers has been included in the standard design for new installations to protect these assets from lightning. Waipa considers lightning is not a major threat to the network.

Floods and Land Erosion

Waipa's network area is subjected to frequent and often heavy rainfalls. There are numerous streams and rivers whose flow-paths change over time. The effect of such erosion on network assets is minimal affecting only one or two poles at any time which are relatively easy to reinstate. Waipa is a member of the Waikato Lifeline Utilities Group and through participating in the group's risk assessment exercise considers floods and land erosion are not major threats to the network. The impact of climate change in terms of intensification and increased frequency of weather events is expected to increase this risk over time.

Earthquakes

Transpower have assessed the probability and consequences of earthquakes damaging their assets for all areas in New Zealand. Transpower have defined three seismic risk zones: Zone A (high risk), Zone B (medium risk) and Zone C (low risk).

Transpower have developed the following range of seismic risk factors that reflect the financial loading on construction works that will ensure the integrity of their equipment:

- the seismic risk factor for Zone C (low risk) is 1.00,
- the seismic risk factor range for Zone B (medium risk) is 1.01 to 1.06 and

- the seismic risk factor range for Zone A (high risk) is 1.02 to 1.14, depending on the equipment type.

Waipa's distribution networks are located entirely within a Zone B (medium risk) area. The network assets are predominantly long rural 11kV pole lines. Waipa considers these assets fall into the category defined by Transpower as "Other Plant" and as such have a seismic risk factor of 1.01.

Waipa considers this is an acceptable risk to manage because rural 11kV pole lines are relatively easy and an inexpensive network asset to repair if damaged by an earthquake. Based on the experience of Orion in the Christchurch earthquakes, cable assets are likely to be extensively damaged in a severe earthquake, requiring a lot of time and effort to repair, and increased failures and reduced useful life thereafter.

In 2014/15 Waipa engaged a structural engineer to assess the seismic adequacy of the Waipa's ripple plant building located at Transpower GXP site in Watkins Road Cambridge. The structural engineer recommended that the building's block walls should be strengthened by external pillars to make it comply with current seismic standards. Strengthening works to the building was completed in 2015/16.

Volcanic Eruption

There are no known active volcanoes in Waipa's distribution area. The Mount Ruapehu eruption in 1995 had no adverse impact on Waipa assets because of prevailing winds at the time. If volcanic ash had been deposited over the rural 11kV pole lines then Waipa would have continued to operate the distribution networks until there was clear evidence of insulation failure. A shortage of water to wash insulators from an ash fall is an expected risk, given that many parties will be attempting to wash plant and equipment at the same time.

Tsunami

The risk of network inundation from a tsunami event effecting the West Coast has been assessed, from the West Coast Tsunami Risk Study commissioned by Waikato District Council and WEL Networks.

The water level rise at the Aotea Harbour mouth resulting from the worst-case event is generated from an earthquake on the Puyseger Trench to the south and west of the South Island. The sea level rise at the heads of Aotea Harbour is a maximum of 2.5 metres, but it is attenuated to around 1.5 metres at the Aotea settlement. To gauge the risk to Waipa Networks equipment, the elevation of supply areas was checked using an online mapping application. Areas along Lawton Drive in Aotea are between 2 metres and 3 metres of sea level, so inundation should not result even if the tsunami occurred at high tide, unless the event is larger than modelled. The network along Lawton Drive is overhead with pole mounted transformers and mostly overhead service main entry, so the likelihood of network issues if inundation occurred is unlikely. The water level rise is expected to be similar to a fast-rising tide not a "wall of water" so damage and erosion from the inrush of water is not expected.

Other tsunami events from the New Hebrides and Tonga-Kermadec trenches would produce a water level rise of 1 to 1.5 metres outside the harbour and 0.5 metres or less inside the harbour, so these are not expected to pose any risk to the network.

The West Coast tsunami risk study did not cover the Kawhia Harbour, but it could be reasonably assumed that the water level rise at the Kawhia Harbour heads would be similar to the 2.5 metres rise at Aotea for the Puyseger Trench event. The study author Jose Borrero commented that the maximum water level rise in Kawhia Harbour would be two metres and could be less. In that case, there is a risk to network supplying Kaora St, Omimiti St and Motutara St on the Kawhia settlement waterfront. In these areas there are some pad mounted transformers and the LV reticulation is underground with pillar connections for consumers. Hence some flooding of pillars and pad mounted transformers may cause some supply disruption, requiring isolation until the event is over, then inspection and possibly cleaning or repair before re-livening. There are also some low-lying areas on Kawhia Road and Kawhia Harbour Road that would experience water level rise, depending on how much the water level rise is attenuated by the harbour mouth. However, the network in these areas is overhead distribution, so no supply issues are expected.

In terms of access for fault staff and repair crews, a number of road sections around Kawhia Harbour and Aotea Harbour are low lying and could be affected with rising water levels washing across the road. Depending on depth, this may delay access but damage to the road surface is not anticipated.

The impact on the network if this event was to occur is considered to be relatively minor, only a small number of connected customers on these waterfronts would be affected and it isn't clear if the water level rise will reach the network assets. When the likelihood of the tsunami event is also factored in (the return period for the Puyseger event cannot be determined but is considered very unlikely), the risk posed by tsunami to the Waipa network is not considered to be significant. At present there are no red, orange and yellow tsunami risk zones produced by Otorohanga District Council or Waitomo District Council for the Aotea and Kawhia areas. NEMA is doing further work on this including tsunami risk zones and this section of the AMP will be updated with that information once it is complete.

Geothermal

There is no significant geothermal activity in Waipa's reticulation area other than a hot water beach at Kawhia. Therefore, there is no corrosive atmosphere to contaminate the overhead lines or hot ground, gases or liquids constraining cable ratings or corrosive liquids damaging cable insulation and conductors. Waipa concludes that there is minimal risk to the network from geothermal activity.

Pandemic

As an essential service, it is critical that we maintain our ability to operate a reliable distribution network during a pandemic. Loss of operating capability is related to a minimum find fault and fix field capability, team members being unable to work due to illness by themselves or their dependents, operational control room capability, and availability of equipment and materials due to impacts on the supply chain. Waipa Networks has maintained a Pandemic Response Plan developed in response to the SAARS and avian bird flu incidents internationally and put the pandemic response into action as a result of the COVID-19 pandemic in 2019 onwards. The experience of implementing a CIMS management structure, allocating field crews into isolation "operating pods", developing contact recording and work crew operating procedures, holding higher equipment stock levels and moving office workers to remote working from home was very valuable in terms of the organisation's preparedness for further pandemic disruption.

Network Risk

Waipa Networks has a robust risk assessment process. Risks are identified and the inherent (unmitigated) and residual risks are ranked according to the risk matrix. Appropriate controls are listed and actions identified.

The following asset categories are considered in the risk management assessment process:

- Overhead line failure and operations.
- Overhead line environment and stakeholders.
- Distribution substations, switchgear and underground.
- Other failures and operations (includes SCADA, network interconnectivity, grid supply etc.).
- Other environment and stakeholder.

The high focus risks are identified as a selection of the highest impact risks, from the categories above.

The following table shows the high focus risks, with the risk rankings and control measures. The risk action plans will be reviewed periodically and the actions progressed to mitigate the risk impacts.

Table 27: Network high focus risks

Risk	Inherent Risk Rank	Residual Risk Rank	Level of Control	Current Actions
Overloaded Customer LV fuse bases causes pillar fire, public safety hazard	High	Serious	Improving	Budget pillar fuse base replacements into AMP. Estimate duration of programme.
Overhead line Vegetation Faults causing loss of reliability	High	Serious	Improving	Reactive trim of hot-spot feeders and continue cutting to spend allocated budget.
Inspection processes behind programme causing reliability risk and Health and Safety risk	High	Serious	Improving	Catch up on survey backlog over 4 years. Increased resources in place
Cable capacity out of Te Awamutu GXP	High	Serious	Improving	AMP project for FY2020/21 to replace TMU cables.
Cambridge GXP Firm capacity exceeded	High	High	Improving	Transpower has commenced GXP site selection and designation. NNCS project consented and under construction.
Te Awamutu GXP Firm capacity exceeded	High	High	Improving	Development planning to determine most economic solution and timing, via Jacobs study then engagement with Transpower.
Land access to existing assets in storm conditions	High	Serious	Improving	Review major storm contingency planning and review 4WD truck capability required to respond.
Operating 11 kV oil ring main units owned by others (Fonterra, St Peters Sch, Waikeria) - risk if operated live	High	Serious	Improving	Safety bulletin to ensure staff are reminded of restrictions and can recognise switchgear. Review if switching competencies should require refresher on switchgear recognition.
Lack of 11kV network backfeed capacity for planned or unplanned outages causing customer damage.	Serious	Serious	Further Controls Needed	Network development planning to identify solutions to network constraints.
Public access inside Pillar boxes in areas where power is underground	Serious	Serious	Further Controls Needed	Pillar inspection programme scoped to determine how long will take to complete. Determine defect rate. Budget pillar replacements.

Risk mitigation initiatives

Aside from the ongoing surveillance and monitoring of Waipa's network and operations, mitigation projects pertaining to risk are set out in this plan:

- Cambridge GXP re-enforcement via new 220/33kV GXP and Waipa Networks sub-transmission investment. Non-network capacity support to manage Cambridge GXP peak loading in the interim.
- Te Awamutu GXP cable capacity limited by thermal constraints, addressed by replacement project.
- Te Awamutu GXP capacity and distribution network constraints, potential projects or non-network solutions being confirmed via development planning studies and engagement with Transpower.
- Network inspection programme delay being addressed by LiDAR and high-resolution photo aerial survey.
- Vegetation management programme to address prioritised areas that will be identified through the LiDAR survey.
- Additional voltage regulator and capacitor installations to manage 11kV network backfeed capacity.
- Staged replacement of Waipa's 2-pole distribution substations following a review of seismic safety and in consideration of both the asset condition and risk priority.
- SCADA disaster recovery facility to increase resilience and single points of failure at Harrison Drive depot.
- Upgrade of existing analogue based communication network to digital network via Microwave ring will provide resilience and high bandwidth to enable safer, secure and more reliable voice and data network.
- Te Awamutu ripple plant ring main unit to provide alternative supply to mitigate switchboard failure risk.

Contingency planning

Waipa's Emergency Management System documents procedures for use in the event of major damage to the network and Business Continuity Plans will be developed for a variety of significant incident types. It contains information on Transpower, territorial authorities' contact details and other information which may be useful at times of emergency. Development of the Business Continuity Plans is underway with consideration given to various "what-if" scenarios. This will prepare Waipa's team for various scenarios and events.

Waipa operates two relatively simple interconnected radial 11kV, predominately pole line, distribution systems extending out from Transpower's Cambridge and Te Awamutu GXPs. Under normal conditions network operations are initiated through a control room and work is dispatched through a call centre. System switch status is recorded on a single line computer mimic diagram. Under extraordinary conditions Waipa expects the control room and call centre functions may be disrupted. During these emergencies network operations and fault dispatch functions will need to be performed by Waipa's own administrative staff and field crews.

In circumstances where the Waipa SCADA, financial and business computer systems also fail, network information held in printed form will be used by Waipa's Fault Staff and Field Supervisors to isolate, repair and operate the networks safely. During these emergencies Waipa expects normal telephone services will be disrupted and direct communications with consumers will be reduced due to the abnormal nature of the operation.

Waipa operates its own independent radio telephone system. Should one or more repeaters fail the system is capable of short-range point–to-point communications which will continue to function. Power restoration will be inherently slow under these circumstances. The majority of repairs required on the networks would be identified by physically patrolling the pole line feeders. Waipa is a participant in the Waikato Lifelines Utilities Group and expects that NEMA in conjunction with other utility owners and local authorities will prioritise Installation Control Points for power restoration.

Emergency Response Capability

Waipa has not experienced storms of significance since Cyclone Drena in 1997 and the "weather bomb" of June 2002. During both these events Waipa contracted external resources to help repair the network. Since that time Waipa has built up its internal field crews and successfully reinstated the network during the February 2004, April 2011, January 2018 and February 2022 storms. Waipa has also formed a liaison with three other local Electricity Distribution Businesses and one contractor to make use of their field resources if required.

Waipa carries sufficient spares in its store to construct several kilometres of pole line and could assemble sufficient internal and external resources to repair and continue to operate its network in emergency situations provided the event is not of such significant scale that people and resources are overwhelmed. Waipa Networks is experienced at self-managing its network restoration resources during storm conditions and will interact and communicate with NEMA authorities and the public during these events.

Security of Supply Participant Rolling Outage Plan

Waipa has prepared a Security of Supply Participant Rolling Outage Plan in accordance with the Grid System Operator requirements.

Busbar Failure Contingency Plans

Te Awamutu

In January 2010, Waipa experienced an outage caused by a busbar fault at Transpower's Te Awamutu GXP simultaneously occurring while maintenance was being carried out on one of the GXP's transformers. This outage affected half of the Te Awamutu feeders. Power was restored by emergency switching, with the network being placed at risk of damage or overloading by operators needing to make "on the spot" decisions during such a large switching operation. Waipa has developed detailed switching plans for any section of busbar at Te Awamutu GXP, should there be a similar busbar event in future. The Te Awamutu busbar contingency plans are internally available and form part of Waipa's Business Contingency Plan

Cambridge

Waipa has developed a detailed contingency switching plan for either section of busbar of the 11kV switchgear at Cambridge.

Business Systems Contingency

Waipa runs its financial and business systems (MagiQ Integrated Data Warehouse) and Windows based programs including AutoCAD (Geographic Asset Information) hosted on servers locally as well as utilising external cloud platforms (e.g., for email and phone system).

The financial and business system (MagiQ) is copied across from production servers onto a backup server each day which is then copied to an offsite location. If required, backups can be used to restore failed systems or to rebuild systems/servers at alternative locations. A daily backup copy of financial and business information and Windows based AutoCAD information is also held off site.

Waipa can recreate the information databases and business functionality after a catastrophic event. Should Waipa's Te Awamutu depot be uninhabitable Waipa's business systems can be recreated at Securecom data centre located in Auckland or Hamilton. There is a plan during 2022 to move to utilising the data centre of a third party to host all Waipa's information system infrastructure.

Supervisory Control and Data Acquisition System Contingency

Waipa's SCADA system comprises a master station and a "hot standby" backup station located in Waipa's control room located at 240 Harrison Drive Te Awamutu and two remote operating terminals located in WEL Networks Control Centre at 114 Maui Street, Te Rapa, Hamilton. WEL networks also run two disaster recovery sites at Avalon Drive and Bryce Street. Both sites are linked via WEL's fibre network so in the event of COVID or similar events, WEL is prepared to operate from these emergency sites to provide the full control services in case one control centre goes down. WEL Control also has three laptops enabling the controllers to access SCADA via a secure cloud network.

The SCADA network configuration and operating schematics are copied across onto Waipa's administration servers and back up servers each day. A daily backup of SCADA network configuration and operating schematics information is held off site and Waipa can recreate the SCADA network configuration and operating schematics after a catastrophic event.

Waipa can purchase all component parts for the SCADA system from its SCADA supplier located in Wellington. Waipa moved into new premises 11 years ago and has demonstrated it can assemble and re-commission the master station, the "hot standby" backup station and communications hub equipment within a short time. Should Waipa's Te Awamutu depot be uninhabitable Waipa's SCADA systems can be recreated at WEL Network Control Centre at 114 Maui Street, Te Rapa, Hamilton. WEL Networks' emergency control room in Avalon Drive, Hamilton is linked via fibre to Maui St so provided Maui St or Harrison Drive SCADA can be recreated within a short time, prompt SCADA restoration to normal is possible.

A project to create a purpose-built disaster recovery SCADA control room with a fibre or microwave-based communication interface independent to the Harrison Drive depot is currently under consideration and planned for 2022/23, to improve resilience of both voice and data network.

During 2021 a complete review and update of Waipa Networks' Emergency Management System was completed. Subsequently specific Business Continuity Plans will be developed for major event scenarios. An exercise to test the emergency preparedness procedures using a significant cyclone event will be completed with the assistance of NEMA.

6.6 Lifecycle management

Waipa considers its network assets within a lifecycle framework that covers the assets from design and procurement through installation, commissioning, operation, maintenance and finally to renewal and disposal. The goal of lifecycle management is to maximise the utility of the assets while minimising total cost over the life of the assets. Examples of this include the natural trade-off between cost and quality/capacity and purchase cost and the total operating costs over the asset's lifetime.

Practical examples include:

- Distribution transformers in salt prone areas have galvanised tanks and longer insulators.
- Selection of pole top switchgear with stainless steel tanks for extended life.
- Selection of enclosed load break switches over open air break switches for extended life, lower maintenance and improved reliability.

In addition to work undertaken on Waipa's network assets, it is also necessary to maintain access to assets and the environment around the assets, e.g., keeping trees clear of overhead lines and maintaining tracks to access assets such as switches. For Waipa, a significant part of the maintenance budget is allocated to vegetation control.

Network assets are exposed to wind, corrosion and other environmental effects and, therefore, deteriorate over time, albeit at different rates. Indeed, asset type and age can be a key predictor in assessing the general state of the network although it is often unreliable in predicting the particular state of any single asset. To manage total lifecycle cost, the cost of condition inspection is balanced against the cost of premature replacement and the costs and risk from asset failure with the latter often being significantly larger for electricity conveyance assets.

Key strategies

Condition-based maintenance

Waipa undertakes a condition-based maintenance programme centred on regular inspection and testing of network equipment. The programme includes the following aims:

- To manage the risk from hazards to staff, consumers and the general public.
- To achieve a reliable, secure system in accordance with service levels and consumer expectations.
- To comply with Waipa's environmental policy.
- To identify required corrective maintenance before failure.
- To minimise the total cost of ownership and maximise the efficiency of Waipa's operations.
- To satisfy legislative requirements.

Waipa seeks to achieve these aims by undertaking maintenance efficiently and effectively. It is a process of continuous improvement and one that will become more effective over time. Waipa endeavours to purchase quality new equipment with minimal maintenance costs to assist with both future reliability and to minimise the total cost of ownership.

Waipa Networks also uses asset health indicators (AHI) to prioritise condition-based maintenance of certain assets such as cables, ring main units, voltage regulators and reclosers. Recently the company has completed pole top imagery of poles and pole top equipment such as transformers and cross arms. These initiatives have given a better picture of the condition of these assets helping the company to prioritise asset replacement strategies and future expenditures. Waipa also has a regular drone based thermal aerial survey of critical assets such as ABS, lines, transformers, dropout fuses, cable pothead terminations and line connections at times of high load. Waipa Networks also carries out drone survey of some commercially sensitive feeders such as Hautapu feeders. In addition to drone and other technologies, Waipa Networks utilises acoustic technology to identify cracked insulators, broken conductor strands and other defective equipment.

Typical maintenance tasks on critical equipment include the following classes of activities:

- Identification of any abnormalities.
- Maintenance in accord with manufacturer's requirements.
- Checking and/or replenishment of grease and insulation components such as SF_6, vacuum.
- Checking and minor repairs or replacement of semi-consumable components e.g., brushes, contacts, gaskets, seals.
- Checking and minor repairs to breakable components e.g., sight glasses.
- Calibration of components such as thermocouples, protection relays, etc.

The key criteria for these tasks are that they restore the original service capacity or utility. They do not increase that capacity or utility.

Asset replacement and renewal

Waipa's policy is to obtain maximum value from each asset, without compromising safety and reliability. Allowing assets to run to failure is generally not a viable strategy given the safety considerations incumbent to electricity conveyance. As such network assets are renewed when condition assessment indicates that they no longer possess the ability to meet their design requirements. Small pole-mount distribution transformers are an example of the exception where run-to-failure would be considered acceptable because the failure and safety consequences are usually minor.

Waipa may choose to replace assets ahead of "end of life" where there are advantages of doing so through economies of scale, for example, in undertaking whole line section renewal where most (but not all) poles and components in the line section are assessed in poor condition. Such a strategy is economically efficient due to the one- off project and site set-up costs especially in rural and remote locations, and in the avoided cost of multiple interruptions to customers.

Much of the existing network was developed in the 1970s and 1980s and accordingly would have, without ongoing prudent maintenance, reached the end of its useful life over a short span of time, probably related to the least durable items like wooden cross arms. Waipa's policy is to spread renewal expenditure to maximise efficiency and achieve consistency in operations. Hence our renewal approach is regular and it intended to avoid large portions of the network falling into a deteriorated state at the same time. It is possible to defer renewal expenditure. However, that runs the risk of increasing failures (incumbent with safety and liability consequences), attendant increased costs and the possibility of inadequate resources being available to correct the problem in a timely manner.

Waipa must continually and systematically renew its assets but replacement of assets is not always straightforward. Consultation with stakeholders is both important and may represent the longest activity in the time scale of executing the works. It can take considerable time to reach agreements with stakeholders such as landowners over access and asset configuration.

In general, asset replacement and renewal is prioritised towards areas where parallel renewal drivers exist, for example, low capacity or low strength lines, ties between feeders without (n-1) security, safety concerns, and/or assets that are expensive or difficult to maintain.

Consideration is given to making assets “smarter” on renewal. Developments in smart grid technologies are making new assets easier to monitor and operate remotely, which is an advantage when assets are difficult to access in a timely way.

Pole Line Hardware Policy

Waipa will continue its policy of not reinstalling recovered pole line hardware on the network. Waipa’s experience has been that reused cross arms pin and strain insulators and disconnectors fail within a relatively short period of time compared to the 70 years plus useful life of a concrete pole line.

Concrete Pole Policy

Waipa will continue installing only pre-stressed concrete poles on the network unless site access is extremely difficult and installation costs are considered excessive. Waipa’s 11kV and 400V feeders are predominately concrete pole lines.

Steel Cross Arms Policy

Waipa has adopted a policy to install only hot dipped galvanised steel cross arms on the network. As the only remaining organic pole line hardware, wooden cross arms were providing a “weak link” requiring replacement after just a portion of the useful life of a concrete pole line. It was observed that hot dipped galvanised steel cross arms on neighbouring networks had lasted well, with no signs of rust. Waipa considers hot dipped galvanised steel cross arms to be “tried and proven” technology.

Routine maintenance and inspection

Where possible, Waipa prescribes time-based condition monitoring over time-based servicing. Benefits of condition monitoring are:

- Increased visibility of an asset’s health.
- Ability to identify trends across asset groups.
- Maintenance actions become more timely (and therefore efficient) as they are driven by asset condition.
- Ability to identify, plan, prioritise and defer preventative maintenance works.
- Ability to assist in planning future capex work.

Monitoring schedules are prescribed tasks designed to detect potential failure conditions. The schedule is determined by balancing inspection frequencies against potential failure interval and the cost of the monitoring activity against the cost of asset failure.

Most of the preventative maintenance is planned. The ground mounted transformer, ring main unit, recloser, automated disconnector and voltage regulator asset classes have preventative maintenance plans.

A plan is made up of a list of assets that have a series of schedules. A schedule is a set of tasks undertaken at regular intervals. The inspection interval is based on time between inspections. For efficiency, tasks with similar intervals at the same site are packaged together.

The due date for each task is updated based on one of two methodologies:

- Variable: The task is due in one period from the previous occurrence’s completion date. This method is generally used for schedules that have a high cost per task occurrence, e.g., out of service tests on a power transformer.
- Fixed: The task is due in one period from the previous occurrence’s original due

date. This method is preferred for schedules with high task occurrence rates, due to either large asset populations or relatively short task frequency. In this case, there is greater efficiency to be gained by grouping tasks in a similar geographical area rather than strict adherence to maintenance frequency.

During routine maintenance, field crews undertake a condition assessment on each asset that then leads to a condition score based off the definitions[15] in Table 28.

Table 28: EEA's AHI scores (with definitions)

AHI category	Meaning
H5	As new condition – no drivers for replacement
H4	Asset serviceable – no drivers for replacement; normal in-service deterioration
H3	End of life drivers for replacement present; increasing asset-related risk
H2	End of life drivers for replacement present; high asset-related risk
H1	Replacement recommended

[15] Condition scoring and definitions from Commerce Commission and EEA guide to Asset Health Indicators.

These scores are the Asset Health Indicators (AHI) levels set out in the EEA Asset Health guide, which have been adopted by Waipa.

Corrective maintenance

Asset conditions scored Grade 1 (H1) and Grade 2 (H2) would typically trigger a defect to be logged with an appropriate urgency assigned for resolution. For very urgent defects these are treated as faults and this may include an emergency shutdown.

Oil Leak Containment

All pad mounted transformers with capacity in excess of 750kVA will be constructed with bunding for oil containment as required by the Resource Management Act 1991. Waipa's fault crews carry emergency oil containment and clean up kits. Larger kits and replacement materials are located at Waipa's Te Awamutu depot and at Transpower's Cambridge GXP and are available 24 hours per day.

6.7 Vegetation management

Overview

Vegetation management makes up a significant component of Waipa's network expenditure. It is necessary to maximise public safety including minimising fire risk and maintaining reliability of supply by preventing interference to lines and the provision of access to network assets. Waipa's network extends through heavily vegetated areas. Vegetation growth rates are typically high, which in dry summers exacerbates the fire risk. Expenditure includes frequent assessment of the network to establish where vegetation is encroaching (or approaching encroachment of) Waipa's overhead

lines. It also includes liaising with landowners with subsequent first-cut costs borne by Waipa associated with physical trimming or felling of vegetation

Legislation

The Electricity (Hazards from Trees) Regulations 2003 specifies minimum distances that vegetation must be clear from overhead power lines “growth limit zone” with distances varying depending on voltage and conductor span length). The legislation also stipulates that electricity distribution networks shall advertise suitable safety information to vegetation owners in appropriate publications as well as contacting those owners whose vegetation is approaching, at or exceeding the specified minimum distances.

The current tree regulations are considered to be unduly prescriptive rather than principles-based and consequently they are ineffective in remote rural locations where tree growth is relatively high and fire risk can be elevated, and it is difficult to measure the growth limit zone many metres above the ground where the vegetation is dense, without expensive survey methods like LiDAR.

Vegetation owners have the option of taking ongoing responsibility for maintaining vegetation outside the minimum distance(s), or granting the line owner (i.e., Waipa) approval to maintain the vegetation outside the minimum distance by appropriate trimming or removal. The same process of cut and trim notice has to be repeated for every individual tree on a property. A network owner has no mandate to remove a small tree from under a line but must wait until it encroaches within the growth limit zone before any action can be taken.

Risks with vegetation management

In practice, this legislation is not leading to optimal outcomes. The growth limit zones are not adequate for ensuring safety of the public in relation to trees particularly with trees of high growth in rural and remote environments. In many rural situations, the tree regulations do not enable a network operator to protect the lines from trees and/or to eliminate the risk of fire. In addition, the complex formulas require detailed and costly survey work to be undertaken if landowners require strict adherence to the legislation.

Trees are one of the significant causes of long duration outages on Waipa’s network. The current tree legislation only permits minimal clearances and removal of vegetation within the prescribed growth limit zone. In areas of high growth, this means that the limits are quickly exceeded after trimming, thereby requiring frequent return visits and high ongoing costs. These costs are further exacerbated in the remote area of Waipa’s network where access is difficult, and the work is undertaken at significant height resulting in relatively high costs of mobilising to work sites.

Another concern Waipa has is with vegetation owners who put themselves at risk by carrying out the vegetation trimming or felling work themselves. In some instances when Waipa notifies vegetation owners of the requirements to maintain minimum distances to overhead lines, vegetation owners elect to undertake vegetation work themselves, against Waipa’s advice. This puts the vegetation owners at risk of electrocution or may elevate the risk of a fire being initiated.

Vegetation management strategy

Waipa undertakes routine inspections of its network to identify areas where vegetation has the potential to (or already is) breaching the minimum specified legislative distances. The inspections are a combination of a rotational survey and reactive trimming of vegetation hot spots. The inspections are undertaken by vehicle, foot, and in 2021, via a fixed wing aircraft LiDAR survey.

Records of vegetation that present a risk to Waipa's network are established and managed in a similar way to an asset, i.e., a record is created with attribute data and specific location details assigned to it. Liaison with the vegetation owners then occurs as appropriate and where applicable work packs are designed and compiled to allow either Waipa or external contractors to undertake the corresponding vegetation control work.

Despite the inadequacies of the tree legislation, Waipa has directed its efforts to manage risk of vegetation interference by, where possible, obtaining greater clearances than those provided by the legislation with the cooperation of vegetation owners. Obtaining greater clearances than the minimum values specified in legislation reduces the potential for network damage, reduces the frequency of inspection required (and subsequent re-trimming of vegetation) and enhances the safety of landowners.

6.8 Surveillance

Asset surveillance (inspections, monitoring, testing and condition assessments) is a major input to determining the health of the network assets and provides Waipa with information that can be used to assess safety risks and reliability issues. A balance struck must be between repeated surveillance and condition or time-based servicing or replacement. Factors to be considered include:

- Expected asset conditions and environment.
- Setting the surveillance period in relation to the known defect rate.
- Balancing the cost of the surveillance activity against the cost of life extending maintenance or replacement or the consequences of asset failure.

Where asset defects are identified from surveillance, there are a number of approaches that can be considered depending upon the circumstances. These include:

- Planned asset replacement.
- Remove asset from service (e.g., rationalisation of air break switches).
- Increase frequency of monitoring.
- Plan preventative maintenance work, including additional diagnostic testing.
- Reprioritise existing works.
- Do nothing and continue to survey at normal frequency.

The approach adopted will principally be governed by risk of failure, public safety and then the criticality of the asset with respect to network reliability, cost of replacement and the cost of more frequent re- inspection in relation to earlier renewal.

Fault recording and analysis

Waipa records faults within the MagiQ shutdown database like time of occurrence, the asset that failed, failure type/cause (where known) and external conditions are recorded against each failure event. Equipment failure trends informs drivers for replacement or maintenance campaigns. In depth analysis of faults is prioritised by the impact on network reliability and the potential risks to safety that might be exposed by the fault.

Inspections

The majority of Waipa's surveillance comes in the form of asset inspections performed by field crews. Due to the spatial diversity of Waipa's network the cost per asset of field inspections is high. For this reason, to date field inspections have largely focused on defect identification, with condition data

being limited to a subset of assets (ground mounted transformers, ring main units, reclosers and voltage regulators). aerial survey has provided condition data in the form of asset health indicators for poles, cross arms and pole mounted transformers for rural feeders.

Digital mobility

Waipa has implemented a field mobility initiative, a health and safety management system called Assura to include field access to digital health and safety system documentation and provide on-site safety risk assessments, tail-gate sign on and management of the work crew and visitors. At later stages this will extend to mobile access network asset information and geographic information systems, and finally a work management system.

The benefits Waipa's expect to see from this approach are:

- Better access to information resulting in improved operator safety.
- Less time spent on preparation of printed documentation for site visits.
- Improved confidence in system data.

Waipa will give consideration to how this may be utilised elsewhere across field work, e.g., capturing of as-built data in the field.

Online monitoring

Waipa's SCADA system provides measurement and logging of the network utilisation and system events, which can be used to identify unusual operating conditions and indicate accelerated service-based aging.

The data provided from online monitoring can reduce the requirements of on-site work and inspections and allows Waipa's Operations team to respond faster to abnormal conditions on the network. Waipa's online monitoring systems currently operate almost exclusively on the 11kV distribution systems. Examples of online monitoring that Waipa undertakes on its 11kV network are included in Table 29.

Increasing amounts of distributed generation is being embedded into Waipa's LV networks. In order to monitor the effect of this technology on Waipa's quality service levels, Waipa is likely to want to improve its electrical surveillance of the low voltage reticulation. It may be possible to utilise this monitoring infrastructure as part of a future network congestion management scheme. Low voltage monitoring provides data that is currently monitored in a non-real time way by engineering staff, and future integration of LV monitoring into SCADA is a potential future step in our ADMS road map.

Table 29: Types of online monitoring

Telemetry type	Measured at relevant assets	Used for identifying	
Current	Recloser sites	Asset failure (electrical protection) Thermal aging Network utilisation and growth	All electrical assets Transformers Cables Overhead conductors
Voltage	Recloser sites	Asset failure (Electrical Protection) Abnormal operating conditions	All electrical assets
Operation counting – cyclometers	Circuit breakers Voltage regulator tap changers	Service wear	Regulator transformers Circuit breakers Sectionaisers Voltage regulators

When procuring new assets for installation on the network, Waipa has a preference for products that have the ability to be remotely monitored.

Engagement of external parties and external reviews

Waipa engages external resources for specialist activities. These tasks generally require skillsets and experience that are not available within the organisation. Examples include:

- Civil and mechanical engineering design.
- Technical surveys for earthing systems.
- Thermographic surveys.
- Partial discharge surveys of cables.

Waipa also engages consultants and auditors to independently review and provide quality assurance of its systems.

6.9 Network development strategy

Waipa undertakes development expenditure in a timely manner to ensure that appropriate levels of network service and reliability are provided in accordance with consumer expectation and in line with organisational strategies.

Waipa has adopted planning processes and technical and engineering standards to ensure that assets placed to meet service levels meet the following requirements:

- Capacity of an asset to convey electricity.
- Quality of supply (voltage within regulatory limits).
- Reliability (SAIDI, SAIFI).
- Security of supply (probabilistic, n-1 or n).
- Load demands of network consumers.
- The safety of its public, consumers, team and contractors.
- Maximise efficiency of operations.
- Prevent unnecessary investment.
- Be undertaken in an appropriate timeframe.
- Minimise risk of long-term asset stranding.

- Comply with regulatory requirements.
- Maximise operational flexibility.
- Maximise fit with organisational capabilities such as engineering and operational expertise and vendor support.
- Comply with environmental requirements.
- Appropriate to environment.

For example, a fundamental criterion considered for 11kV/415V transformers is the maximum demand and delivery of required voltage. Ground mounted transformers are equipped with maximum demand indicators and any transformer where the indicated load exceeds the transformer rating is considered for upgrade. Other options such as phase rebalancing, and or moving load to other transformers are also considered. Other factors taken into account are the load duration, i.e., how often the transformer is close to, or above, its ratings, and the time of day and year of the highest loadings.

Increases in load are then reflected in planning upstream through the various classes of Waipa's assets back to the Transpower GXP. The load on all 11kV feeders is continuously monitored and the data is used for system modelling and project planning purposes.

As the network comprises 11kV and 400V reticulation assets only, Waipa need only buy a limited scope of assets. The assets are chosen to comply with the load requirements and fault duty of the network.

Other inputs to Waipa's network development plans come from District Councils, Waikato Regional Council, property developers, Fonterra and other major industrial consumers. Waipa uses these sources in the following ways:

- The District Councils in Waipa's reticulation area have adopted a 30-year planning horizon for local development. Waipa regularly assesses the impact of these developments on the network and makes submissions on these plans as appropriate. Given the growth in the Cambridge area and recent interest from industrial customers in the area, a more comprehensive grid exit point capacity and sub-transmission network development plan has been completed, to address the longer-term capacity needs of the area. A similar grid exit point and sub-transmission plan is under development for the Te Awamutu network area.
- The impact of developers subdividing existing properties is assessed from year to year.
- The two Fonterra dairy factories, Waipa's largest consumers, keep Waipa informed of their maximum demand (MD) requirements on an annual basis. Any significant increase in the long-term capacity requirements are discussed as they arise and a solution agreed between the parties.
- Major developments are monitored as they arise, with network development plans being developed to determine efficient supply methods. Examples of these are the Waikeria Prison upgrade project and the APL aluminium and glass joinery factory development.

As Waipa has a number of long radial rural feeders there is a need to provide conductors of adequate cross-sectional area to maintain satisfactory voltage levels along and at the extremities of these feeders. Typically, the initial sections of all feeders radiating out from Transpower's Cambridge and Te Awamutu GXP require 300mm^2 Al cables and heavy line for adequate fault rating, back feed capacity and voltage support.

Waipa's main assets comprise: cables, lines, reclosers, voltage regulators, ring main units, enclosed switches/ABS and dropout fuses. Their performance ratings are described in the following table. Due to the radial configuration and simplicity of the network it is cost effective to limit the number of models of reclosers, ring main units, voltage regulators, enclosed switches /ABS and dropout fuses to one model for each asset.

Table 30 Asset performance ratings

Asset Ratings / Distance from GXP	TPNZ Circuit Breaker	Waipa Cable	Waipa Line	Waipa Recloser	Waipa RMU	Waipa ABS	Waipa DDO
<3km	800A 26kA 3sec CBG GXP 1250A / 630A 26kA TMU GXP	420A, 26kA 3c 300mm^2 Al XLPE Cu Screen	490A AAAC Krypton 158mm^2	630A, 16kA 4sec	630A 20kA 3sec	630A, 12kA 1sec	100A, 12kA 1sec
3km-10km		420A, 13.1kA 3c 300mm^2 Al XLPE Cu Screen					
10km-25km		325A, 10kA 3c 185mm^2 Al XLPE Cu Screen	418A AAAC Hydrogen 111mm^2 333A AAAC Helium 77mm^2				
>25km		225A, 8.9kA 3c 95mm^2 Al XLPE Cu Screen	250A AAAC Flourine 49mm^2				
spur		130A 3.5kA 3c 35mm2 Al XLPE Cu Screen	148A ACSR Squirrel 21mm^2				

Al: Aluminium
Cu: Copper
ACSR: Al Conductor Steel Reinforced
AAAC: All Al Alloy Conductor

Standardising assets and designs

Waipa's network standards document the design and construction of network assets. The Network Standards are used for assets where ownership and/or maintenance responsibility ultimately rests with Waipa.

The standards contain information and drawings to be used in designing and constructing network assets. These standards and policies include safety by design, consideration of safety at all stages of the equipment lifecycle for public safety at the design stage. This assists Waipa in meeting its obligations under the Electricity (Safety) Regulations 2010. They also assist in standardising assets to help achieve reliability of supply targets.

Waipa, along with other New Zealand EDBs, has access to, and the use of, the PowerCo Contract Works and Network Operations standards library. Where appropriate, PowerCo's documents are used to develop and update Waipa's standards. This also increases the standardisation of practices across the industry for greater efficiency.

Table 31 summarises some of the key strategies for standardising assets and designs at Waipa

Table 31: Summary of standard strategies for assets/design

Asset category	Standardised features	Standardising methods
Distribution, and, LV lines	Standard suite of conductors/cables to be selected from – generally available conductor/cables.	Waipa's Design Manual. Other types not included in standard needs specific network review and management approval.
Distribution, and, LV cables		
Distribution substations/ transformers	Size of transformers (pole-mounted) generally dictate supporting pole. Off the shelf models for network consistency.	Waipa's Construction Manual.
Distribution switchgear	Selection generally from preferred suppliers of off the shelf goods – bespoke options avoided unless exceptional circumstances warrant.	Waipa's preferred suppliers list.
Poles	New concrete poles are pre-stressed type. Load changes to hard wood, larch poles result in replacement. Select from approved manufacturers and limited pole types only.	Waipa's Construction Manual. Relevant utility pole standards to apply to new poles.
Other network assets	Generally procure from preferred (i.e., pre-approved) suppliers.	Waipa's preferred suppliers list and Design Manual.

Strategies for asset efficiency

Waipa monitors and considers losses when looking at the system configuration and network development. In practice, the physical considerations (e.g., conductor size and pole spacing) and the requirement to deliver regulatory voltage tend to take priority at the asset design and construction phases of the lifecycle and this determines the losses.

Demand management also plays a part in energy efficiency. Where trends indicate future increases in demand for example, this is factored into the capacity of new or replacement transformers.

Waipa specifies the level of power factor required to be met by users of the network to maximise the efficiency of utilisation. Similarly, maximum harmonic levels are specified for consumer installations.

Waipa will consider energy efficiency when purchasing and replacing future substation power transformers and the cost of the fixed and variable losses over the life of the transformer are considered.

Lines pricing is designed to incentivise consumers to install transformers of an appropriate rating. However, in many cases, consumers and their consultants prefer to over specify transformer capacity in anticipation of future requirements (thus increasing standing losses).

Energy efficiency initiatives also pertain to electricity users. Waipa has interposed Use of System Agreements (UoSA) with electricity retailers. Waipa, therefore, does not have direct contact with consumers, limiting its ability to influence consumer behaviour. As the local EDB, though, Waipa provides advice to consumers through publications, e.g., newsletters.

Setting asset capacity

The theoretical starting point for quantifying new capacity is to build, "just enough, just in time", and then add incrementally over time. However, Waipa recognises the following practical issues:

- The standard size of many components, which makes investment "lumpy".
- The ability of Waipa to obtain a commercial return on investment.
- The one-off costs of construction, consenting, traffic management, access to land and reinstatement of sealed surfaces, which may make it preferable to install additional capacity rather than returning in the short to medium-term. This is especially the case since network assets typically have long lives, far in excess of the regulatory period and the 10-year horizon of this Plan.
- The addition of extra capacity can, in some cases, require complete reconstruction, for example, where larger conductor requires stronger poles or closer pole spacings, leading to considerable increases in total cost of ownership if an incremental approach is used at the outset.
- The need to avoid overload risk. Overload can lead to asset failure, reductions in service and reductions in asset lives.
- In terms of some items, e.g., power transformers and underground cables, the marginal cost of providing additional capacity for the future is typically small relative to overall project costs.

Waipa's guiding principle is therefore to minimise the level of investment ahead of demand while minimising the costs associated with doing the work as well as the total cost of the asset over its lifetime. This recognises that the costs of investment in advance of requirements is far more preferable than investment after failure has occurred or consumer supply is lost.

Generically in determining capacity requirements, Waipa monitors and reviews loading data across the network (and specific areas depending on what is being considered) and assesses trends in data, liaises with other relevant stakeholders in the district (for example, the Waipa District Council around its development plans), whilst reviewing existing infrastructure and any current capacity restraints. Considering these (and other) factors in combination is generally the best approach for determining capacity.

More specifically at the asset level, more detailed criteria are considered in determining asset capacity. Some of these are summarised in Table 32.

Table 32: Summary of criteria used to determine capacity of network assets

Asset category	Criteria to determine capacity*
Distribution and LV lines	Loading, growth forecasting, health and safety considerations. Surrounding land use (man-made or natural environment), climatic conditions, topography.
Distribution and LV cables	
Distribution substations and transformers	
Distribution switchgear	
Poles	Expected demand within next 10 years, taking into account diversity.

Transformers/ switchgear/ buildings	Expected future fault and load levels – generally only available in step sizes
	Conductor mechanical loading (i.e., size of conductor and span lengths drive pole size), environment, loading from other sources (i.e., steady state and/or dynamic loads).
	Current loading, expected future growth and demand forecasting.

Note – not an exhaustive list.

6.10 Prioritisation of development projects

Waipa prioritises Transpower new investments and Waipa network development projects by a combination of the number of customers affected and predicting when Transpower transmission, GXP assets and the Company's feeder assets become constrained. The following table shows the priority that the Company places on these constraints.

These predictions are made by analysing:

- Transpower's transmission line security level.
- Transpower's GXP underlying maximum demand growth.
- Waipa's underlying feeder load trends.
- Customer driven work.
- Waipa's feeder reliability (SAIDI, SAIFI) performance.
- Waipa's feeder security level.

In prioritising development work, Waipa assesses the estimated cost and benefits. The drivers of the work are considered along with, the benefits to stakeholders. Table 33 summarises the ratings of typical benefits.

Table 33: Considerations in prioritising development projects

Description	Comments	Rating (10 = highest)
Safety	Waipa will not compromise the safety of staff, contractors and the public. Safety is fundamental to the way Waipa undertakes its activities and as such has highest priority.	10
Voltage	Consumers want items of their electrical plant and equipment to perform. This requires stable voltage levels free of harmonic interference.	9
Capacity	Overloading can lead to overheating, reduction in asset life, fire, explosion or cascade tripping.	8
Reliability	Consumers want a reliable supply.	8
Security	Consumers want a reliable supply.	7
Environmental	Managing impact on the environment is a key part of Waipa's values, especially in highly sensitive areas.	6

Energy Efficiency	Medium consumer-density EDBs like Waipa have relatively high numbers of transformers, all of which incur losses regardless of consumption. Energy efficiency is taken into account during design and purchase of network assets. Waipa also seeks to maximise the efficiency of its network through operations, notwithstanding the limitations from Waipa's network physical constraints.	5
Renewal/ end of life	Lower priority if it is safe, has adequate capacity and voltage and low costs.	4

In assessing the potential benefits of the work, consideration is also given to the number of affected consumers, the total kW/kWh and the impact (if any) on revenue/ costs, e.g., reductions in maintenance/ increased line charges.

Potential projects come from a wide range of work including technical studies of the network, e.g., load flow analysis, consumer requests, consideration of load growth, information on proposed load changes, examination of existing constraints and limitations within the network and asset monitoring e.g., large concentrations of maintenance work may result in line renewal and reliability studies.

Projects are developed and budget pricing is undertaken on an annual basis. The benefits are assessed in terms of the criteria above and projects ranked accordingly. This is undertaken by the engineering staff. From this information a draft plan and budget is developed. This is then discussed with, and approved, by the CEO before being submitted to the Board for approval or alteration. Once approved, it is included within Waipa's annual budget. The programme of projects is then managed on an ongoing basis (both underway and planned projects) to track expenditure and to ensure that any planned projects are still relevant. The programme is then updated accordingly. Monthly reviews are undertaken by engineering and finance staff to manage the status of Capex projects and capitalise or expense costs when and where appropriate.

Network Analysis to Identify Constraints

Transpower's new investments and Waipa's network development projects are evaluated using network development analysis including load flows which identifies when an asset is predicted to become constrained. Waipa then prioritises and schedules projects so that the assets are not constrained and solutions are implemented in a timely manner

Capacity Constrained Feeders

Waipa deems that a feeder has reached its capacity constraint when its 10th MD exceeds its switchgear, cable or overhead line maximum thermal rating.

Voltage Constrained Feeders

Waipa deems that a feeder reaches its voltage constraint when the delivered voltage levels anywhere along the length of the feeder fall below the minimum design limit of ±5% and prescribed regulatory voltage of 0.94 per unit (that is, ± 6%) for LV networks.

Security of Supply Constrained Feeders

Waipa's stated security of supply objective for 11kV urban and suburban areas and other 11kV lines where interconnection can be provided economically is n-1 switched. This provides security of supply in the event of a fault close to the GXP, or the feeder circuit breaker being removed from

service for maintenance This objective can be best tested by actual load flow analysis of feeders in a back-feeding configuration. The previous practice of limiting 11kV feeders to be loaded up to 66% of their rating so that there is the ability to switch load to two (or more) adjacent feeders accounts only for thermal capacity, when the load flow analysis of back feeding Cambridge feeders showed clearly that voltage was often a key limiting factor for back feeding.

Investment in voltage regulators and capacitors to achieve security of supply through back feeding is relatively much less than providing feeder interconnections or constructing new feeders. However, some longer rural feeders are encountering voltage limits and it is imperative to investigate alternative solutions for the long-term ability of the network to continue to meet forecasted demand. Solutions to security issues will be economically tested where the cost is excessive or the security benefit provided is modest.

6.11 Policies on Distributed Generation

Waipa has welcomed all enquiries from consumers and other interested parties regarding the commercial and technical viability of a variety of distributed generation (coal/diesel, micro-hydro, wind and photo-voltaic, etc.) proposals.

Waipa's connection policy requires distributed generators to contribute to any network enhancements that are required to eliminate any input constraints caused by the distributed generator.

Applications and a description of the consenting process and associated legislation and technical requirements for distributed generation are available on Waipa's website.

Waipa's salient requirements for new generators are:

- Operators must ensure their generator operates safely and does not produce any adverse effects on the network or any other network consumers.
- Generators must not produce any voltages or harmonics outside regulatory limits, interfere with network protection systems or inject fault currents above network capabilities.
- Generator owners must provide protection against over and under frequency, overcurrent, phase to phase faults and phase to earth faults.
- Generators must comply with all relevant regulations, standards and codes of practice.
- Applicants who reduce the net reactive power supplied to Waipa's network by Transpower will be encouraged, while those who require excessive additional reactive power support will be declined or required to supply power factor correction.
- Generators must be tested fully before being connected.
- Connected generators will be disconnected; in emergency situations, if the generator has failed to pay any fees or charges, if there is a change or increase in distributed generation without Waipa's prior consent or if the generator fails to have an electricity retailer.
- Standard fees apply for applications and inspections.

Most of the distributed generation installations have been downstream of the consumer's metering point and generally photovoltaic applications. This type of distributed generation has had little effect on the network given low levels of penetration to date, but high voltage issues on LV feeders have been observed and this remains a potential issue with increasing penetration.

6.12 Policies on Non-network Solutions

Waipa encourages all forms of non-network solutions that can be provided at an economically competitive price and are practical alternatives to conventional network augmentation, to address network constraints. Non-network solutions such as energy efficient lighting and heat pumps may reduce network MD and energy consumption by consumers within their installations.

Non-network capacity support is being implemented to support the Cambridge network during peak load periods from 2020 to 2025 until the new West Cambridge GXP is commissioned. A portfolio approach is being considered, including contributions from the following sources:

- Distributed Generation (DG) or diesel generation.
- Demand Response (DR) or load reduction with industrial and commercial customers.
- Distributed Energy Resources (DER) or thermal storage systems for ice and chilled water storage to turn-off refrigeration at industrial processing plants.
- Distributed Energy Resources (DER) or battery storage to complement solar PV.

To further investigate the potential impact of new technologies on the network, the following Business Plan initiative commenced in 2016/17:

- Monitor the impact of the 100% PV St Kilda subdivision via metering the distribution transformers and analysing the effect on demand consumption, export, voltage and harmonic content from inverters. The St Kilda subdivision has covenants requiring the installation of at least 3kW of PV solar panels on every house. A similar aged subdivision has been monitored to provide a comparison for the analysis.

The St Kilda PV monitoring programme has produced some interesting results, including that St Kilda consumers still impose the same peak network demand in terms of morning and evening peaks, in spite of the solar PV generation connected to each house. The impact of DG on voltage rise on the LV network is still being investigated, theoretical modelling indicates that the LV design for this subdivision is reasonably robust for the intended level of PV penetration. Further investigation into the effect of Home Energy Management Systems (HEMS) on the self-consumption of solar PV generated electricity was completed using a trial of the NextIdea Power Genius HEMS.

Battery energy supply systems are an emerging technology that has potential to be a non-network solution to meeting peak demand or improving reliability to some customers. The approach of tendering for market provided non-network solutions will be considered for the Te Awamutu network constraints, to test what the market can provide in terms of peak load management.

Line Pricing Incentives

Waipa offers controlled load, day/night and 8-hour supply kWh line pricing to all retailers to encourage consumers to reduce network MD at peak times. From 2016 new pricing has been phased in to provide for peak, shoulder and night periods as a pricing signal to reflect the impact on the network of demand at different times of the day. This pricing was fully implemented from 2021.

Embedded Generation

Waipa will consider using non-network solutions such as diesel generation to reduce network MD and delay conventional network capital expenditure where it is prudent and economic to do so.

Consumer Advice

Waipa's website (Info for Customers/Energy Efficiency) contains suggestions for consumers to save power without adversely impacting on their lifestyle.

Virtual Smart Home

Waipa continues to provide information related to smart and energy efficient technology which can be found at www.virtualsmarthome.co.nz. Waipa's aim was to provide ready access to the latest in smart and energy efficient home technologies for its customers. Waipa therefore developed the concept of a 'virtual' smart home on the internet where customers could easily access the technology and interact with it.

The smart home website goes beyond a typical demonstration of smart technology by also providing users with tips regarding energy safety and efficiency.

Power Factor

Waipa will continue to require consumers to install sufficient power factor correction at their installations to maintain a minimum power factor of 0.95 (lagging) to reduce reactive power loading on Waipa's feeders. Transpower has not at this point enforced reactive power penalty charges related to off take power factor at Cambridge or Te Awamutu GXPs.

Transpower routinely advises Waipa each year what the power factor at Cambridge GXP and Te Awamutu GXP has been during the previous year. To date Transpower has advised that power factor at both GXPs remain satisfactory.

Impact of Demand Management on the Maximum Demand

Waipa has a ripple control load management system that is able to control 5MW of connected load in Cambridge and 5MW of connected load in Te Awamutu over peak periods. Waipa has assumed for the purpose of forecasting MD that its load control system is fully functional and that full load control is being exercised over lower North Island peak load periods as required.

Waipa has assumed for the purpose of forecasting MD that any form of additional Demand Side Management will not have any material effect on reducing the MD. Currently, there is no quantitative evidence that retailer demand side management initiatives have been adopted.

As noted above, a portfolio approach to non-network capacity support is being considered to support the Cambridge network during peak load periods from 2020 to 2025 until the new West Cambridge GXP is commissioned

6.13 Non-network solutions

The electricity distribution model has, until recently, remained relatively unchanged for many decades. However, the industry is now seeing the increasing availability of alternative technologies to the traditional network assets of poles and wires mainly through small scale distributed generation and battery storage. The use of non-network solutions, where appropriate and economic, can offset investment in standard network assets. However, it needs to be recognised that an effective electricity network provides significant diversity benefits of electricity utilisation between ICP's and typically has the ability to provide flexibility in meeting consumer demand.

With respect to new non-network solutions (technologies), Waipa follows the work of a national industry group considering the potential impact of disruptive technologies and the manner in which network assets will be operated and managed in the future. Technologies which are becoming increasingly available and affordable are likely to impact the network. These include distributed generation (photo-voltaic, in particular), to a lesser extent wind and electric vehicles in conjunction with capability improvement and cost reduction in storage batteries.

Load control as an alternative to capacity upgrade

Waipa has capacity constraints imminent at the Cambridge GXP and the Te Awamutu GXP. In some areas, particularly on the Te Awamutu network, feeders are becoming constrained due to voltage capacity. Should there be demand growth above capacity, there are a number of tools that Waipa could apply other than capacity upgrade, including:

- Hot water load management: Utilising the ripple control system to remove participating hot water load during peak periods but note that this is essential fully utilised at present in managing GXP peaks.
- DER: Establishing a generation participant programme to utilise backup generators embedded within consumer installations based on ripple control or demand management signalling.
- Network pricing: Pricing signalling that encourages consumers to reduce load during peak times. Note that this relies on retailers passing these pricing signals on to consumers.

These legacy solutions have become less applicable as the line and energy segments of the electricity supply chain have been vertically disaggregated and line charges have diminished relative to the costs of energy. By way of example, the cost difference between delivered day/night energy has been markedly reduced in recent years. Irrespective, the ripple control system remains a valuable tool for load management and is used to good effect when there are restrictions in Transpower's capacity to supply.

Battery storage and demand side management as an alternative to capacity upgrade

Waipa does not plan any investment in battery storage within the planning period of this AMP. This is predominantly due to the current economic price point of utility scale storage being in excess of network solutions. Aside from not having a need for batteries, other factors to be considered are:

- The current market pricing and payment structures, systems and tools are not currently available to allow for Waipa or its consumers to realise the value in demand side management.
- The uncertainty around the safety risks and maintenance costs associated with battery systems.
- Current battery costs.
- Uncertainty in the regulatory environment as to ownership of these assets.

Waipa will keep abreast of this rapidly developing area and review its position on battery storage, demand side management and associated infrastructure during this planning period. Waipa is also learning from other distribution networks approaches to tendering for non-network solutions, that can provide access to more economic demand management. For example, battery installations can become more economically feasible if the operator can "value stack" by obtaining multiple revenue streams from sources other than network demand management, reducing the cost burden to the network for this service.

Distributed generation, photovoltaic/solar and wind

The reduction in the cost of photovoltaic systems and greater consumer interest is resulting in increases in the number of photovoltaic installations into Waipa's network. Figure 31 plots the distributed generation capacity (dominated by solar and with an average capacity of 5kW per installation) installed into Waipa's network in MVA from 2011 to 2021. This shows steady growth, but the total capacity is not significant in relation to network load. There are two major contributors to photovoltaic DG on the network, the St Kilda subdivision where at least 3kW of PV was required per house as a covenant condition, and the Lakewood development, where Waipa Networks installed relatively large PV arrays within an embedded low voltage network. Aside from these, the growth in PV DG has been relatively modest. Total distributed generation-installed capacity is approximately 13.3 MW as at 31 January 2022 (this includes the 8 MW Fonterra co-generation unit at Te Awamutu Dairy Factory which is excluded from Figure 31). Given the current relatively low utilisation (generation) rate from photovoltaics, the current capacity build is not expected to markedly alter network requirements over the next five years and perhaps not even over the 10-year planning period.

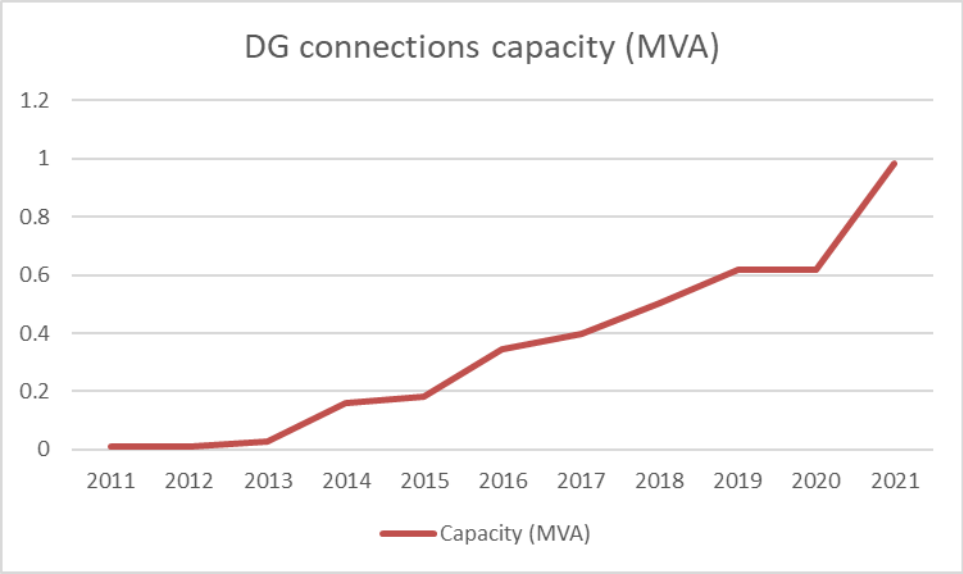


Figure 31: Distributed generation connections into Waipa's network since 2011

It is also noted that, as more cost reflective network pricing is introduced with an emphasis on higher fixed daily charges, the attractiveness of photovoltaic installation will likely diminish with the actual saving being specifically related to a reduction in energy consumption (variable) prices.

Predicting the future installation of large-scale photovoltaic installation is uncertain. This will be influenced by a number of factors, including the recent (1 October 2019) removal of avoided cost of transmission benefits, falling installation cost, improving solar panel efficiencies, reducing storage battery costs, the degree of marketing undertaken by suppliers, the potential for local or national government subsidies/funding schemes, and changes to standard connection and operating standards of EDBs and possibly the Electricity Industry Participation Code. Wind DG is not considered to be a major factor in the Waipa network as wind speeds are not generally favourable.

Solar DG by nature generates intermittently. Wind DG also has an inherent intermittency that produces bi-directional power flows. They can lead to an increase in the voltage swings in the network requiring capacity reinforcement, particularly in the LV network. Additionally, it is considered

likely that there would be little or no reduction in the network peak demand – or at least the potential to strike that peak and to which the network must be designed.

Widespread installation of solar DG particularly in the Waikato has the potential to cause voltage problems on the network, especially if penetration increases to the extent that reverse power flow on feeders occurs. Waipa gives this due consideration when assessing network (and feeder) capacity and when reviewing applications for the installation of DG.

Battery technology

This is an important factor in both EVs and in the uptake of PV. Low-cost batteries could enable some installations to become independent of the electrical network, if the flexibility of demand capacity provided by the network is not a consideration, and, provide others with a means to store the PV generation and use it at times which produce maximum benefit. But, as with the utilisation of photovoltaics, the cost of the batteries needs to be balanced against the introduction of cost reflective network prices, the requirement for which has been signalled by the Electricity Authority.

Waipa's network provides the opportunity for ICPs to share the benefits of diversity of load.

A study of battery costs for EV and stationary storage commissioned by the EU in 2018 forecast falling battery costs as illustrated in Figure 32.[20] This shows past falling costs and projected costs out to 2030 down to €100/kWh representing an approximate halving of current costs.

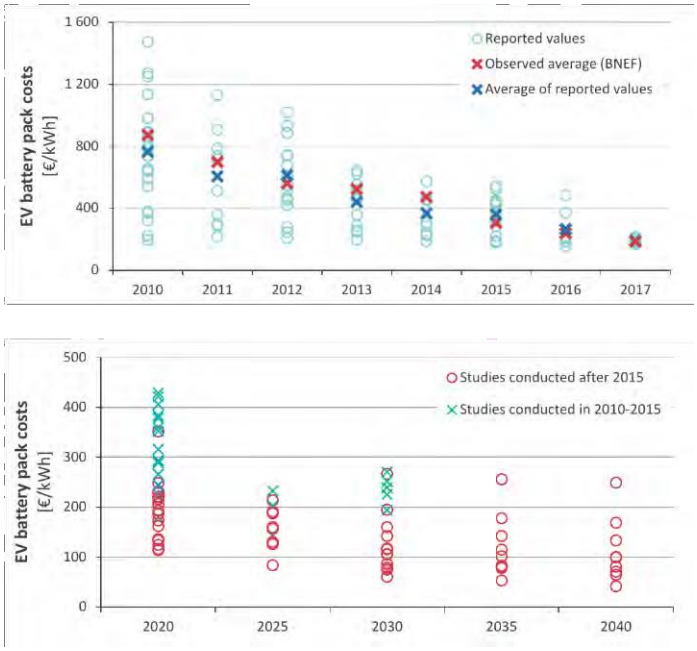


Figure 32: Forecast lithium-ion battery costs

[20] "Li-ion batteries for mobility and stationary storage applications "JRC science for Policy Report; ISBN 978-92-79-97254-6".

These cost reductions are expected to drive increased take-up of both battery storage for PV installations, thereby increasing their utility, and the take-up of Evs assuming these costs pass below price threshold points for consumers. The main issue from a strategy perspective is that the future take-up rates for these technologies is uncertain. Waipa is mindful of this and will monitor this technology closely.

Remote Area Power Supplies

Remote Area Power Supplies (RAPS) are essentially an alternative electricity supply from a standalone generation system, instead of a network connection. A RAPS system typically utilises a combination of solar generation, battery storage and diesel backup to provide supply.

There are a very small number of instances where RAPS may provide immediate benefit, by minimising economic losses, typically at sites characterised by:

- Extreme remoteness resulting in increased line and vegetation maintenance costs.
- Extremely low consumer count per km of line requiring renewal.
- Poor asset health driving a case for short term renewal.

Waipa does not currently have plans for any significant investment in RAPS within the next five years.

Network adaption

Ultimately, the role of network services may diversify to range from a traditional full lines service to provisioning firm capacity, fault current and frequency regulation support for micro networks. The greatest risk for Waipa may not be mastering the technology involved but rather the ability to properly reflect its long-run and marginal costs for the services it provides.

The factors driving the uptake of new technologies are likely to result in a need for evolving asset management practices within the period of this AMP. However, future plans can be adapted as the technology becomes established and its effects more certain. Waipa will continue to monitor these technologies and consider how the network can best be managed to give maximum benefit to all stakeholders. Waipa anticipates that a degree of investment will be required to accommodate EVs when their additional demand commences.

6.14 Key assumptions

In preparing this AMP, and undertaking its asset management activities, one of the key assumptions made by Waipa is that the business will carry on in perpetuity, i.e., the assumption is that Waipa will own, operate and maintain an electricity distribution network into the future.

Other key assumptions (quantified where possible) are set out in Table 34.

Table 34: Significant assumptions underpinning Waipa's asset management (and AMP)

Assumption	Sources of uncertainty	Possible impact of uncertainty
That no major disasters or widespread systemic problems will occur.	While contingency planning and emergency response plans are in place, it is difficult to predict the timing, extent and location of events with any great degree of certainty.	Extensive damage to significant proportion of Waipa's network requiring significant expenditure (both opex and capex) in a relatively short timeframe. Waipa has no debt, a strong balance sheet and is expected to have the capacity to deal with all but the most serious of disasters.

That there are no significant changes to local authority (i.e., Waipa's District Council (WDC)) long-term plan.	WDC may alter existing plans. This may allow opportunity for cost sharing with Waipa – for example, if road widening, or renewal of underground services occurs, then there may be opportunity for Waipa to renew electrical infrastructure (or underground overhead sections) at the same time.	Inclusion of as yet unplanned activities by Waipa.
Inflation assumptions.	Inflation is manged by the monetary policy of the Reserve Bank of New Zealand (RBNZ). While RBNZ aims to keep inflation near the 2% target midpoint, this could vary.	Inaccuracies in forecast expenditure amounts (either over or under depending on actual vs assumed price inflator allowed for). Further detail is presented in the expenditure forecasts section.
There are no significant changes to forecast load demand.	Step change in district population growth, or load demand from industry growth.	Additional or reduction in forecast growth expenditure, changes in transmission prices.
Consumers remain satisfied with current reliability and resulting costs.	Consumers may change preferences – i.e., accept less reliability for lower lines charges. Uncertainty here is knowing consumers future preferences.	Less revenue which in turn would result in less expenditure. Ultimately, this would result in a less reliable network.
No significant changes to regulatory regime and requirements.	Change in Government, changes to regulatory nature/requirements of EDBs.	Revision of plan may be required to adhere to any changes in regulatory requirements.
The rate of uptake of new technologies (e.g., EVs, PV).	The rate of uptake of new technologies is largely unknown at this stage.	The widespread charging of EVs on the network has the potential to provide a source of revenue which currently does not exist, albeit that investment may be required. The widespread installation of PV can have two principal effects. A reduction in delivered energy to ICPs where all of the output is consumed within the premises and if large numbers of consumers sought to inject into the network the level of PV or their internal control, would need to be limited to prevent voltage problems. In event of injection from ICP PV the network will be required to deliver to other ICPs. The introduction of cost reflective line charges will likely dampen enthusiasm for PV given line charges should relate to installed network capacity not delivered energy. If the cost of battery storage were to significantly be reduced, the benefits of photovoltaics would be further enhanced but again it is advocated if network charges related to the provision of capacity and ICP's required for security of the network capacity the utilisation of photovoltaics and batteries would be constrained.
That no major new unknown loads or new sources of generation connect to the network.	Inability to accurately predict future growth which is controlled by others, change in economic opportunities for various industries.	May require upgrade and/or modification(s) to network depending on nature and scale of new load(s) or generation. Addition to growth expenditure above forecast.

6.15 Asset management maturity assessment

In 2021/22 Waipa completed a fifth assessment of its asset management processes in accordance with the AMMAT questionnaire in Schedule 13: Report on Asset Management Maturity as attached in Section 12.

The following graph shows Waipa's performance as determined by the AMMAT in 2021/22. Increases in scores have resulted for Asset strategy and delivery, Structure, authority and responsibilities, Risk management processes, Legal and other requirements and Continual improvement. The scores for Contingency planning, Outsourcing of asset management activities and Training, awareness and competence reduced for one question each.

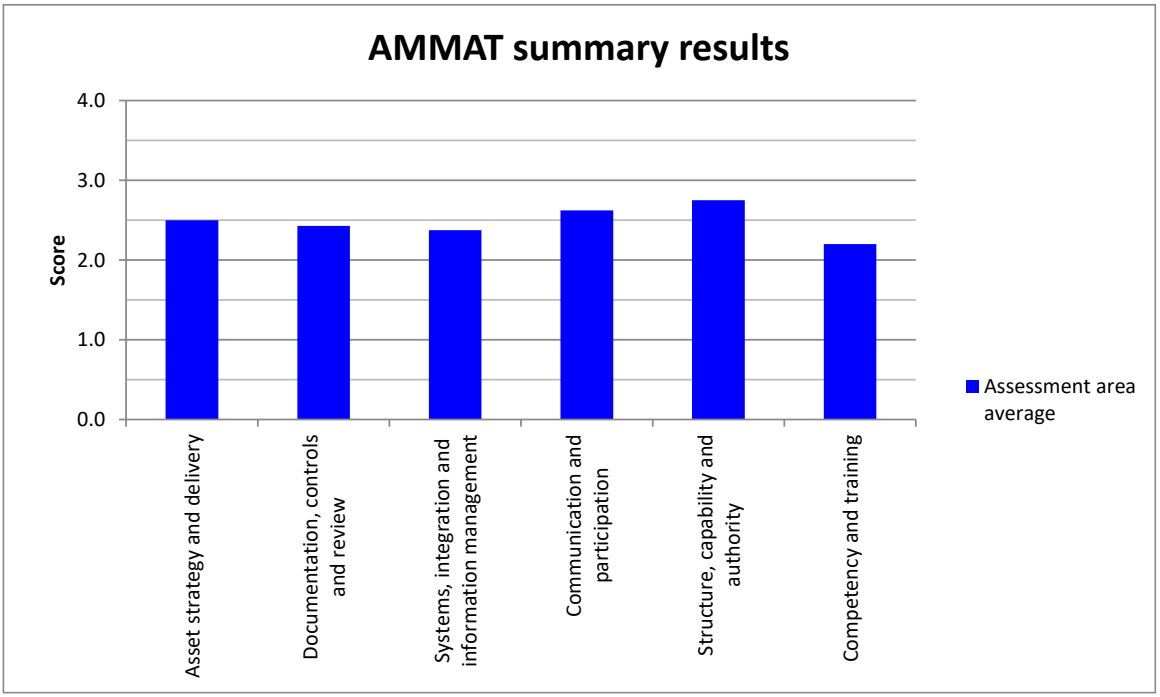


Figure 33: AMMAT summary results

Waipa considers its current asset management processes are in general adequate for its stakeholder's requirements and are provided at a cost acceptable to them. That said, there are areas identified within the AMMAT results that illustrate potential for improvement that would be of benefit to Waipa's asset management practice. An Asset Management Improvement Plan has been formulated, and action plans will be implemented over the next several years to put in place enhancements to asset management practices and systems and lift selected AMMAT scores.

6.16 Asset management improvement

Completion of the AMMAT has identified areas of improvement in Waipa's asset management. A selection of improvements (those deemed as having the greatest importance/benefit) based upon the AMMAT assessment are below.

Waipa believes that further development of asset management systems and asset data will assist in making these asset management decisions, in particular further work is required in developing asset condition data, asset health indicators and forecasts of network equipment renewal expenditure. Planning to implement asset management process improvements commenced in 2018/19, with an external review of asset management practices. This resulted in the formulation of an Asset Management Improvement Plan (AMIP) to identify and prioritise areas for improvement.

Specific asset management improvements selected for implementation include:

Process and Systems:

- Further external stakeholder communication (as outlined in this AMP).
- Document key asset management processes (Asset Planning, Life cycle, AMP).
- Continue to refine the ADMS roadmap for the whole network business.
- Continue review of contracting processes.

Reliability:

- Discuss guidance for coding adverse weather and unknown faults to maximise the data for analysis.
- Discuss reliability improvements due to automated devices being installed on the network and the reliability expected.

Development

- Develop a high-level capital planning process.
- Further develop point of supply plans (Cambridge GXP completed, Te Awamutu further work to continue into 2022/23).
- Develop major capital project delivery processes for sub-transmission projects.

Maintenance and Replacement

- Complete the asset health indicators for all assets
- Develop simple fleet management plans.
- Document defect inspection processes with the incorporation of pole top photos, wood pole inspections and re-inspection processes for defects beyond their defect period.

Asset Management Systems

The current legacy asset management systems listed here have technology deficiencies, namely they are discrete and unconnected systems and require manual interventions by staff and multiple data entries to update information:

- Abbey SCADA system.
- AutoCAD Geographic Asset Information system.
- MagiQ Integrated Data Warehouse system.
- ETAP network modelling software.

Waipa has completed a review its asset management process and systems to determine what gaps in functionality exist, and to prioritise new systems to match the information system capabilities desired. The result was the ADMS roadmap.

A high-level summary of the ADMS roadmap is as follows. Waipa Networks will proceed to implementing a Geographical Information System (GIS) to replace the current system of geographically based AutoCAD drawings for network assets. This will allow better asset data to be retained for network assets and greater levels of asset-based analysis to be achieved using the database structure related to the GIS. Aerial survey data will be used to provide precision GPS positioning of assets and analysis of pole photos will provide asset health indicator data for the overhead assets. The GIS will be implemented using an ESRI Arcview GIS on the Utility Network

Common Information Model (UN CIM). This will allow all other compatible systems to access the same network model, reducing the effort required to implement and integrate those subsequent systems.

Subsequent systems to be implemented will be a SCADA and Outage Management System (OMS) and network analysis software drawing on the same UN CIM network model and data as the GIS. The OMS will provide improved faults dispatch, automated calculation of reliability statistics and improved integration with customer records. Following on from the above systems will be an asset management system to manage network asset data and assist in forecasting renewal expenditure for all asset classes based on age, asset health/condition and criticality. Further developments to implement an Advanced Distribution Management System (ADMS) will prepare Waipa Networks for the future of distribution network operation, where the functionality to manage Distributed Energy Resources (DER) and operate as a Distribution System Operator (DSO) will be required, A timeline for the ADMS roadmap and these projects is provided in Figure 34.

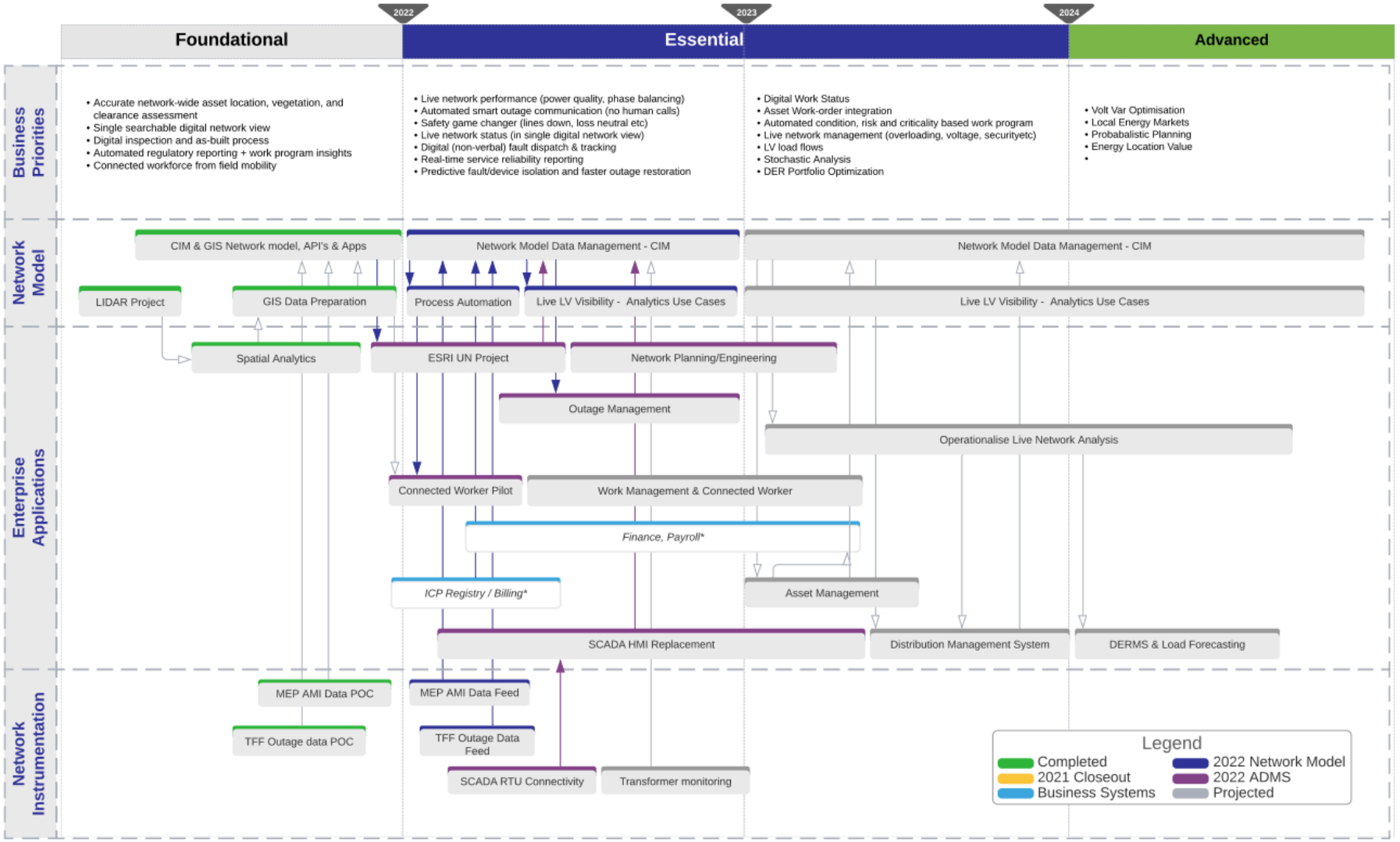


Figure 34: Information Systems Strategic Plan Roadmap

7. Network development

7.1 Overview

Waipa's network has been developed over time in response to the demand of its consumers and this development will continue into the future. This section provides details on the anticipated forecast growth in demand and changes that are expected to the network to accommodate that.

In the past Waipa has been able to schedule and implement all of Waipa's development projects in good time to avoid the assets becoming constrained, without incurring any conflicts of resources. However, in the last three years engineering resource limitations have deferred progressing projects due to the workload pressure of major developments (Waikeria prison expansion, new APL glass factory) such as:

- New or upgraded Voltage regulator projects for Cambridge area.
- New capacitor project for Pukeatua feeder in Te Awamutu area.
- Replacement Te Awamutu GXP cables.
- Ring Main Unit to connect the Te Awamutu ripple plant to an alternative feeder.

Planning and commencement for these projects is now in advanced stages for implementation in 2022/23.

Waipa takes its 11kV supply directly from Transpower's 110kV/11kV 40MVA 15% impedance transformers at Cambridge and Te Awamutu. Transpower's 11kV fault duty is now such that Waipa feeder cables radiating out from these GXPs require a 500MVA or 26kA fault duty screen for the first few kilometres before the fault duty diminishes sufficiently for normal distribution switchgear with a fault duty rating of 250MVA or 13.1kA.

Non-network solutions to developing capacity in response to growth are considered in parallel with network solutions to identify the best outcome, as described in section 6.12. With rapid technological change, emerging technologies related to distributed energy resources and energy storage are becoming more economic, and hence will be considered as non-network solutions.

7.2 Growth/demand projections

Maximum Demand Growth at Transpower's GXPs

Cambridge GXP

Over the past 5 years the underlying average growth in energy (kWh of electricity) imported through Cambridge GXP was +1.67% per year.

Over the same period the 5-year average growth in metering data MD at Cambridge GXP (with full load control) was 0.35% and has ranged between -3.7% and +12.5% per year.

The maximum recorded instantaneous demand at Cambridge GXP is 51.1 MVA on 11 August 2020, associated with delayed restoration of half of the controllable hot water load. A more typical maximum demand with functioning load control is circa 43 MVA, but a cold snap produced a network peak of 48 MVA in August 2021, related to penetration of heat pump residential heating and the sustained residential load growth in the area.

Te Awamutu GXP

Over the past 5 years the underlying average growth in energy (kWh of electricity) imported through Te Awamutu GXP was +1.82% per year.

Over the same period the 5-year average growth in metering data MD at Te Awamutu GXP (with full load control) was +2.14% and has ranged between -2.0% and +5.7% per year. The Te Awamutu GXP MD has increased recently due to operating restrictions on the Fonterra Te Awamutu factory cogeneration unity.

The maximum recorded instantaneous demand at Te Awamutu GXP is 40.8 MVA on 12 August 2019

Maximum Demand Growth at Transpower GXPs

The historical large step increases in MD at both Te Awamutu and Cambridge (17.4 % and 26.9% respectively) were associated with a change in load control policy. Waipa places less emphasis on controlling its own anytime MD instead it focuses on controlling its contribution to the 100 Lower North Island Coincident Peaks. Fluctuations since reflect annual seasonal differences and annual changes in Fonterra demand/Te Awamutu dairy factory internal generation.

Figure 35 shows both the historical and forecast demand for the whole network, noting that column headers are calendar years. The growth rate for Cambridge GXP is projected to be approximately 4.5% per annum due to large industrial step changes in demand, that have some uncertainty. The growth rate for Te Awamutu GXP is projected to be approximately 1.8% per annum.

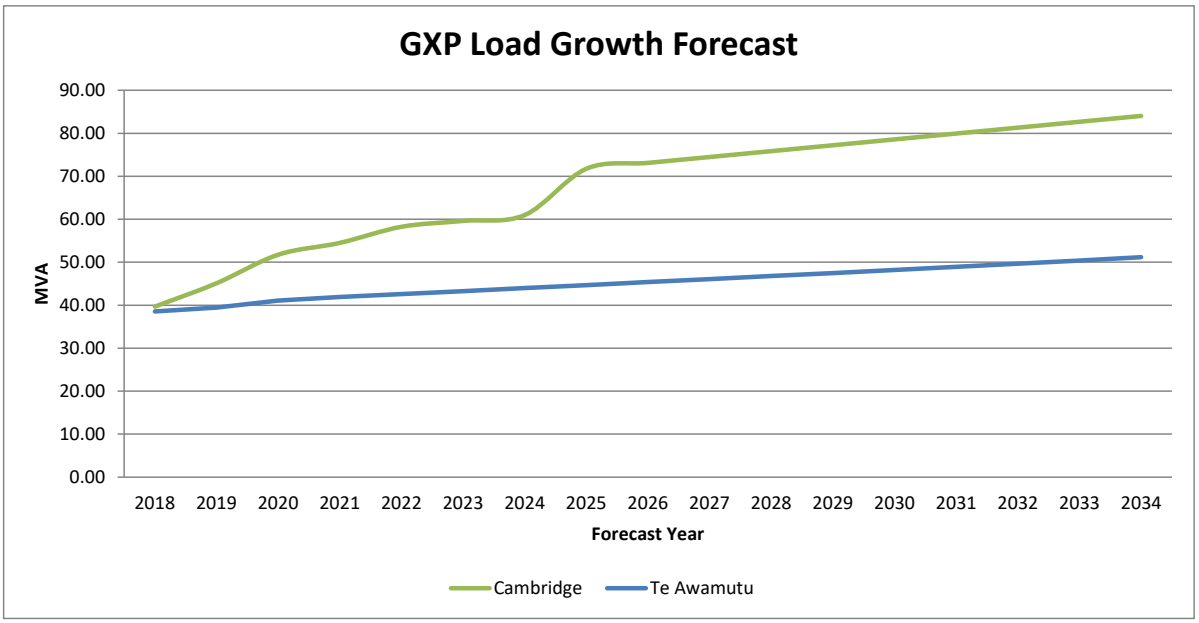


Figure 35: Network peak demand trend and forecast

MD growth predictions for all Waipa's feeders were established using half hourly load data. The underlying MDs on Waipa's feeders were determined by analysing each half hour load and eliminating abnormal loads caused by total or partial switching of feeders for capital and maintenance works and for restoration of supply after a fault. Development of a load forecasting tool using a projection of historical feeder maximum demands has been completed in 2017, in order to more accurately assess future growth on feeders. Both the Cambridge and Te Awamutu forecast have been developed with low, medium and high scenarios based on inputs of subdivision development from the Waipa District Council zoning plans. Table 35 shows the Te Awamutu Low scenario with compound growth, plus known load steps.

The following tables show the forecast maximum demands of each feeder (Amps) and diversified maximum demands at GXPs (MVA) using this new load forecasting tool.

Table 35: Forecast demand growth by planning area

CAMBRIDGE														
	C2702	C2712	C2862	C2842	C2772	C2722	C2802	C2832	C2852	C2732	C2742	C2762 & 2812	C2872	GXP
Year	Rotorangi	CBG North	Monavale	Tamahere	French Pass	Cambridge Town	Leamington	Cambridge East	St Kilda	Kaipaki	Pencarrow	Hautapu A & B	APL	Total, MVA
2020	283	191	233	266	327	302	299	243	28	230	244	437	140	51.7
2021	299	238	235	271	336	305	307	250	29	235	256	437	140	54.5
2022	306	286	237	276	345	307	314	257	31	240	267	437	140	58.2
2023	314	288	239	281	354	309	322	265	32	244	279	437	140	59.6
2024	322	291	241	287	364	312	329	273	33	249	291	437	140	61.0
2025	329	294	243	292	373	314	337	281	34	254	303	437	634	71.7
2026	337	297	246	298	382	317	344	290	35	259	314	437	634	73.1
2027	345	300	248	303	391	319	352	298	36	263	326	437	634	74.5
2028	352	303	250	309	400	321	359	307	37	268	338	437	634	75.8
2029	360	306	252	315	409	324	367	317	38	273	350	437	634	77.2
2030	368	309	254	322	418	326	374	326	39	278	361	437	634	78.6

TE AWAMUTU														
	T2742	T2752	T2822	T0022	T0023	T0024	T0026	T0027	T0025	T2842	T2832	T2762	T2782 & T2802	GXP
Year	Kihikihi	Mystery Creek	Ohaupo	Kawhia	Kiokio/Waikeria	TA West	Hairini	Paterangi	Pirongia	Pokuru	TA East	Pukeatua	Fonterra A & B	Total, MVA
2020	230	95	135	132	290	266	253	177	190	222	215	254	128	41.9
2021	232	96	147	135	295	269	257	178	192	224	217	260	128	42.6
2022	234	98	159	137	299	273	260	178	195	227	219	267	128	43.3
2023	236	99	171	140	304	276	264	179	197	229	221	274	128	44.0
2024	238	100	184	143	308	280	267	179	199	231	223	281	128	44.7
2025	240	102	196	146	313	284	270	179	201	234	225	289	128	45.4
2026	242	103	208	149	317	287	274	180	203	236	227	296	128	46.1
2027	244	104	220	151	322	291	277	180	206	238	229	304	128	46.8
2028	246	106	232	154	327	294	281	181	208	241	231	312	128	47.5
2029	248	107	244	157	332	298	284	181	210	243	233	320	128	48.2
2030	250	108	256	160	337	302	287	181	212	245	235	328	128	48.9

Impact of Substantial Projects or Developments on Maximum Demand

The load forecast allows for the 1.1MVA load increase associated with the Lakewood development, a combined hotel, apartment and commercial development on the northern edge of the Cambridge CBD which is nearing completion. Fonterra is intending to install a new 1.5 MVA wastewater treatment plant at their Hautapu diary factory, and that has been included in the load forecast in 2025 assuming that the West Cambridge GXP is complete and capacity is available. Allowance is also made for a potential 0.75 MVA industrial processing development in the Cambridge area within the next five years. A 2.5 MVA load increase in 2022 associated with the new Waikeria 600 bed prison facility has been incorporated into the Te Awamutu GXP forecast, with a subsequent increase of 1 MVA potentially required in 2028. Historical new developments comprise; subdivisions, dairy farms and small retail outlets. In the mid-2010s Waipa connected two large fast moving consumable goods outlets which were considered large loads. However, it is predicted that this type of load can be connected to the network without dramatically increasing the MD beyond forecast predictions because of load diversity on the respective GXP and Waipa's ability to manage controlled load.

A significant development that has been developed in the past year is the APL glass manufacturing factory on newly zoned industrial land at Hautapu. The initial stage (now completed) involves the construction and fitout of a 400m by 100m factory building, with associated 2.7 MVA electrical load. This required the installation of a new express feeder from the Cambridge GXP and a back-up connection to the Cambridge North feeder to supply the factory. The load increase at Cambridge GXP is expected to exceed the seasonal overload transformer capacity from 2021, requiring a special protection scheme to shed feeder load in the event of a supply transformer or 110kV line tripping at peak load periods. Non-network capacity support in the form of peaking diesel generation is under construction to avoid the risk of load shedding in these circumstances. Subsequent development of an aluminium extrusion plant in the five-year time frame would increase demand at the site to an estimated 13 MVA, but connection is contingent on developing increased capacity. To supply this further GXP capacity will be required, as well as new 33/11kV zone substation capacity to supply the site and the Hautapu dairy factory.

Transpower GXP Assets Longevity

Using the firm transformer capacity and n-1 security criteria the longevity of Transpower's GXP assets has been predicted assuming an MD growth of 2.2% per annum at Cambridge GXP and 1.8% per annum at Te Awamutu GXP.

Waipa predicts Transpower's transformer firm capacity including the winter overload capacity of 47MVA at Cambridge GXP was reached in 2021.
The Te Awamutu GXP transformer firm capacity was reached in 2019.

Te Awamutu GXP Transmission Supply

With the commissioning of the Hangatiki – Te Awamutu 110kV line in July 2016 Te Awamutu has a secure n-1 transmission line supply, including diversity of route and transmission system source. Waipa Networks sought a second transmission supply to Te Awamutu given longstanding issues with unplanned and planned transmission outages on the single Karapiro – Te Awamutu pole line. The unreliability of the transmission supply was unacceptable to Waipa's Te Awamutu customers.

The line was constructed and commissioned in July 2016 and has operated without incident since.

The new line from Hangatiki to Te Awamutu provides the needed security of supply (n-1) and will improve reliability. This line is operated by the Transpower System Operator as part of the national grid but is owned by Waipa.

Impact of Demand Management on the Maximum Demand

Waipa has assumed for the purpose of forecasting MD that any form of Demand Side Management will not have any material effect on reducing the MD. Currently, there is no quantitative evidence retailer demand side management initiatives have been adopted by their respective consumers.

Waipa has a ripple control load management system that controls 5MW of connected load in Cambridge and 5MW of connected load in Te Awamutu over peak periods. Waipa has assumed for the purpose of forecasting MD that its load control system is fully functional and that full load control is being exercised over peak load periods.

Waipa assumes that for the immediate future smart meters and smart tariffs introduced by retailers will continue to offer load control to connected consumers. We have seen some decline in uptake of ripple control relays in new connections, this is assumed to be partly due to alternative water heating options such as instant gas hot water heaters.

Waipa Feeder Analysis

Prior to and during 2017 load flow models for all of the 27 11kV feeders were developed. Load flow analysis of Cambridge feeders was completed to assess capacity, voltage and security of supply via adequate back feed from alternative feeders. This work identified a number of voltage support investments required to ensure voltage performance during peak loads and during back feeding.

Analysis of the Te Awamutu feeders commenced in 2019 and was concluded as part of the Te Awamutu GXP Upgrade study. This identified the need for sub-transmission re-enforcement of the network to address capacity, security and voltage limits, and voltage support projects to ensure voltage performance during peak loads and during back feeding.

Using data collected over a period of 1 year between 1 April 2017 to 31 March 2018 the underlying MDs on all Waipa's feeders were determined by analysing each half hour load and eliminating abnormal loads caused by total or partial switching of feeders for capital and maintenance works and for restoration of supply after a fault.

The underlying feeder MDs frequencies are shown on the following load duration graphs.

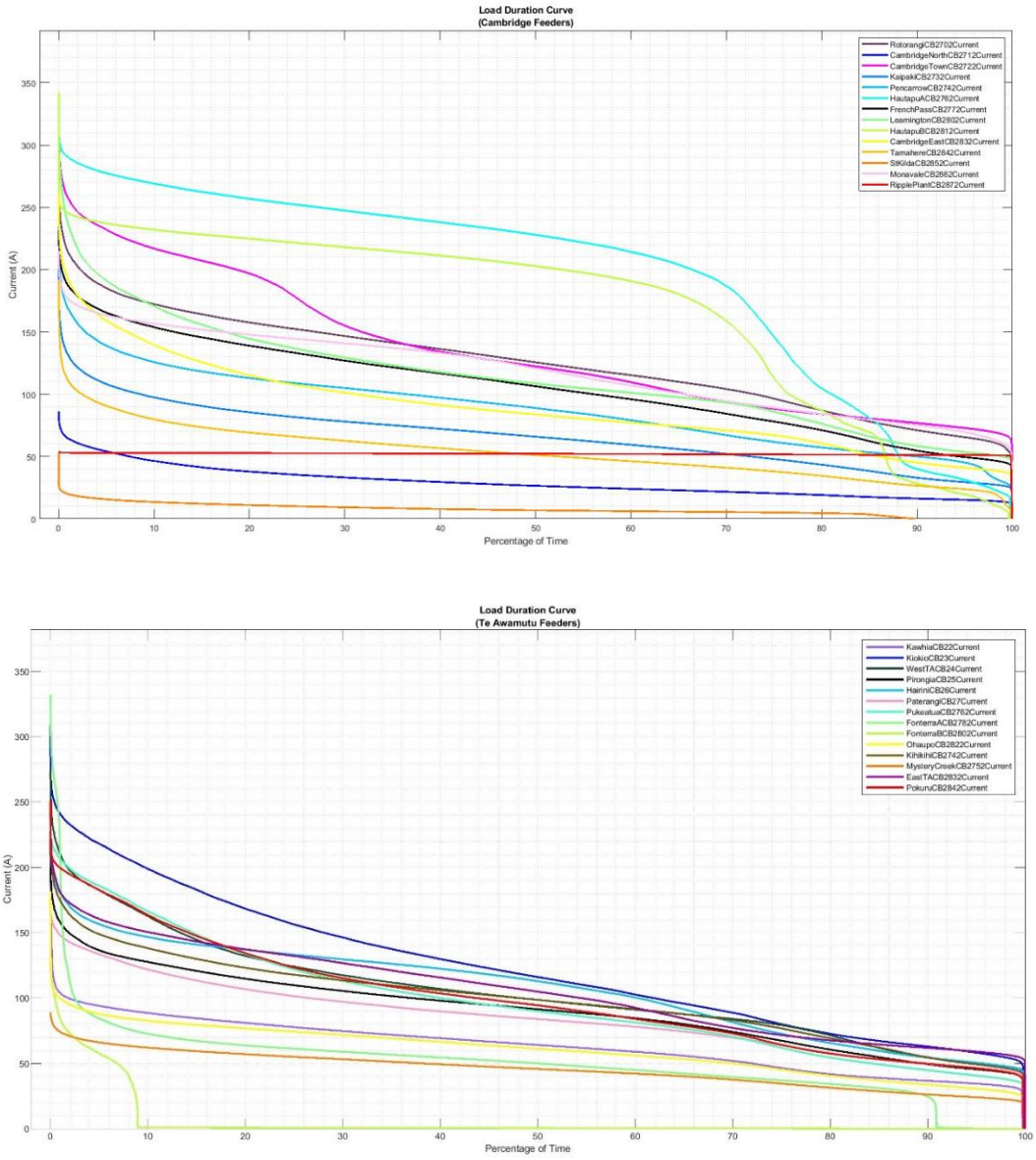


Figure 36: Load duration curves for Cambridge and Te Awamutu feeders

Electric vehicles

The transportation sector utilises a significant amount of energy, and with aggressive decarbonisation targets planned electrification of vehicles is a significant expected future trend. Uptake of EVs will impact on both the need for generation and the electrical networks which distribute it.

The impact of EVs on the network remains to be determined and depends heavily on the level of penetration and time of charging. Without effective demand control and incentivisation of off-peak use, peak demand could increase significantly. The ripple system could be utilised in accord with user requirements to assist in maximising the efficiency of charging relative to time of use.

A watching brief is maintained on future government policy related to transportation electrification which could increase EV uptake. Based on current forecasting it is not expected that EV numbers in Waipa will increase at such a rate that Waipa will not be able to respond to meet the supply demand. However, visibility of low voltage networks will be critical as EV penetration increases, to ensure that LV and distribution transformer capacity can be managed. Effective load control to incentivise EV off-peak charging will be critical to ensure network investment is minimised and excessive costs are not imposed on customers. Waipa will continue to monitor EV technology and uptake in the region and have included modest EV scenarios in load forecasting. Waipa will consider alternative line delivery price structures, if deemed appropriate, to manage potential significant increased demand from electric vehicles.

7.3 Cambridge area plan

Two 40MVA (continuous) ODAF transformers were installed at Cambridge GXP in July 2002 and provide a firm transformer capacity of 40 MVA continuous with a summer rating of 45 MVA and a winter rating of 47 MVA. The winter rating is the constraint, with load peaking in August and September with a combination of domestic and commercial heating load and the ramp up of dairy milking and processing. Both transformer 11kV incomers and busbar are rated at 47.6MVA.

The highest AMD on these transformers on this GXP was 51.1 MVA on 11 August 2020, after issues with our ripple plant had turned off hot water to half the Cambridge network for an extended period. Previously before the connection of the APL glass factory, the peak was 42.7 MVA, in August 2019. A realistic peak with operational load control including APL load is expected to be circa 47 MVA.

The total number of outgoing feeders supplied from Cambridge GXP 11kV switchboard is fourteen including the APL feeder and ripple plant supply.

Assuming the dairy factory requires no more than 10MW, there is a 1.5% per year growth in underlying MD at Cambridge GXP and including the APL 2.7 MVA step load increase occurs on peak, the winter capacity limit of 47 MVA was exceeded in 2021 under peak cold load conditions. This also assumes that load control tariffs or their equivalent continue to be offered and used by consumers. In June 2020 Transpower installed a feeder load shedding scheme to automatically shed load if one of the Hamilton - Karapiro 110kV circuits or one of the Cambridge supply transformers trips. This scheme will operate to shed feeders if either a Hamilton – Karapiro 110kV circuit or Cambridge supply transformer trips and the concurrent demand exceeds the available remaining transformer overload capacity.

This means the applicable load limits are:

- Summer transformer rating 45 MVA
- Winter transformer rating 47 MVA
- Cambridge 11kV switchboard limit 47.6 MVA

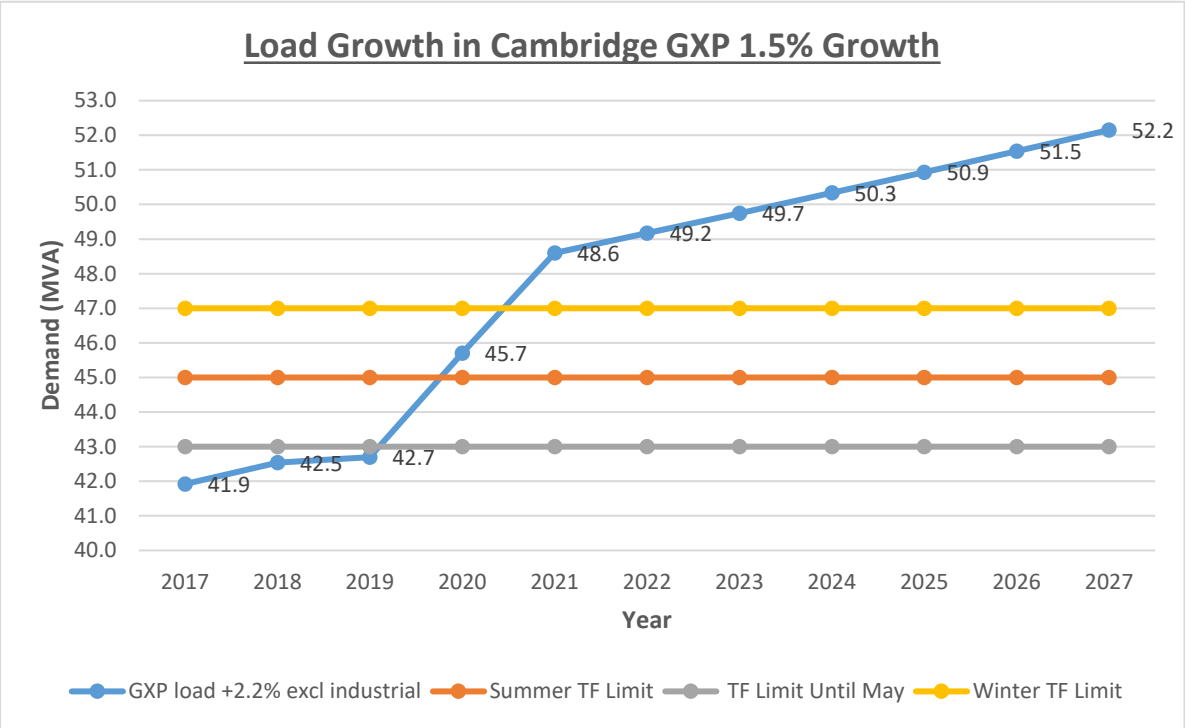


Figure 37: Cambridge short term load forecast

Note that the load forecast in Figure 37 excludes the APL Stage 2 load increase that could occur in 2025 and the Fonterra wastewater treatment load increase of 1.5 MVA planned for 2025 (due to lack of network capacity to connect this). The growth rate of 1.5% has been chosen as representative of recent demand increases. Additional non-network capacity support (discussed below) would be required to manage the Cambridge GXP load beyond 2023.

Analysis of load duration curves indicates that in the August to early October period load in Cambridge will exceed the available Transpower capacity under n-1 conditions (i.e., the loss of a single 110kV circuit or Cambridge transformer). This situation will continue in the following five years, as shown by the 1.5% load growth forecast in the graph above.

Non-Network Capacity Support (NNCS)

To manage the interim period until the Cambridge GXP capacity can be reinforced, Waipa Networks is working with a partner to provide Non-Network Capacity Support (NNCS) to maintain peak loads within the available transmission capacity. Over the period a combination of solutions will be used to reduce winter peak loads, including

- Distributed diesel generation.
- Demand Response (DR) or load reduction with industrial and commercial customers.
- Distributed Energy Resources (DER) or thermal storage systems for ice and chilled water storage to turn-off refrigeration at industrial consumers.
- Distributed Energy Resources (DER) or battery storage to complement solar PV.

Diesel generation has been selected as the first option, given that an initial survey of other alternatives did not produce much usable capacity. A 3 MW generation site is being established and will be commissioned in mid-2021 and may provide sufficient capacity without further extension until the West Cambridge GXP is commissioned at the end of 2024. The generation site is consented for a total of 6 MW, but fault level limitations at the Cambridge GXP limit generation to the currently

planned three units. This is a temporary solution and will be removed once the GXP and network solution is installed.

Cambridge GXP is deeply embedded in Transpower's grid and has experienced only four unplanned transmission system outages since 2006 (Otahuhu "D" shackle 12 June 2006, lightning 9 July 2011, bird strike during a planned circuit outage 26 November 2017, protection mal-operation at Hamilton Substation 25 January 2018). A circuit breaker failure on the 11kV switchboard caused a complete loss of supply in 2013, leading to the switchboard replacement.

Transpower advise that the 110kV circuits supplying Cambridge GXP are likely to be constrained following another 5 MVA load increase, for periods of low Karapiro generation at peak times. The Hamilton-Cambridge section of the 110kV circuits is limited to 57MVA in summer and 72 MVA in winter, so further load increases at Cambridge in the medium term will not have 110kV circuit firm capacity at peak times. This has prompted Waipa Networks to investigate alternative transmission capacity options for the Cambridge GXP.

7.4 Cambridge GXP Development Plan

The transmission capacity issue (and associated security of supply issues) described in Section 7.3 does not meet Waipa's security of supply criteria and is not in line with good industry practice, prompting the investment process which is currently underway. Development planning commenced in 2018 to investigate solutions to provide additional capacity and diversity of transmission connection into the Cambridge area, with Transpower investigating a long list of approximately ten alternatives. Jacobs were commissioned concurrently by Waipa to develop long-term sub-transmission development options to alleviate the existing and future projected network constraints and to develop a set of design concepts for a short list of three options and to estimate their implementation costs. The three sub-transmission options developed were aligned to three separate transmission development paths proposed by Transpower; new 220/33kV GXP, upgrade Cambridge GXP and new 110/33kV GXP. The three sub-transmission options differed primarily in the geographic transmission GXP connection point. After economic and technical evaluation by Transpower, the preferred GXP option was selected as a new 220/33kV GXP to the west of Cambridge. Approval to proceed with site selection and designation was obtained from the Waipa Networks Board and the project is proceeding.

The long-term option selected is:

- Option 1: New 220/33kV Cambridge West Substation: This option involves the construction of a new 220/33kV GXP substation (by Transpower) in close proximity to the existing Otahuhu-Whakamaru 220kV lines to the west of the Cambridge township. Waipa would need to install three 33/11kV zone substations at Cambridge West, Hautapu (Bardowie) and Leamington and the associated sub-transmission supply network. This option delivers significant diversity of supply into the Cambridge region since the Waipa network would be supplied by two independent GXPs, each on a separate part of the transmission grid.

GXP options on the two other locations in the area were considered but were not preferred as they were less economically favourable and had other technical disadvantages. Those options were:

- Option 2: Upgrade Cambridge GXP: This option involves the upgrade of the existing Transpower Cambridge 110/11kV GXP connected to the Hamilton – Karapiro line. The upgrade would install two three winding transformers (110/33/11kV, 120/80/40MVA) in the place of the existing transformers, installation of a full 110kV bus and the cabled connection of one circuit of the existing Arapuni – Hamilton-110kV B line. Later a second Arapuni – Hamilton circuit connection is required from

the Arapuni – Hamilton- 110kV B line. Waipa would also need to install three 33/11kV zone substations at Cambridge West, Hautapu (Bardowie) and Leamington. With this option, it is expected that the construction of a new220/110kV interconnection project for the Waikato region would be brought forward to 2036 compared to 2044 in Option 1 due to higher demand on the 110kV grid. The 220/110 kV interconnection will likely require a new site to install a new 220/110 kV transformer and the bussing of 220 kV and 110 kV circuits to reinforce capacity to the regional 110 kV network from the high capacity 220 kV network.

- Option 3: New 110/33kV Fencourt Substation: This option involves the construction of a new 110/33kV GXP substation (by Transpower) that connects to the existing Arapuni-Hamilton 110kV lines in the Fencourt area. This would be initially to the double circuit Arapuni – Hamilton B line and longer term to the Arapuni – Hamilton A line. Waipa would also need to install three 33/11kV zone substations and the associated sub-transmission supply network in a similar configuration as per Option 2. This option would also enable the Waipa network to be supplied by two independent GXPs, each on a separate part of the transmission grid. With this option, as for Option 2, it is expected that significant 220/110kV interconnection project is required in 2036, brought forward from 2044.

A summary of the comparison of the options is presented in the table below.
As is usual, the options are not easily comparable due their different costs, risk profiles, visual impacts etc. Thus, in an effort to summarise the different facets of the options identified for the development of Waipa's Cambridge network, the options have been ranked in terms of the following significant project features:

- **Visual Impact / Consents / Land acquisition / Public Opposition**: the difficulties associated with securing the rights to build lines/substations/etc. The ranking ranges from 1 (difficult) to 5 (easy).
- **Flexibility / Scalability**: the ability of the supply network to be modified, expanded and cope with high growth. The ranking ranges from 1 (inflexible) to 5 (very flexible).
- **Security / Resilience**: the ability of the supply network to survive equipment outages and significant events (i.e., earthquake). The ranking ranges from 1 (not resilient) to 5 (very resilient)
- **Additional Capacity into the Region**: the extent to which the option increases the capacity to supply electricity into the region. For this item Transpower has modelled the additional capacity each of the options delivers into the region.
- **Capital Cost**: Includes planning, project management, design, procurement and construction. The cost estimates are approximate given the concept stage of the project definition.
- **Project Timeline**: Most of the projects will take a relatively long time to complete. In some cases, the consultation periods would be significant and thus project timelines would be long. Indicative project timelines have been estimated by Jacobs, which include the total project time (from consenting through to commissioning).

Table 36: Comparison of GXP options

Feature	Option 1 New Cambridge West 220/33kV Substation	Option 2 Upgrade Cambridge GXP	Option 3 New Fencourt 110/33kV Substation
Visual Impact / Consents / Land Acquisition / Public Opposition	2	3	2
Flexibility / Scalability (future demand)	5	4	4
Security / Resilience	5	3	5
Additional Transmission Capacity into Region (MVA)	≈189	≈149	≈120
Capital Cost NPV@2020 (Waipa)	**$16.8M**	**$19M**	**$19.4M**
Capital Cost NPV@2020 (TP)	**$28.7M-$53.4M**	**$35.8M-$51.0M**	**$31.5M-$57.4M**
Capital Cost NPV@2020 (Total)	**$45.5M-$70.2M**	**$54.8M-$70M**	**$50.9M-$76.8M**
Project Time-line (years)	4-6	3-7	4-6

The Option 1 New 220kV/33kV Cambridge West Substation is considered a superior solution because:

1. The solution is enduring and future-proofed, providing an ultimate capacity of 189MW to the region via connection to the higher capacity 220kV grid. The margin over the next best solution is circa 40 MW, which is close to the current full load of the existing Cambridge GXP.
2. Diversity of transmission connection is achieved, which is important for resilience and management of risk in the longer term as growth occurs. The 220/33kV solution improves the overall security and reliability of the Cambridge network through that diversity of connection.
3. The location of the new GXP connection and Waipa Networks' co-located zone substation provides support to the growing areas to the immediate west of Cambridge (zoned for residential development) and the growing area of Tamahere to the north west, at present the supply to those areas is less reliable and suffers from voltage constraints. The improved location of the new 220/33kV GXP is reflected in the lower cost of the network investment for Option 1 compared to Options 2 and 3.
4. The 220/33kV solution reduces load on the Transpower 110kV grid. This frees up capacity for Powerco load at Hinuera and Waipa Networks load at Te Awamutu. A future 220/110kV interconnection in Hamilton East is also deferred by the 220/33kV option, which is a saving for other transmission users.

Option 1 does have the downside of requiring the acquisition and designation of a new transmission substation site.

Option 2 Upgrade Cambridge GXP offers some benefits, chiefly that an existing designated site is used, avoiding the need for designating a new substation site. However, there are some significant downsides to this option:

1. It has higher cost than Option 1 and provides a much lower ultimate capacity to the region. The margin between the ultimate capacity of the two options is close to the current peak load of the current Cambridge GXP.
2. Does not provide diversity of GXP or connection to a separate part of the transmission grid.
3. Perpetuates loading on the Transpower 110kV grid, which constrains capacity available at other nearby GXPs (Te Awamutu and Hinuera). Brings forward investment needs on Transpower's 110kV grid supplying the Waikato region.
4. Cable connections to the existing Arapuni – Hamilton circuits could be required on private land, requiring easement rights to be obtained. Potential consenting activities would be required due to the voltage and height of the cable termination poles.
5. The substation is now surrounded by a residential subdivision, so constraining the space available to install a full 110kV bus and connect new 110kV cable circuits within the existing site footprint.
6. Installing larger supply transformers will need to meet existing District Plan noise limits. This is likely to require either transformer design mitigation or onsite noise barriers to manage noise.
7. It has higher sub-transmission network cost and is in a less ideal position related to the western network growth.

Option 3 is the least preferred of the options, with many of the same problems as Option 2, but with the complication of requiring a new designated GXP site (same as Option 1) as well as offering the lowest ultimate capacity to the region. Option 3 does offer diversity of GXP and separate grid connection. The downsides of this option are:

1. It has higher cost than Option 1 and provides a much lower ultimate capacity to the region. The margin between the ultimate capacity of the two options is close to the one and a half times the current peak load of the current Cambridge GXP.
2. Perpetuates loading on the Transpower 110kV grid, which constrains capacity available at other nearby GXPs (Te Awamutu and Hinuera). Brings forward investment needs on Transpower's 110kV grid supplying the Waikato region.
3. As per Option 1, this option has the downside of requiring the acquisition and designation of a new transmission substation site.
4. It has higher sub-transmission network cost and is in a less ideal position related to the western network growth.

Option 1 Concept Network Design

A geographic and one-line diagram for Option 1 is illustrated below. The concept involves the construction of a new 220/33kV GXP immediately underneath/adjacent to the existing Otahuhu-Whakamaru (OTA-WKM) 220kV lines (red lines in the geographical diagram below) and the staged construction of three new 33/11kV zone substations in Cambridge West, Bardowie and Leamington.

The 33kV sub-transmission circuits interconnecting the zone substations would also need to be installed. The development proposed is as follows:

- **Cambridge West (CBW) GXP:** A new 220/33kV GXP preferably near the SH1 Waikato Expressway, but subject to site selection and land acquisition this location could be further north. This would locate the new GXP adjacent to the OTA-WKM 220kV lines. The new GXP would contain 2 x 80MVA transformers in order to cope with future load growth in the area. The new GXP is expected to require a land area of approximately 100m × 115m.
- **Cambridge West Zone Sub (CBW):** A new 33/11kV zone substation established in Cambridge West, on the site of the new 220/33kV GXP. It would supply the future load growth in Tamahere and other areas in the north-west Cambridge region. The new zone substation would require a land area of approximately 40m × 40m.
- **Bardowie Zone Sub (BRD):** The Bardowie zone substation established in the Hautapu industrial zone on land in the Bardowie industrial park. It would supply the Fonterra Hautapu dairy factory, APL and other emerging industrial load in the area (an area of at least 40m × 40m would be required).
- **Leamington Zone Sub (LMT):** The Leamington zone substation will be preferably located on the north-east corner of the intersection of Matos Segedin Dr and Cambridge Rd. In future, this zone substation will shift load off the Cambridge substation and supply the southern 11kV feeders (an area of at least 40m × 40m would be required).

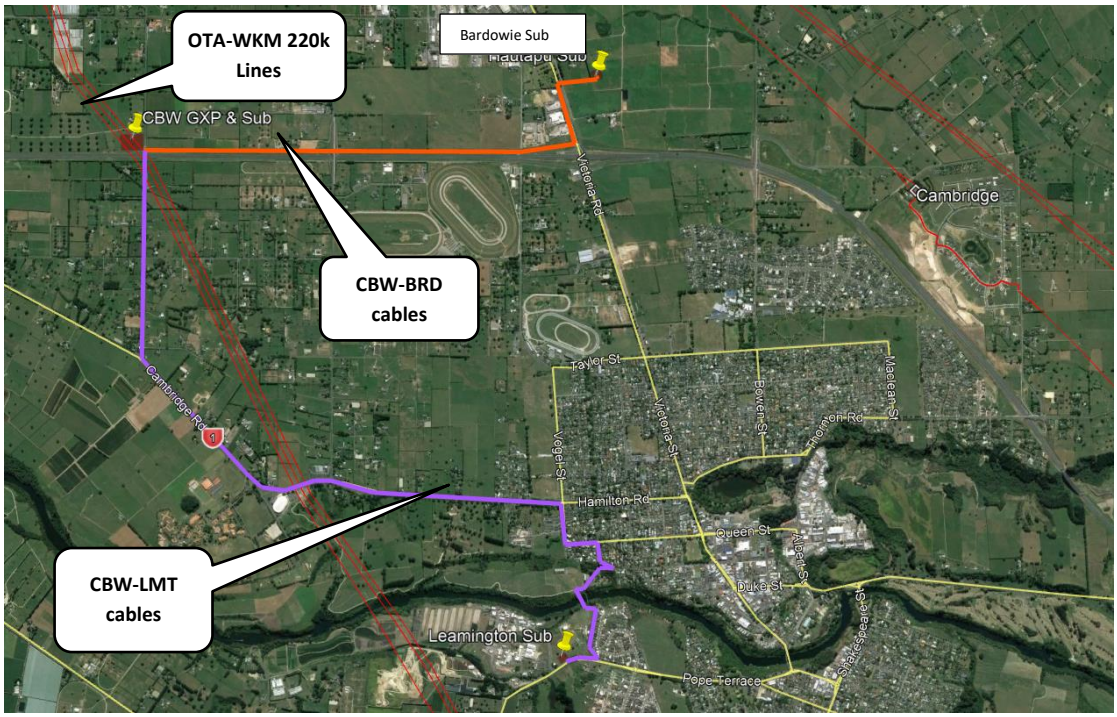


Figure 38: Option 1: Geographic Diagram: Cambridge West GXP and Zone Substations and 33kV Sub-transmission Circuits

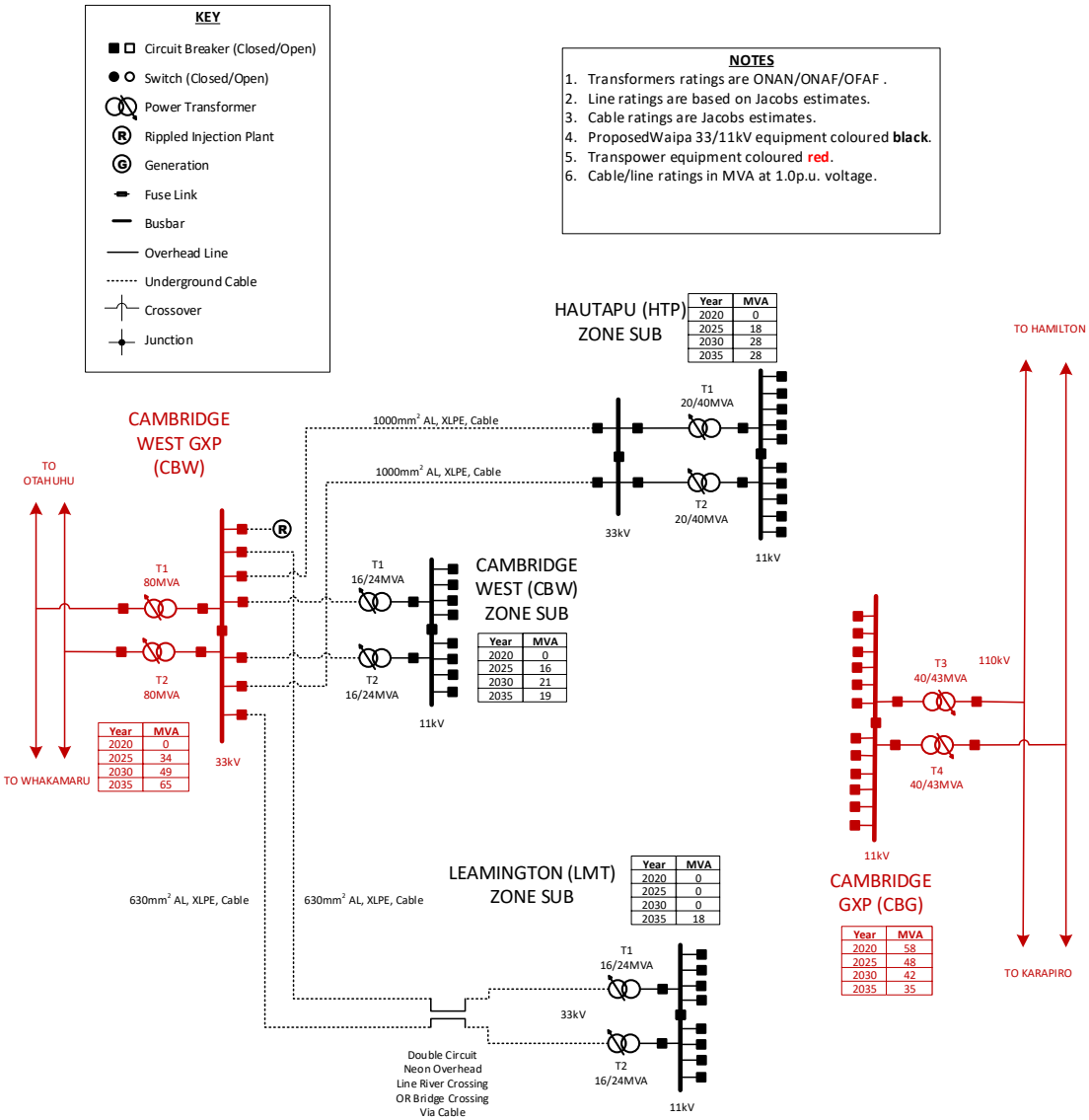


Figure 39: Option 1: Geospatial Diagram: Cambridge West GXP and Zone Substations and 33kV Sub-transmission Circuits

Figure 40: Proposed Location for Bardowie Zone Substation

Note that, due to the lead times for the implementation of Option 1, a short-term 11kV supply option for APL, the associated 11kV feeder load shedding scheme and Non-network Capacity Support had to be implemented prior to implementing one of the long-term options.

7.5 West Cambridge GXP feeder integration plan

Integration of the new zone substations supplied by the West Cambridge GXP will require new connections and reconfiguration of the distribution network.

Cambridge West Zone Substation – 11kV Feeders Integration Plan

In order to assess the integration plan for the Cambridge West zone substation, Jacobs has used Waipa's ETAP model (original model) to perform power flow analysis and determine the distribution of current along the 11kV feeders. The distribution of loads on the 11kV feeders have been scaled (highlighted in yellow) in accordance with the 2019 forecast supplied by Waipa and the results are shown in the following table.

Table 37: Waipa forecast and power flow results: original and scaled ETAP models

	C2702	C2712	C2862	C2842	C2772	C2722	C2802	C2832	C2852	C2732	C2742	C2762 & 2812
Feeders	Rotorangi	CBG North	Monavale	Tamahere	French Pass	Cambridge Town	Leamington	Cambridge East	St Kilda	Kaipaki	Pencarrow	Hautapu A & B
2019 Forecast	267	143	215	194	238	300	291	236	27	225	232	437
Original Model	291.2	147.8	305.2	109.9	225	318.7	314	266.6	12	225.5	279.8	304.9
Scaled Model	291.2	147.8	212.9	208.1	225	318.7	314	266.6	24	225.5	279.8	408.2

Jacobs has reviewed the power flow results and marked onto the diagram below the 11kV current flow at specific locations, with the objective of determining a plan to integrate a new Cambridge West zone substation into the existing 11kV network.

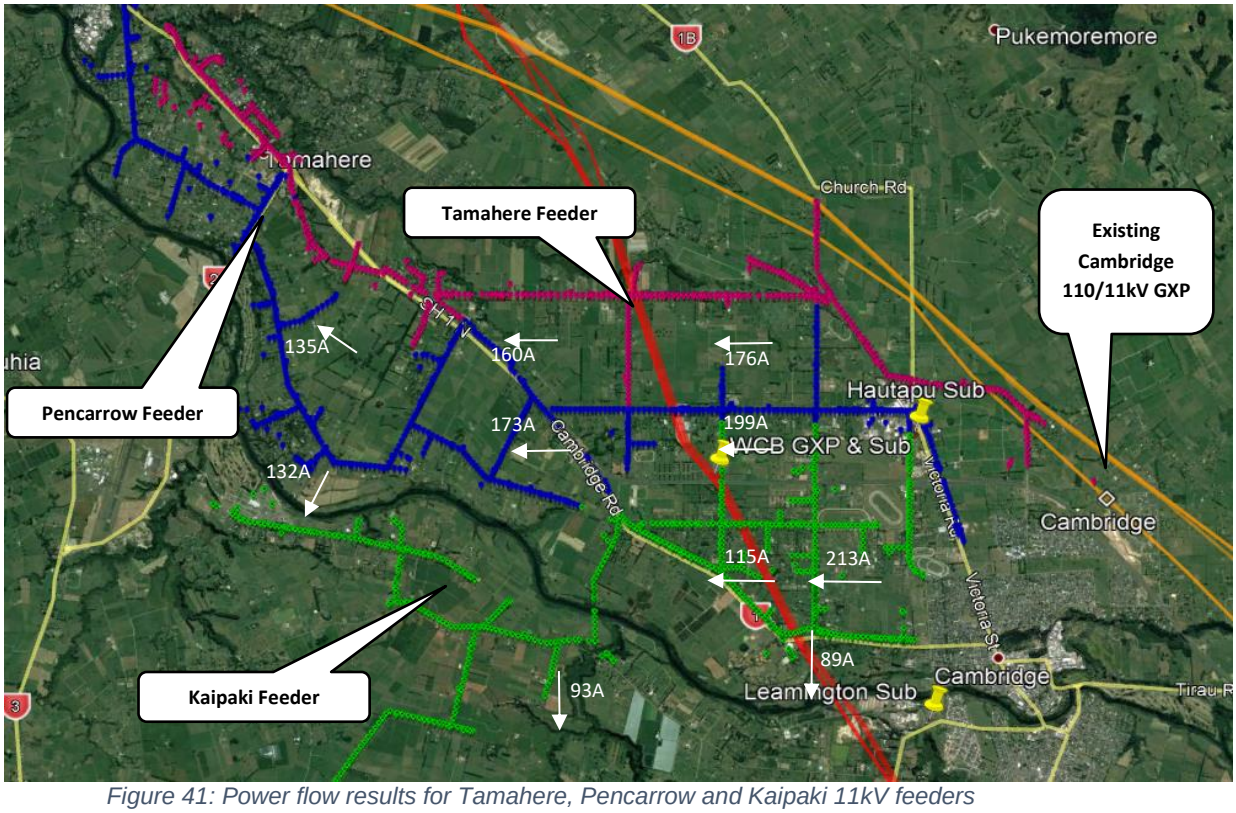


Figure 41: Power flow results for Tamahere, Pencarrow and Kaipaki 11kV feeders

The diagram below illustrates a potential future configuration for the 11kV network associated with the proposed new Cambridge West zone substation after the installation of a new 220/33kV GXP. The configuration is based on the existing 11kV network and initially includes the installation of four 11kV feeders. The timeline is dependent consenting/ design/ procurement/ construction/etc. but it is assumed that this configuration could be established in time for commissioning of the GXP in 2024.

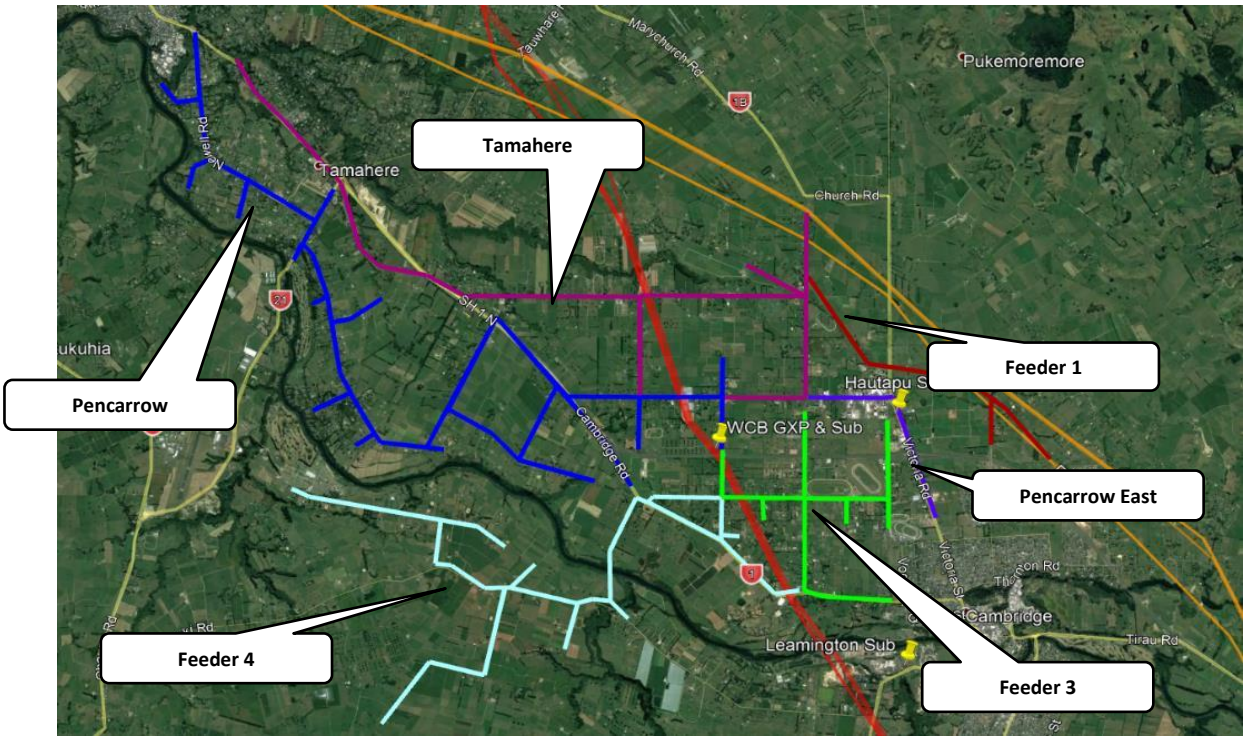


Figure 42: Proposed new configuration of 11kV feeders to be supplied by Cambridge West Zone substation

Bardowie – 11kV Feeders Integration Plan

The Bardowie zone substation will supply the existing and emerging industrial load at Hautapu, including Fonterra and APL. These large industrial consumers will inform Waipa of their maximum demand requirements on a regular basis. A load of 18MVA/945Amps is assumed at the time when the Bardowie 33/11kV zone substation is commissioned. This figure includes the existing Fonterra dairy load as well as the projected APL load. In future, Jacobs understands that an aluminium extrusion plant is planned that will add significant load to the Hautapu substation which may, accompanied by other industrial load, exceed the (N-1) rating of the substation. However, given the uncertainty of the future industrial load this will be investigated as new information becomes available.

It is assumed the Hautapu zone substation will be equipped with 8 x 11kV breakers, which will supply the local industrial loads. For costing purposes, we have assumed, initially, that at the time of commissioning the substation would be equipped with 6 x 300mm^2 AL, 11kV feeder cables each of between 300-700m length to supply the Fonterra and APL plants.

Leamington – 11kV Feeders Integration Plan

The zone substation in Leamington will likely only be needed in the longer term when:

- The network load on the Cambridge West, Cambridge GXP and Bardowie Substations exceeds the (N-1) limits.
- The industrial and residential load on the south side of Cambridge develops beyond the capacity of the 11kV feeders.

Neither of the above is likely to become an issue before 2030. There will be some residential development in the Leamington region according to Waipa District zoning plans. Apart from that, Waipa is not aware of any potential large customers that might have a significant impact on the southern sections of Waipa's network.

The new feeder integration plan for Leamington depends on the actual load growth in Cambridge as well as the network configuration when the load exceeds the (N-1) limits. Given the distant time-line for the Leamington zone the 11kV feeder integration has not been investigated in detail. For costing purposes, we have estimated the 11kV cable costs would be the same as that for the Cambridge West zone substation.

Development Timeline

Jacobs was supplied with Waipa's load forecast and this included the maximum demand (MD) growth predictions for the 11kV feeders and the existing Cambridge GXP. Based on the MD growth predictions, the required timeline of the network development is as follows:

- Prior to 2025: A feeder load shedding scheme and non-network capacity support is implemented at the Cambridge GXP to manage the post contingency overloading (tripping of HAM-KPO circuit or CBG transformer) of the transmission network.
- 2025: The new Cambridge West and Bardowie zone substations are commissioned. This time frame accounts for the time-line to consent/plan/design/procure/construct the substations (i.e., assuming best case scenario). The forecast maximum demand at Cambridge GXP in 2025 is projected to be 48.4 MVA (2,540Amps at 11kV) which will be beyond the (N-1) limits. The initial load shifted to Cambridge West and Hautapu are estimated to be 16 MVA and 14.5 MVA respectively. This will reduce the maximum demand at Cambridge from 48.4 MVA to 17.9 MVA.

- 2025-2033: During this period, Waipa will undertake minor works to re-configure/re-balance the 11kV feeder network so that the maximum demand at each of the substation loads are maintained within their (N-1) limits. The (N-1) constraint will be avoided for approximately 10 years based on the current growth predictions, but feeder constraints to the south of Cambridge may advance the next step.

- 2033: A new zone substation at Leamington is commissioned to supply the southern feeders. It is assumed the Leamington substation will take an initial 17MVA of load from the Cambridge GXP, which is approximately 85% of the total load supplied by the southern feeders, including Leamington, Roto-o-rangi and Monavale, at that time.
- 2033 onwards: The demand is expected continue to grow and possibly violate the (N-1) protection constraints by ≈2050.

Cambridge Non-network Capacity Support

Waipa Networks will develop non-network capacity support for the Cambridge GXP until the West Cambridge GXP is commissioned. Initially this will take the form of a diesel peaking power station with 3 MW of capacity, connected to the Hautapu B feeder and constructed on land belonging to Fonterra. Referring to the load forecast in Figure 37, if the West Cambridge GXP and sub-transmission development is delayed beyond 2025, additional non-network capacity support will be required beyond the initial 3MW of diesel generation.

7.6 Te Awamutu GXP and planning area

Two new 40MVA (continuous) OFAF transformers installed in July 2004 provide a firm capacity of 40MVA continuous with 24-hour contingency ratings of 40.7 MVA at Te Awamutu GXP. This is a protection limit and Transpower have advised that it will be increased, by protection upgrades to 52 MVA summer, 54 MVA winter by June 2022.

The highest AMD on these transformers on this GXP was 40.8 MVA in 2019. This corresponds to 39.6 MW at typical peak power factor of 0.97. This increase in load was due to the Fonterra Te Awamutu dairy factory operating with lower output from their on-site generator due to vibration issues. Winter loads have not reached this peak again since.

The transformers feed two 11kV switchboards in parallel. The first 11kV switchboard installed in 1997 (Switchboard A) is in good order and currently supplies six feeders. The switchboard incomers, bus-coupler and bus bars are rated at 1250A, limiting the board to 24MVA under an n-1 contingency. The second 11kV switchboard rated at 47.9MVA was installed in June 2004 to supply four existing feeders. A further four additional feeders were installed on this parallel switchboard in March 2007. Two more feeders have been added and the Kiokio and Waikeria feeders are in the process of being transferred across. This will reduce the load off Switchboard A and allow load growth to occur without constraints due to switchboard capacity.

The total number of outgoing feeders supplied from Te Awamutu GXP 11kV switchboard is fourteen excluding a ripple plant supply. In January 2007 the Fonterra Te Awamutu dairy factory contracted for 4.5MW for 2007/2008 and will connect a new waste water treatment plant (1.1 MVA) by June 2022. The factory completed a conversion of their coal fired boiler to be fuelled by wood pellets during 2020.

Assuming Fonterra requires no more than 4.5MW, the Waikeria Prison upgrade proceeds (initially 2 MVA with an ultimate maximum load of 4 MVA at some future point) and there is a 1.8% per annum growth in underlying MD at Te Awamutu GXP, the firm capacity of 40.7MVA 24 hour post contingency rating will be exceeded in 2020. This assumes that load control tariffs or their equivalent continue to be offered and used by consumers. This makes the Transpower transformer protection upgrade timely, in providing additional transformer capacity.

The future load increases at Waikeria Prison indicate it would be prudent to shift the new Kiokio and Waikeria feeders to new circuit breaker on the higher capacity Switchboard B, due to rating limitations on Switchboard A where the feeders currently connect. Transpower have confirmed feasibility and cost of this upgrade and have commenced design, with the expected completion in March 2022.

There was a partial failure of the 11kV switchboard in 2010. These types of failures pose a risk to continuance of supply to our customers, as switchgear failure can require a lengthy replacement period and back feeding the affected feeders at peak times can be difficult.

Waipa's n-1 security level for Transpower's substation assets at Te Awamutu GXP has been met, however upgrades are required as outlined above to maintain n-1 security with the projected load growth.

7.7 Te Awamutu area plan

Area overview

Development planning commenced in 2020 to consider solutions for GXP capacity in Te Awamutu, given the capacity, voltage and security constraints of the 11kV southern feeders in particular driving the consideration of a 33kV sub-transmission network and zone substation. The investigation will consider the 110/33/11kV transformer configuration at the GXP and associated sub-transmission network to best meet the long term needs of the network.

Network issues to be solved by the Te Awamutu area plan are:

- Te Awamutu GXP firm capacity.
- 11kV feeder cable capacity at the Te Awamutu GXP.
- 11kV feeder voltage constraints, in particular on the southern feeders of Pukeatua, Kiokio, Pokuru, Kawhia, and the northern feeders Pirongia and Ohaupo
- Security constraints for back-feeding feeders across the network.

Demand forecasts

Growth in the Te Awamutu area will be largely driven by residential and industrial development around the Te Awamutu urban area. As a commuter town supporting Hamilton and as a centre for the rural economy, residential growth is expected to continue. Industrial development is likely to take up the land available given the convenience of transportation routes.

Waipa District Council development areas are shown in Figure 43. A load forecast has been developed using the land title forecasts provided by Waipa District Council, with low, medium and high scenarios reflecting different rates of uptake. Combined with allowance for forecast step loads, compound load growth on existing feeders outside urban areas and a modest scenario for electric vehicle uptake, a range of forecast outcomes has been derived. In Figure 35, the Low scenario with compound growth plus known step changes is presented. All three scenarios are presented in Figure 44.

The growth rate in the forecast varies from 1.8% in the low scenario to 3.2% in the high scenario. Significant features are the 2 MVA load increase on the Waikeria feeder for the Waikeria Prison upgrade, with the potential for a subsequent additional 2 MVA increase. The network capacity for the second step has already been constructed and is contracted to the Department of Corrections on a use it or lose it basis for 10 years (i.e., before 2029).

The development of the Bond Road industrial area in the norther suburbs of Te Awamutu will also have a significant effect on demand, comprising a 17 Ha block between Bond Road and Ohaupo Road/SH3. The ultimate 6.5 MVA load for this area has been incorporated into the Ohaupo feeder forecast, but will require a dedicated feeder once development advances beyond the Ohaupo feeder capacity.

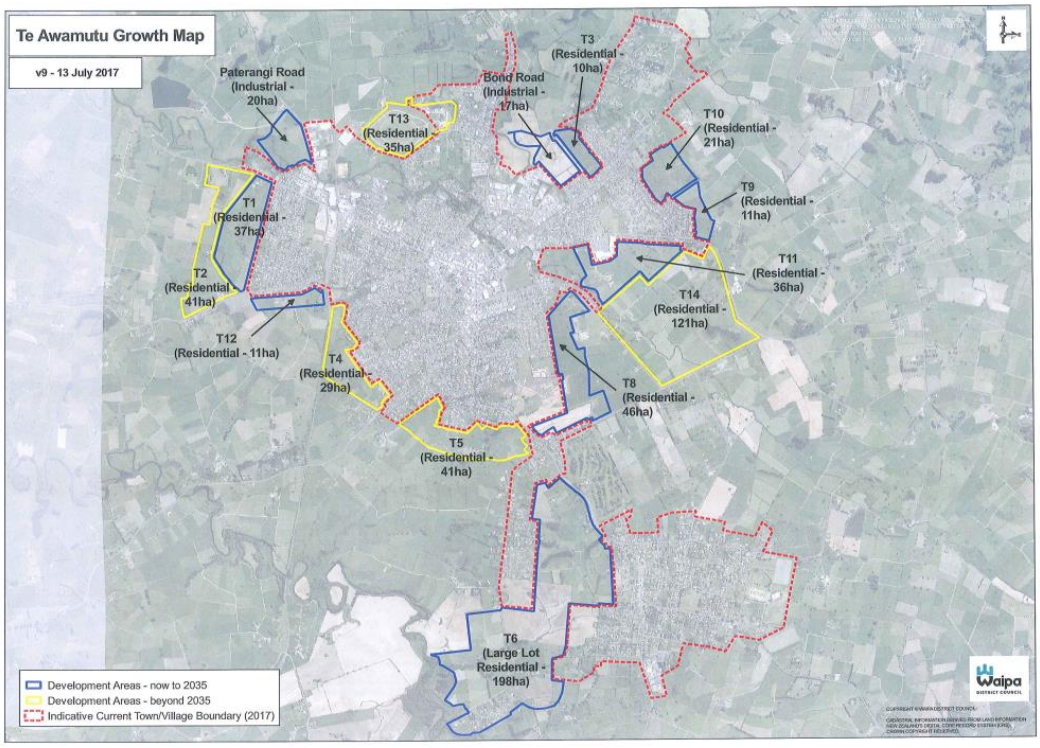


Figure 43: Waipa District Council Te Awamutu growth map

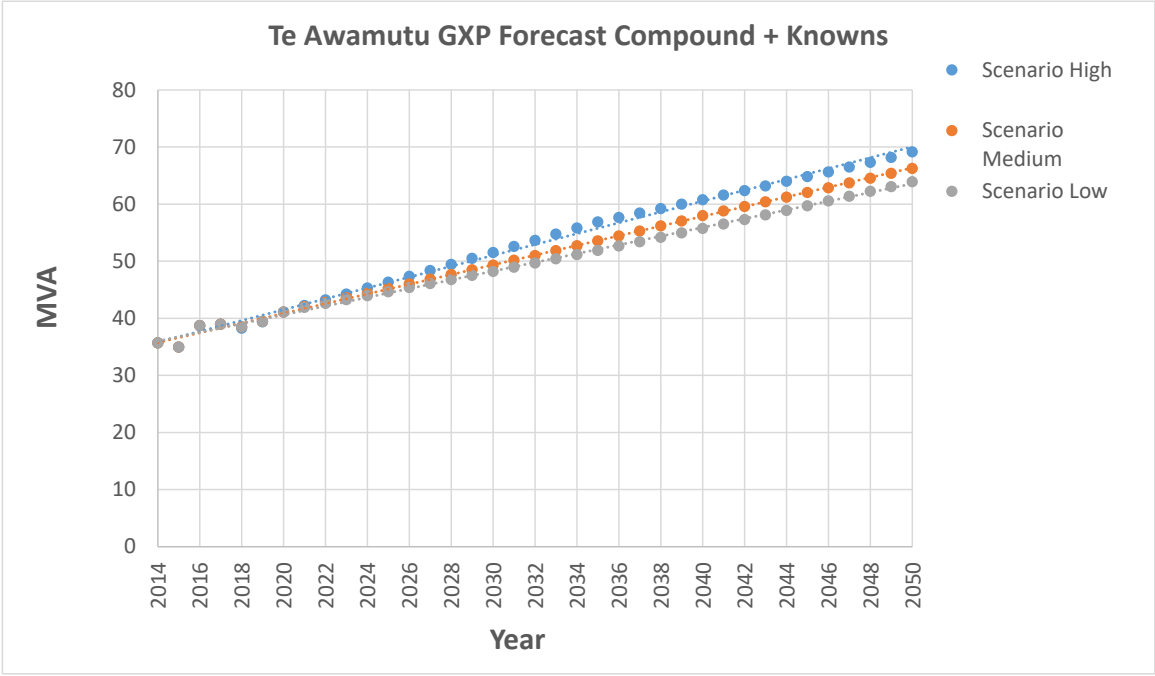


Figure 44: Te Awamutu GXP load forecast

Area constraints

Analysis of the network has identified constraints related to 11kV voltage, that will prevent Waipa delivering regulated voltage limits to consumers. Constraints related to security will prevent feeder back-feeding during faults and planned outages, resulting in longer periods of unplanned outages or planned shutdowns to more customers to accommodate network work. Capacity constraints may limit the ability to supply new customers, organic load growth limit the economic and social development of the district.

GXP Capacity

In 2019 the Te Awamutu GXP supplied a peak load of 40.8 MVA. In terms of GXP capacity, the existing 40 MVA nominal transformers will be upgraded via a protection upgrade to provide capacity of up to 52MVA (summer) and 54MVA (winter). However, constraints remain with Transpower's 11kV switchgear that will not be completely solved by two new circuit breakers installed on Switchboard B in 2021/22. The key issue with continuing to supply at 11kV is that this will not meet the long-term capacity, security and reliability requirements of the Te Awamutu network due to the limitations of 11kV feeders as load increases.

Feeder Capacity and Security

Using the high scenario load forecast, a capacity constraint analysis was completed, comparing the feeder load to the capacity of the initial line or cable in the feeder. Note that this does not guarantee that the entire feeder has capacity for the future load, but it is a reasonable first-pass approach. The forecast feeder loading is presented in Table 38 and the percentage of capacity feeder loading is presented in Table 39.

Table 38: Forecast Te Awamutu feeder loading for 2020 to 2040

		Feeder Loading (MVA)				
No	**Feeder Name**	**2020**	**2025**	**2030**	**2035**	**2040**
1	T0022 (Kawhia)	2.52	3.03	3.55	4.11	4.83
2	T0023 (Kiokio)	4.44	4.83	5.28	5.76	6.32
3	T0024 (West TA)	5.10	5.72	6.36	7.04	7.66
4	T0025 (Pirongia)	3.57	4.07	4.52	4.99	5.35
5	T0026 (Hairini)	4.77	5.43	6.05	6.69	6.81
6	T0027 (Paterangi)	3.45	3.86	4.31	4.77	4.99
7	T0028 (Ripple)	1.01	1.01	1.01	1.01	1.01
8	T0029 (Waikeria)	1.71	3.86	5.78	5.97	6.21
9	T2762 (Pukeatua)	4.81	5.55	6.38	7.35	8.42
10	T2782 (Fonterra A)	0.00	0.00	0.00	0.00	0.00
11	T2802 (Fonterra B)	2.48	2.48	2.48	2.48	2.48
12	T2822 (Ohaupo)	2.41	4.42	6.46	8.52	8.87
13	T2742 (Kihikihi)	4.44	4.81	5.20	5.63	6.73
14	T2752 (Mystery Creek)	1.84	2.02	2.21	2.44	2.75
15	T2832 (East TA)	4.15	4.38	4.66	4.97	5.32
16	T2842 (Pokuru)	4.29	4.56	4.85	5.20	5.57
	Feeder Max Total	51.0	60.0	69.1	76.9	83.3
	TMU Max	41.3	48.7	56.1	62.4	67.6

Table 39: Forecast Te Awamutu feeder loading as a percentage of capacity

		Feeder Loading (%)				
No	**Feeder Name**	**2020**	**2025**	**2030**	**2035**	**2040**
1	T0022 (Kawhia)	38.5%	46.2%	54.1%	62.7%	73.7%
2	T0023 (Kiokio)	67.8%	73.7%	80.5%	87.9%	96.4%
3	T0024 (West TA)	87.1%	97.7%	108.6%	120.2%	130.8%
4	T0025 (Pirongia)	54.4%	62.1%	68.9%	76.0%	81.7%
5	T0026 (Hairini)	86.5%	98.4%	109.7%	121.3%	123.4%
6	T0027 (Paterangi)	48.3%	54.0%	60.2%	66.7%	69.7%
7	T0028 (Ripple)	-	-	-	-	-
8	T0029 (Waikeria)	26.0%	58.9%	88.2%	91.1%	94.7%
9	T2762 (Pukeatua)	73.4%	84.6%	97.3%	112.1%	128.4%
10	T2782 (Fonterra A)	-	-	-	-	-
11	T2802 (Fonterra B)	18.9%	18.9%	18.9%	18.9%	18.9%
12	T2822 (Ohaupo)	36.7%	67.5%	98.5%	129.9%	135.2%
13	T2742 (Kihikihi)	80.5%	87.2%	94.2%	101.9%	122.0%
14	T2752 (Mystery Creek)	31.5%	34.4%	37.7%	41.7%	47.0%
15	T2832 (East TA)	75.2%	79.4%	84.4%	90.0%	96.3%
16	T2842 (Pokuru)	65.4%	69.5%	74.0%	79.3%	84.9%

> 100% line/cable rating

> 66% line/cable rating

The significance of the 66% capacity limit shown in orange is that for back-feeding purposes, it can be assumed that a feeder with 66% capacity loading can be back fed by two neighbouring feeders with less than 66% capacity loading. This is an accepted planning approximation, but in reality, the back feed capacity is often determined by voltage limitations not capacity.

Feeder Voltage

Feeder voltage constraints are defined as whenever the delivered voltage anywhere along the feeder falls below 0.95 per unit (0.95 per unit is 95% of nominal voltage). The analysis using 2020 maximum load is shown in Figure 45, with areas of low voltage shown in red.

In the case of Kawhia, Pirongia and Ohaupo, these voltage constraints are expected to be solved with additional voltage regulators and/or capacitors. With the other highly loaded feeders in the south of the network, these methods are already fully employed and different solutions will be required to supply the forecast growth.

No	Feeder Name	MVA
1	T0022 (Kawhia)	2.52
2	T0023 (Kiokio)	4.44
3	T0024 (West TA)	5.10
4	T0025 (Pirongia)	3.57
5	T0026 (Hairini)	4.77
6	T0027 (Paterangi)	3.45
7	T0028 (Ripple)	1.01
8	T0029 (Waikeria)	1.71
9	T2762 (Pukeatua)	4.81
10	T2782 (Fonterra A)	0.00
11	T2802 (Fonterra B)	2.48
12	T2822 (Ohaupo)	2.41
13	T2742 (Kihikihi)	4.44
14	T2752 (Mystery Creek)	1.84
15	T2832 (East TA)	4.15
16	T2842 (Pokuru)	4.29
	Feeder Max Total	51.0
	TMU Max	41.3

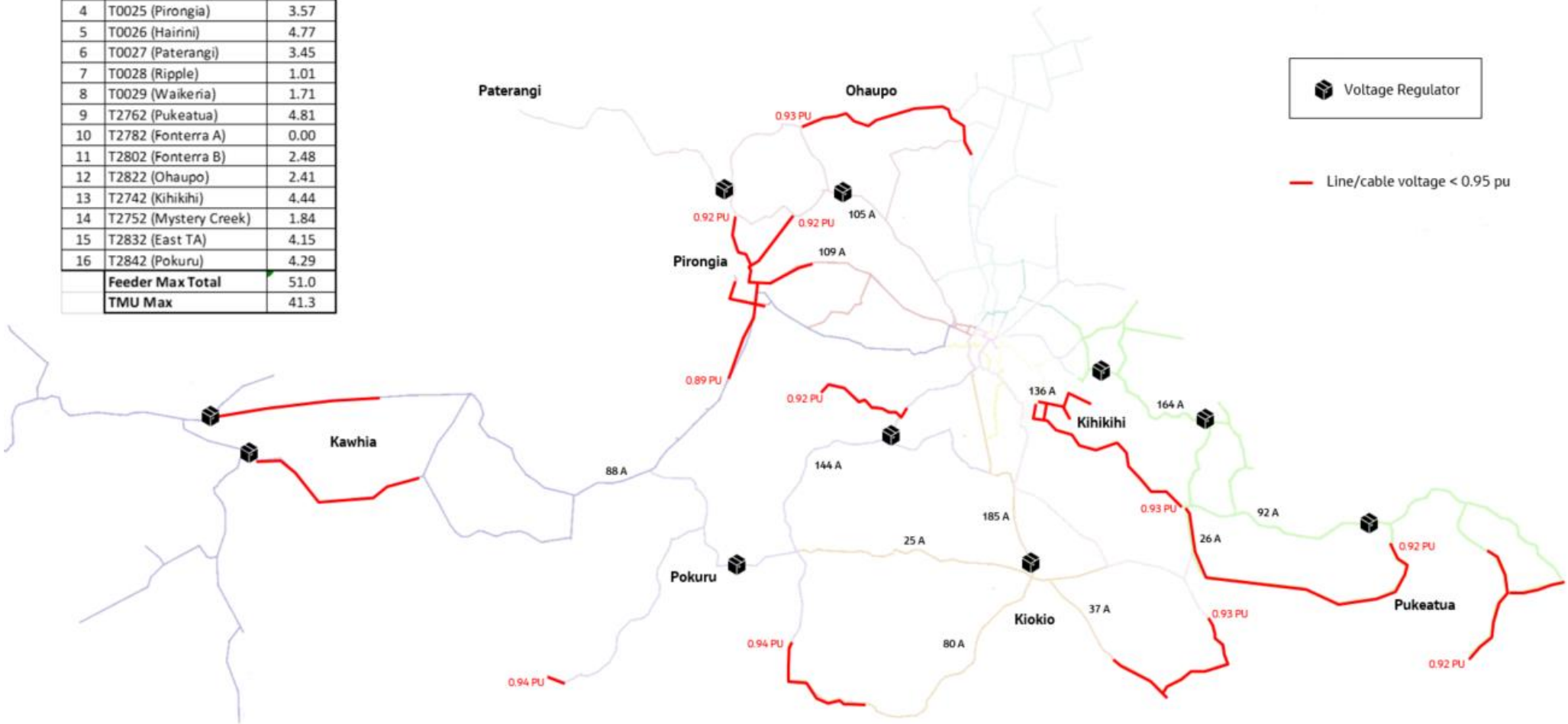


Figure 45:2020 load flow results showing voltage constrained feeders

Summary of Network Constraints

The following table provides a summary of the constraints identified on the Te Awamutu network feeders.

Table 40: Summary of capacity, voltage and security constrained feeders

No	Feeder Name	Capacity	Voltage	Security of Supply
1	T0022 (Kawhia)		2020	by 2040
2	T0023 (Kiokio)		2020	2020
3	T0024 (West TA)	by 2030		2020
4	T0025 (Pirongia)		2020	by 2030
5	T0026 (Hairini)	by 2030		2020
6	T0027 (Paterangi)			by 2035
7	T0028 (Ripple)			
8	T0029 (Waikeria)			by 2030
9	T2762 (Pukeatua)	by 2035	2020	2020
10	T2782 (Fonterra A)			
11	T2802 (Fonterra B)			
12	T2822 (Ohaupo)	by 2035	2020	by 2025
13	T2742 (Kihikihi)	by 2035	2020	2020
14	T2752 (Mystery Creek)			
15	T2832 (East TA)			2020
16	T2842 (Pokuru)		2020	by 2025

It is evident that the southern Te Awamutu network is approaching the point where capacity and voltage limitations will seriously compromise the security and reliability of the network. Development options must be investigated to determine the most appropriate method of achieving adequate long-term supply.

7.8 Te Awamutu GXP development plan

Possible development options for the Te Awamutu GXP and the network are under investigation. A preliminary analysis considered the options below, but further, more detailed analysis is being completed to determine if a more staged development is possible, with the objective of deferring cost, or if non-network solutions can be used to defer or avoid network investment.

Options Considered

The following options were considered and evaluated with the assistance of Jacobs:

- Status quo: Continuing with incremental 11kV feeder development and accepting degraded security at the Te Awamutu GXP.
- New GXP Substations: Additional transmission connection to 220kV or 110kV transmission lines in the area was considered.
- Conversion of 11kV to 22kV distribution: This option involves re-insulating 11kV lines, replacing any cable assets, voltage regulators and switchgear and replacing distribution transformers to operate existing 11kV feeders at 22kV.
- Upgrade of Te Awamutu GXP to 11kV and 33kV supply with sub-transmission: This would involve Transpower installing two new 110/33/11kV. 80/40/40 MVA transformers and a new 33kV indoor switchboard would be installed. 33kV sub-transmission circuits and two zone substations would be established.
- Non-network development options: Battery energy storage systems modelled around Tesla Powerwall technology were investigated as a solution to peak demand limits on some of the fastest growing feeders
- Non-network development options: Battery energy storage systems were also evaluated as a deferment option for zone substation or GXP reinforcement.

Tendering for non-network solutions may provide more economic demand management services as the provider is able to “value stack” other revenue streams from their assets.

Once the Te Awamutu area development plan is complete and approved, the plan and the forecast expenditure will be added to this section of the AMP.

7.9 Impact of distributed generation on maximum demand

The existing 7.5MVA co-generator at Fonterra Te Awamutu dairy factory is directly connected to the Te Awamutu GXP via two 11kV dedicated feeder cables. This generator has no effect on other Waipa network assets, but it does impact on Transpower’s Te Awamutu GXP assets and MD.

Standby generation of 3 MVA will be connected to the new Waikeria Prison connection point to provide electricity when the network connection is unavailable for planned or unplanned outages.

Although Waipa encourages distributed generation on its network Waipa continues to have a modest number of small capacity connections each year, although the rate of connection is increasing. As at 31 January 2022 there is 5,336 kW of predominately photovoltaic distributed generation connected to the network excluding Fonterra’s cogeneration.

To date Waipa’s experience has been that no committed distributed generation projects have had any impact on Waipa’s reticulation assets or network development plans. Waipa has assumed for the purpose of forecasting MD that any existing or future distributed generation will have minimal effect on MD. Distributed generation, by nature, is not available 100% of the time. This is caused by periods of low generation, faults or maintenance on distributed generation or lines connecting it to the network.

7.10 Voltage constraints

While normal 11kV reinforcement techniques are economic, the network is running out of capacity due to voltage limitations on longer rural feeders, as illustrated by the constraints analysis presented above. The 11kV reinforcement has mainly involved the traditional approach of:

- Upgrading all under sized feeder conductors to remove capacity constraints and improve delivered voltage.
- Relocating, enhancing, adding or removing voltage regulators or capacitors to ensure regulatory voltage is maintained at all times.
- Establishing new 11kV feeders and reallocating load between the new and existing feeders.
- Relocating, adding or removing line auto reclosers, sectionalisers, disconnectors and dropout fuses to satisfy system operating needs.

New Voltage Regulators

Waipa has a regulatory obligation to supply consumers’ network connection point within specified voltage limits not withstanding momentary fluctuations. Waipa’s load profile is typical of most EDBs with morning and evening peaks which occur for 6-8 hours each day. For the remaining 16 to 18 hours Waipa’s urban and suburban pole line feeders operate well within their current rating capacity and deliver statutory voltage.

However, during peak loading periods, the Waipa's rural pole line feeders without enhancement cannot deliver regulatory voltage. The cost-effective solution is to install voltage regulators on these rural lines so that regulatory voltage is maintained at NCPs over peak periods. The use of capacitors as an alternative method of voltage support to augment voltage regulators has also been introduced.

Waipa has established a programme for installing 3 can, 200A or 300A, 32 step, 0.625% per step type voltage regulators and switched 750 kVAr capacitors. Appendix B shows the proposed Voltage Regulator and Capacitor Programme. The need and timing of voltage regulator and capacitor installations proposed from 2022/23 onward will be confirmed by Waipa's ETAP network modelling software and actual load growth.

Pukeatua

Planned for 2021/22 is a switched voltage support capacitor and in 2023/24 an upgrade to VR12 (installing a third regulator can for capacity. .

Kaipaki

In order to back feed the Monavale feeder, including the existing industrial load at Aotearoa Park, a 200A voltage regulator is required after ABS 936, to be installed in 2022/23.

Roto-O-Rangi

Low voltage has been modelled on the Roto-O-Rangi feeder at peak load. To solve this and to assist in back feeding either the Leamington feeder or portions of the Monavale feeder, a 300 A voltage regulator and one 750kVAr capacitor will be installed in 2022/23.

Leamington

Load flow modelling shows low voltage beyond X547, requiring a new 300A voltage regulator before A840 to be installed in 2022/23. This was planned for 2020/21 but a protracted lead time for equipment ruled this out. The option of installing two capacitors was considered, while this is less cost, the superior back feed capacity for supplying the Roto-O-Rangi feeder makes the larger investment in a voltage regulator the preferred option.

Pencarrow

A 750kVAr capacitor has been budgeted for 2022/23 to support off-loaded sections of the Kaipaki and Monavale feeder when the Monavale feeder requires back feeding from Kaipaki. This project was planned for 2021/22 but equipment was not available.

Pirongia

A new 300A voltage regulator has been budgeted for 2023/24 to resolve voltage issues on the Pirongia feeder (identified in the voltage constraints analysis) and to assist with back feed capacity.

Kawhia

A new 300A voltage regulator has been budgeted for 2023/24 to resolve voltage issues on the Kawhia feeder (identified in the voltage constraints analysis) and to assist with back feed capacity.

Unallocated voltage regulators

Four unallocated voltage regulator additions have been budgeted in 2024/25, 2026/27 and 2028/29 to reflect the expected additional voltage support that will be required in future. Network modelling

using the new feeder forecasts will be completed in 2022/23 to further define the future required voltage support investment.

7.11 Te Awamutu GXP Cable Upgrade

Investigation into the cable capacity of cables exiting the Te Awamutu GXP down the driveway and crossing the bridge on Racecourse Rd to multi-circuit cable termination poles has revealed that the circa 1966 paper insulated lead coated (PILC) copper cables are significantly de-rated under the installation conditions and are under rated for the feeder loadings. There are eleven cables in close proximity and at below normal depth of burial, contributing to mutual heating that de-rates the cables. In situ testing of soil thermal resistivity and calculation of cable capacity has been completed by AECOM. Given the uncertainty around the actual cable ratings, there is some risk that cable failure may occur due to thermal stress. Since most of the cables have peak loadings in winter when soil conditions are expected to be moist and hence thermal resistivity would be lower, this risk is mitigated somewhat.

The original circa 1966 PILC cables are fifty five years old, compared to the PILC cable expected life of 70 years. A recent partial discharge test on the feeder cables indicated only one cable with elevated partial discharge activity, so that is reassuring.

To address the cable capacity issue, a full cable thermal design was completed for the feeder cables exiting the GXP, using thermally stabilised backfill and duct banks to achieve a reliable cable capacity. The cables will be split between the existing right of way and a new route out of the north side of the Te Awamutu GXP, across land purchased by Waipa Networks and out to Racecourse Road. This will reduce the thermal constraint of the existing right of way. Cables will be thrust underneath the Mangapiko Stream to connect to the overhead network on the south side. The design has been protracted by thermal issues and the high ratings required by the loading on the 11kV feeders.

The budget to replace the feeder cables exiting the GXP has been transferred to the 2022/23 budget, because of the delay imposed by the design and the lead time to order cable.

7.12 Reliability safety and environment

In reviewing the impact of existing distribution assets on safety and the environment and the requirements of the Electricity (Safety) Regulations 2010, the Public Safety Management System based on NZS 7901:2008 and the Electricity (Hazard from Trees) Regulations 2003 Waipa had identified three major asset types that presented a significant public safety hazard.

These were oil-filled ring main units, non-compliant transformer substation enclosures and two pole transformer substation structures.

The last oil filled ring main unit was removed from service in 2014/15. The last non-compliant transformer enclosure was removed from service in 2014/15.

Two Pole Transformer Substation Replacements

Waipa had five (as at 31 December 2021) two pole hardwood platform transformer structures that are over 40 years old. While the hardwood platforms have been maintained as required over the years these assets are approaching the end of their economic life. Furthermore, this type of substation structure no longer conforms to modern industry standards and presents an operating and maintenance risk for staff and contractors.

All of these two pole transformer structures will be replaced on a condition prioritised basis by either a single pole transformer substation or a pad mounted substation for staff and public safety in a programme to be complete by 2022/23. The cost associated with this activity is identified as Other Reliability, Safety & Environment expenditure of the Capital Expenditure Budget in Section 10 of this AMP.

Multi-circuit Single Mode Failure Risk Mitigation

In a number of locations on the network multiple feeder circuits have been erected on a single pole line. This has been driven by congested routes exiting the vicinity of GXPs and the desire to reduce cost. However, in a number of cases the feeders on a single pole line serve adjoining areas, restricting the ability to back feed significant network areas during planned maintenance or forced outages. The risk of being unable to supply a significant number of customers following a single car versus pole accident that takes out up to three feeders is credible.

The new supply to the Waikeria Prison upgrade has converted the first section of the new Kiokio feeder to cable along the route of the multi-circuit feeder, to improve voltage performance. This will reduce risk by removing one of the feeders from the multi-circuit, and providing a cable feeder to back up the overhead section of the other two feeders in the event of a fault

The risk of failure of the overhead multi-circuit feeders will be managed by instigating an intensive maintenance regime, completing an acoustic and thermal survey of the lines to detect any incipient faults before failures occur. This additional maintenance cost was added to the operational budget from 2018/19. The first survey completed identified a number of insulator and cross arm failures that were proactively replaced before an outage occurred. This risk mitigation removed the need to spend at least $2.22m in 2017/18 and 2018/19 on multi-circuit undergrounding projects.

Install Remote Controlled Auto Reclosers

The installation of remote controlled 11kV auto reclosers will increase feeder segmentation which will reduce the number of consumers impacted by faults and enable quicker supply restoration thereby improving reliability performance.

Waipa's target of no more than 200-300 consumers or 15-20km of 11kV line between remote controlled 11kV auto reclosers has been completed within the 2015/16 programme to install additional NOJA pole mounted remote controlled 11kV auto reclosers.

Further work is planned to implement loop automation schemes using reclosers to provide "self-healing" networks, sectionalising faulted sections and automatically restoring supply to unfaulted sections of feeders.

Install Automated Open Point Switches

With the completion of the recloser programme, the next step in improving reliability through automated network devices is to increase the speed of sectionalising faults and restoring sections of the network through remote controlled open point switches. This programme will install modern enclosed and motorised load break switches equipped for remote control at feeder open points and logical points for fault sectionalising. The programme is designed to target the highest SAIDI feeders, where greatest benefit of remote restoration will be obtained and fault staff attendance is delayed due to distance.

The annual expenditure of $545k previously allocated to recloser and bypass disconnectors has been allocated to automated open point switches. The programme has been estimated at 14 switches per annum for four years; initial analysis during 2016/17 found that circa 32 switches could be found with reasonable reliability benefit. The switches installed in the first two years of the programme have delivered reliability benefits. The programme will continue to install these switches in 2020/21, with budget for 10 automated switches being included.

Install 11kV Dropout Isolation Fuses on Spurs & Services

Waipa's Cambridge and Te Awamutu pole lines were historically constructed with a minimum of isolation points installed between the main 11kV distribution lines and either 11kV distribution network spur lines or consumers' 11kV service mains. Consequently, when a fault occurs on an 11kV distribution network spur line or consumer 11kV service main all the distribution network up to the nearest protective isolation device is without power. Continuing the installation of 11kV dropout fuse isolation points on network spurs and consumers' service mains will reduce the number of consumers impacted by phase-to-phase faults on these spur lines and provide easier disconnect points enabling quicker supply restoration to other consumers thereby improving reliability performance indices.

Approximately 35 additional two or three phase 11kV dropout isolation fuses will be installed on network feeder spurs and 35 additional two or three phase 11kV dropout isolation fuses will be installed on consumers' service mains each year to minimise the number of consumers affected by faults and improve fault isolation and restoration of supply times. This is an on-going activity and a budget provision has been made to install 70 per year.

Waipa Feeder Reliability

Waipa has a semi-rural network with relatively high consumer density on rural feeders. As a result, faults on rural feeders affect a larger number of consumers than other more typical rural and semi-rural networks. At the same time travel times to these faults can be longer than for urban networks. Analysis has shown the average number of consumers affected by a fault on Waipa's network is substantially higher than for most other networks. Waipa's objective is to continually improve the reliability performance of its network feeder assets to meet Waipa's understanding of the growing expectations of consumers.

As the network development plans implement sub-transmission and zone substations where required by growth, a secondary benefit is the reduction of customer numbers and length of feeders, so a reliability performance increase can be expected. For example, the new zone substation at the West Cambridge GXP will split the long Kaipaki, Pencarrow and Tamahere feeders, reducing the ICPs supplied by each individual, new feeder.

Te Awamutu Ripple Control RMU Alternative Supply

The Te Awamutu ripple control plant has a single supply from Transpower CB T0028. To reduce the risk of a circuit breaker or switchboard failure causing the loss of load control and street light control in Te Awamutu, a duplicate supply is required. This duplicate supply also allows Transpower to proceed with Switchboard A arc flash protection installation that requires outages of the switchgear. A project to install a new Siemens 8JDH RMU and a duplicate supply to the ripple control plant from CB 2822 Ohaupo feeder has commenced in 2021/22and will be completed in 2022/23.

Network Monitoring –Gridkey LV Monitoring

In St Kilda, Cambridge we have a 100% solar PV residential subdivision, with all dwellings required by covenant to have at least 3kW of solar PV generation installed. The Gridkey LV monitoring system allows visibility of the current and voltage at the distribution transformer and the power flows on individual LV feeders. This is expected to be useful not only for understanding the behaviour of the LV power flows associated with solar PV export, but also should the St Kilda residents adopt electric vehicles or batteries in large numbers, this will give a useful test bed for assessing the impact on the LV network. This programme installs Gridkey LV monitoring on St Kilda transformers and other representative transformers elsewhere in the network, in order to learn more about transformer utilisation and LV circuit loadings.

Soundproofing Cambridge Ripple Plant Building

A noise complaint from a neighbouring resident in the St Kilda subdivision (bordering the Cambridge Substation where Waipa Networks' ripple plant building is sited), noise monitoring in December 2019 confirmed that the ripple plant was not compliant with the Waipa District plan noise consent levels. This project will install sound proofing material into the building then repeat the noise monitoring to check compliance.

Arc Flash Evaluation

Arc flash events have occasionally occurred while operating WNL assets, and elsewhere within the industry. It is industry best practice to take all practicable steps to provide arc flash protection for electrical workers in New Zealand. It isWaipa Networks' general policy that anyone working on or operating equipment where there is a risk of arc flash shall wear appropriate level of PPE or maintain a "safe" distance from possible sources of arc flash and/or arc blast.

The arc flash assessment and hazard is a function of the working distance, the magnitude of the arc fault current and the duration of the arc. It follows that assessment is dependent upon where and what work is being done on Waipa Networks' assets. In the USA the National Fire Prevention Association (NFPA) has produced a document, NFPS-70E, which covers the issue of electrical arc flash safety, and the IEEE 1584 provide a standard for calculating the energy level arising from an arc flash event. These documents are used to assess the arc flash and associated risk levels for any network assets. Reference should be made to this document if further detail or background is required.

Notwithstanding the requirement of the general Policy, Waipa Networks accepts that there may be some risk, in unforeseen circumstances, of arc flash incident energy levels exceeding the rating of the PPE used. Due to the pre-dominant overhead nature of the network and the physical separation this provides between the live equipment and workers, Waipa Networks is satisfied that the probability of serious harm from overhead assets is as low as reasonably practicable. If possible, all assets with high risk levels must be de-energised before any work is carried out on them.

Earthing Practices

Waipa Networks has a process to install, test and maintain earthing of various equipment as per its design manual. The risk of hazards associated with non-standard earthing practices is recently recognised, and in 2021, Waipa Networks engaged Mitton ElectroNet to perform on site testing at twelve transformer and ring main unit distribution assets in the Te Awamutu and Cambridge areas. The assets tested were selected based on the risk they present to the public due to their location (i.e., proximity to residential property, public parks or schools) and ease of testing (i.e., proximity to large areas of soil to allow accurate voltage traverse investigation.

As part of this investigation, the following tests were performed:

1) Soil resistivity, to determine the respective topsoil resistivity.
2) Off-frequency earth grid current injection, to determine:
    i) Asset earth system impedance.
    ii) Touch and step voltages around the asset.
    iii) Transferred hazards on to equipment in the area.

Site safety with respect to touch and step voltages are assessed in accordance with the requirements of the EEA Guide to Power System Earthing Practice [1] (EEA Guide), which provides a means of compliance with Electricity (Safety) Regulations 2010 [2].

It is obvious from this investigation that further improvements of the design standard and drawing sets are required to clarify the earthing requirements at each site. Further work is required develop a separate design standard and construction drawings to provide clarity on earth testing, industry standard installation practices and earthing in special locations. Additional training and consultation will be carried out in 2022/23 to improve the overall approach, testing, measured results and installation standard.

Non-system growth project

Depot space for parking operational vehicles and storing network equipment and materials was under pressure. To provide for future depot storage requirements for the Cambridge sub-transmission network and additional contracting equipment, an additional piece of land was purchased in 2021/22 to provide storage and laydown area. This will free up depot space for equipment storage and operational vehicles sufficiently for foreseeable requirements.

8. Customer works

8.1 New connections

This chapter outlines Waipa's approach to connecting new consumers and how expenditure is forecast relating to the connection of new consumers. The process used to connect new consumers is tailored to ensure the fast, efficient and cost-effective connection of new electricity consumers to the Waipa's network.

Overview of consumer connections

Every year, Waipa connects approximately 550 new residential, commercial and industrial electricity consumers to the distribution network. Depending on the size or number of the new connections, the ability to supply the new connections may demand investment to extend the distribution network to the desired point of supply, or to upgrade assets to meet the required capacity.

On occasions the new consumer connection may require the upgrade of near end of life network assets to accommodate new equipment and/or an upgrade in capacity. When this occurs, Waipa gives consideration to the assets being replaced, and may cover the costs (at least in part) of the new equipment.

The quantity of subdivisions and other developments and the timing of their reticulation are driven by the developers of each site. Recently customer driven activity has increased in Cambridge and Te Awamutu and their surrounding areas which is reflected in this AMP forecasts. This activity is augmented by planned increase in Waikeria prison load resulting from the prison upgrade.

Investment in new network extensions, driven by developer and consumer requirements will continue as required.

Connection process

Residential consumers requiring a new connection in developed areas, such as new builds or subdivision development, will often contact an electrician who will make an application to Waipa on their behalf. The electrician will submit the proposed connection specifications and design and notify Waipa of any special requirements, such as the need for an easement. This will then be reviewed and approved provided the distribution assets have sufficient capacity. Upon approval, the installation will be planned and performed by the Waipa contracting division.

Larger commercial consumers, subdivision developers, and others will often contact Waipa directly to discuss connection requirements or work with engineering consultancies to develop suitably sized distribution systems for their proposed works. Installations of this size will often involve relatively significant infrastructure development, network extension or asset renewal. Waipa works with these larger entities to facilitate the connection of large loads in a standardised and efficient manner.

Where asset replacement is required, Waipa will review this on a case-by-case basis to determine the level of contribution, if any, that Waipa will provide. It is beneficial for Waipa to work with developers during the connection process as it provides an opportunity to upgrade assets that may be approaching end of life or its capacity rating.

Waipa's consumer connection process and capital contributions policy is set out in further detail on the Waipa website (www.waipanetworks.co.nz).

Kiokio/Waikeria

The 600 bed Waikeria Prison upgrade is under construction and required significant network and Transpower reinforcement to supply the additional 2.5 MVA load, with potential to expand to 4 MVA in future. The new 600 bed facility is opening in first quarter 2023. The network upgrade is now complete with the Waikeria and Kiokio feeders now split and additional capacity added.

Further work to be completed by 2022 (readiness for potential 4 MVA load):

- Transpower to upgrade Switchboard B with two new circuit breakers to provide additional capacity and connect the new Kiokio and Waikeria feeders.

The previous AMP plan was for Transpower to upgrade the incomer cables and transformer cooling to allow the supply transformer rating to be increased to 55 MVA. The Te Awamutu development planning analysis continues to investigate the best solutions for growth in the Te Awamutu network, along with the potential for a non-network solution.

Expenditure forecast

The ability to forecast works relating to new consumer connections is relatively limited. Currently, forecasting strategy is reliant on trending expenditure information from recent years, residential development forecasting from major developers and WDC planning, having an understanding of the current economy driving local commercial development, and other environmental factors.

Over the planning period, capital expenditure forecasting will be based on the following assumptions:

- Residential development in the Te Awamutu and Cambridge areas will continue at an approximate rate as seen over recent years, i.e., approximately 2% per annum ICP growth.
- Commercial development to continue at or around current rates.
- A general steadying in load through the installation of energy efficient lighting and heating in residential applications slows the need to increase capacity of distribution assets. It is noted though that if the widespread uptake of electric vehicles occurs, this may increase demand in some localised areas.

8.2 Asset relocations

This section outlines Waipa's approach to the relocation of distribution assets when required by external stakeholders, such as landowners or district councils in Waipa's area and Waka Kotahi/NZTA. It includes an overview of typical drivers of asset relocation, managing the relocation works and how they are funded.

Overview of asset relocations

Electricity distribution assets often require relocation due to the development of the surrounding environment or infrastructure where they are installed. This is typically due to the activities of other utility owners operating in Waipa's network, e.g., the replacement of water pipes, telecommunications circuits, roading activities, or through the development of land for farming or commercial activities or urban development.

Working with the stakeholder undertaking the project that has requested asset relocations provides an opportunity to upgrade segments of the network, or replace aged assets, at reduced cost. Waipa considers undertaking asset relocations during major works because of this.

In most circumstances Waipa receives contributions from the external stakeholder requesting the relocation of assets, reducing the amount of Waipa's investment in these projects. In most asset relocations resulting from road works, Waipa bears costs, often in the form of materials in accordance with required legislation. For other projects, Waipa considers these on a "case by case" basis. Waipa's capital contributions policy is set out in further detail on the Waipa Networks website.

Expenditure is capitalised where assets are in poor condition or approaching end of life and are able to be renewed or upgraded during the performance of the asset relocation process. Otherwise, relocation of the same individual asset is considered operational expenditure. Where major works are required for asset relocation, such as major roading and other infrastructure projects, Waipa will build this into the capital expenditure plan to resource the project. Asset relocation projects proposed for the planning period are set out in the following sub-section.

Asset relocation projects

Waipa is aware of the following asset relocation projects at the date of this AMP:

- Cambridge Rd undergrounding west of Kelly Rd for Waipa District Council to remove overhead lines associated with a roading development. This project is underway and will be completed during 2022.
- Victoria Rd, Cambridge undergrounding for Waipa District Council, to be completed in 2022.
- Hautapu Road industrial area undergrounding, Waipa District Council has requested pricing.

- Te Awamutu Mutu Street undergrounding, Waipa District Council has requested pricing.

9. Fleet management

9.1 Fleet management overview

This fleet management section provides a summary of key Waipa's asset classes, their populations, age profiles, condition and specifics of their preventive maintenance regimes and renewal. Good fleet management enables prudent and efficient outcomes in the management of the network assets and allows the drawing out of specific capex and opex programmes for more focused resourcing and cost control.

Many of Waipa's asset management objectives are common across the different fleets. These include public safety as the top priority, maximising asset utility while minimising total cost (life cycle strategy) and meeting the network service level targets that have been set.

Waipa has established an inventory of critical distribution system spares. The inventory comprises stock with long delivery lead times, stock no longer manufactured and minimum level of stock required to re-establish supply.

Below are charts of the network equipment asset health in accordance with the EEA Asset Health Indicator Guide, using either inspected condition scores where available or an assumed age – asset health relationship for the asset population. The exception is for ground mounted transformers and RMU, reclosers and voltage regulators, where inspected asset health condition data is available from the maintenance inspection programme, and rural network poles, cross arms and pole-top transformers based on high-resolution photos from the 2021 aerial survey.

Most assets are younger than industry averages with low numbers of assets considered currently in need of replacement. Only pole mounted switches and transformers appear to be approaching the industry average age. Waipa intends to do more work on the air break switch fleet to assess the condition and operability of the fleet. In general conductor and insulators are in good condition.

Asset Criticality

Waipa Networks pays particular attention to high criticality assets. The loading level of GXPs and the need for further investment is closely monitored and discussed in this plan. There are a number of cables that exit the GXPs that have been temporarily de-rated due to unknown soil conditions and hence temperature at high load. There are also sections of multi-circuit lines with more than one feeder on a pole. These are subject to additional condition monitoring to mitigate the risk of multiple feeder faults. The first sections of feeders that have the highest reliability impact if faults occur have regular vegetation patrols to identify and trim vegetation. Voltage regulators are critical to maintaining regulated voltage limits to consumers at peak load periods. A specialised maintenance regime is applied to voltage regulators. Reclosers are critical to isolating transient faults to avoid sustained outages, and to isolate fault areas to affect the minimum number of consumers as possible. A specialised maintenance regime is applied to reclosers. Ground mounted transformers and ring main units have a higher risk of public safety if they are insecure or faulty, so a specialised maintenance regime and three yearly inspection programme applies to these assets. Assets vulnerable to third party damage are protected where possible. Defects from condition monitoring are prioritised to ensure that those that have a high probability of causing outages or that may pose a health and safety risk are attended to urgently.

9.2 Overhead structures (poles)

Asset management objectives

Apart from the fleet-wide asset management objectives (safety, lifecycle, reliability etc.), pole renewals may be undertaken coincident with conductor or pole component renewal/replacement works where it is deemed economically beneficial to do so.

Fleet overview

The risk of failure posed by wooden structures is managed by the asset condition survey criteria, which requires all hardwood poles supporting HV lines and all larch wood poles to be defected and replaced, as well as any poles in poor condition not expected to last until the next survey. This defect survey criterion is intended to phase out all hardwood and larch poles that support HV lines, regardless of condition, once the survey has completed a full rotation. That would leave any acceptable condition hardwood and larches holding up LV only, which then would be inspected regularly (five yearly rotation). The risk of failure posed by concrete poles especially light Vierendeel and Bill Young poles is recognised. Improvements in standard testing procedures for wooden poles will be developed in 2022/23 based on the recently completed EEA guide to wood pole inspection along with improvements in the asset condition survey inspection standard.

The 110kV line from Te Awamutu to Hangatiki now provides the needed security of supply (n-1) to the Te Awamutu network and improves reliability. This line is operated by the Transpower System Operator as part of the national grid, but is owned by Waipa. This line was constructed with a 50-year design life and has robust steel pole and concrete pole construction. Apart from minor defects repaired in 2021, the line is in very good condition and has operated without incident since commissioning in June 2016.

The population of reinforced concrete poles within the network is relatively unaffected by age.

Populations and ages

Table 41 presents a summary of Waipa's distribution (including LV) pole fleet by type.

Table 41:Pole fleet types

Pole Types	Material	Number	%
Hardwood	Wooden	285	1%
Softwood	Wooden	1,062	5%
Larch	Wooden	187	1%
Brown Bros Light	Concrete	10,088	45%
Brown Bros Heavy	Concrete	322	1%
Stresscrete	Concrete	7,289	33%
Bill Young	Concrete	497	2%
Window	Concrete	176	1%
Other	Other	3	0%
Busck	Concrete	2,137	10%
Concrete	Concrete	50	0.2%
110kV Line	Concrete and steel	188	1%
Total		**22,284**	**100%**

Condition, performance and risks

Condition assessments of poles has identified end of life indicators for some of the older hardwood cross arms – primarily through evidence of 'flogging' or splitting. Where possible, cross arms exhibiting these conditions are grouped for replacement, with the insulators renewed at the same time.

Network Survey Status

Up until 2021 there was a backlog of network survey inspections, caused by high levels of new connections work. The completion of the aerial survey and identification of defects from high-resolution photos of the rural network has given a view on network condition (asset health indicators) and defect stock.

Waipa has monitored the causes of system faults over recent years and has found that very few identified asset defects have caused unplanned outages. Asset defects which have caused faults have generally been unidentifiable by survey, such as insulator or surge arrestor failures. The management of criticality has been demonstrated as being effective.

Waipa commenced the third visual asset condition survey in 2019/2020 using internal resources. The third survey was expected to take 8 years to complete and feeders were to be surveyed in the same order as the second survey. However, progress with the visual ground survey has fallen behind. A four year response plan to catch up the deficit was embarked upon in 2018, but has again failed to maintain progress after a promising start. A re-evaluation in 2020 has resulted in moving away from an eight-year rotational inspection programme. Waipa completed an aircraft based LiDAR (laser 3D survey) of the entire network and pole imagery survey of the rural network in early 2021. This is intended to achieve multiple objectives:

- Surveying for ground and building clearance compliance with NZECP34, which requires a five-year inspection interval.
- Identifying overhead line asset defects using pole photos, initially for rural poles and later for urban poles.
- Determining asset health indicator scores for overhead network assets.
- Identifying and prioritising vegetation clearance issues and obtaining high precision GPS positions of overhead network assets for the new GIS project.

Ground mount transformers and ring main units will be inspected every three years and wood poles will continue to be surveyed from the ground to facilitate physical testing and below ground inspection.

The defects identified by the aerial survey will be prioritised, particularly because 80% of the network will be surveyed at once for defects, and 100% of the network for conductor clearance. Preventative maintenance work packages and capital asset replacement work packages will be developed by the Waipa planning team to address equipment found to be defective or in poor condition and assessed as likely to fail within a five-year period.

Thermal Surveys

Waipa uses an external service provider with a drone to carry out an annual thermal survey of arterial feeder disconnectors, lines, transformers, dropout fuses, cable pothead terminations and line connections at times of high load. Thermal "hot spots" are treated as urgent and are repaired as soon as possible.

The total number of 11kV and 400V defects awaiting repair (as at 31 March 2021) is 800 as shown in Table 44. Total defects remaining have increased significantly from 399 in 31 March 2018 to peak at 1044 in April 2019. Focus on defect repairs has accelerated, with a reduction of defects on hand to a stock of 378 at present (January 2022). This reduction has been achieved by eliminating duplicate defects in the NCS historical data record, and maintaining all overhead defects in the aerial survey defect data. This data will be reported out of the new GIS in future.

Table 42: Remaining defects as at 31 March 2021

	Totals
Total defects remaining	800
11kV defects remaining	716
400V defects remaining	84

Asset defects are prioritised into the following categories for remedial work; Urgent (3 months); 1 year and within 5 years. An urgent priority is assigned to asset defects that presented a safety hazard to the public, field crews, livestock or property. The 1-year and within 5-year priorities are assigned to asset defects on a diminishing probability of causing loss of supply. However, in practice when a shutdown area is identified for defect repairs, all defects regardless of priority are remedied at the same time, in order to make most efficient use of resources once the line crew is deployed to an area and a shutdown is planned

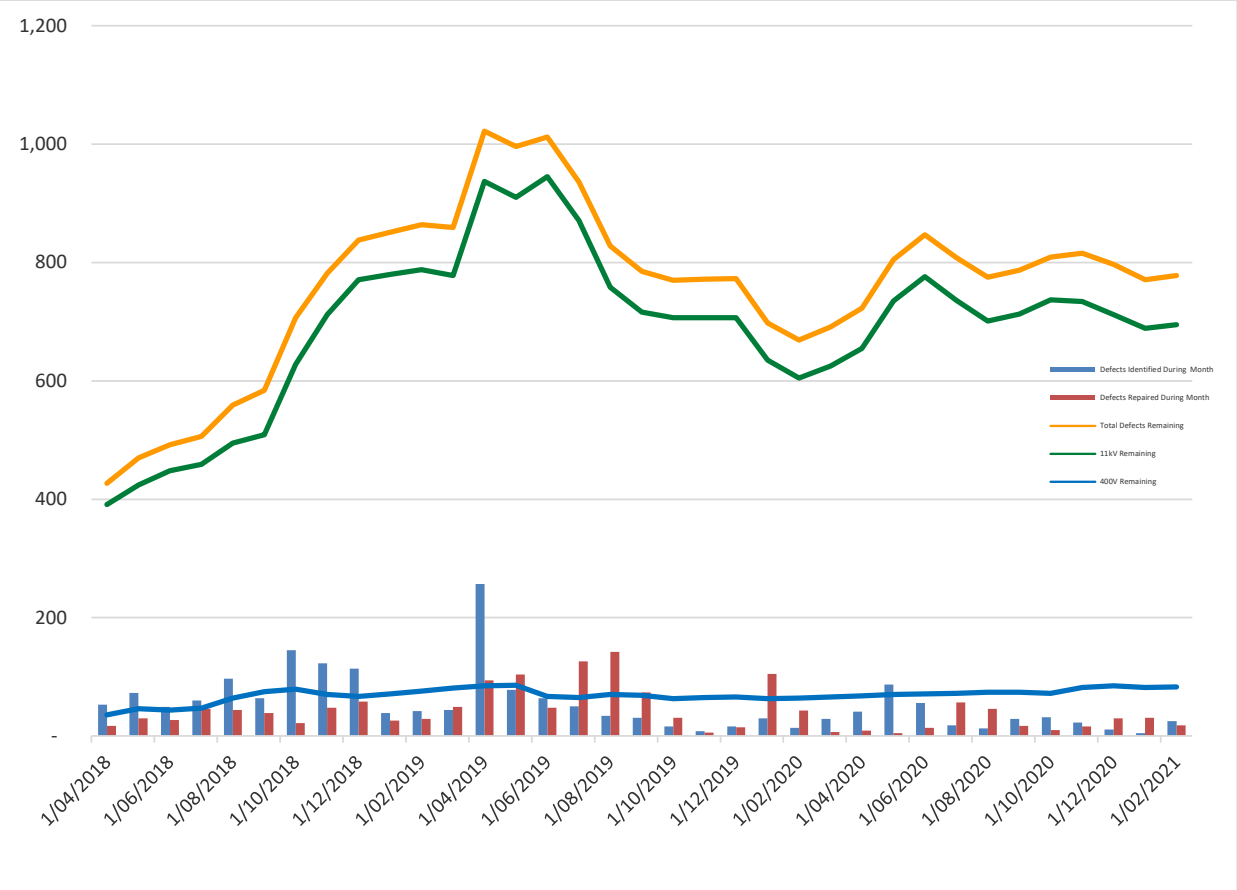


Figure 46: Network defects over time

Other Asset Condition Programmes

Waipa gains further asset condition information from:

- A vegetation management programme.
- An earth testing and repair programme.
- Asset thermal surveys.
- Partial discharge surveys (as required).
- Acoustic monitoring.
- Corona surveys (as required).

Asset Stock and Asset Health Indicators as at 31 March 2021

The AHI condition values derived for the distribution pole fleet, based on the pole type and age profile are presented in Figure 47. This clearly illustrates that very few poles are classified in the H1 category, showing that there is no need for significant renewal projects to be undertaken during the planning period. The other AHI scores (H2 to H5) remain relatively unchanged.

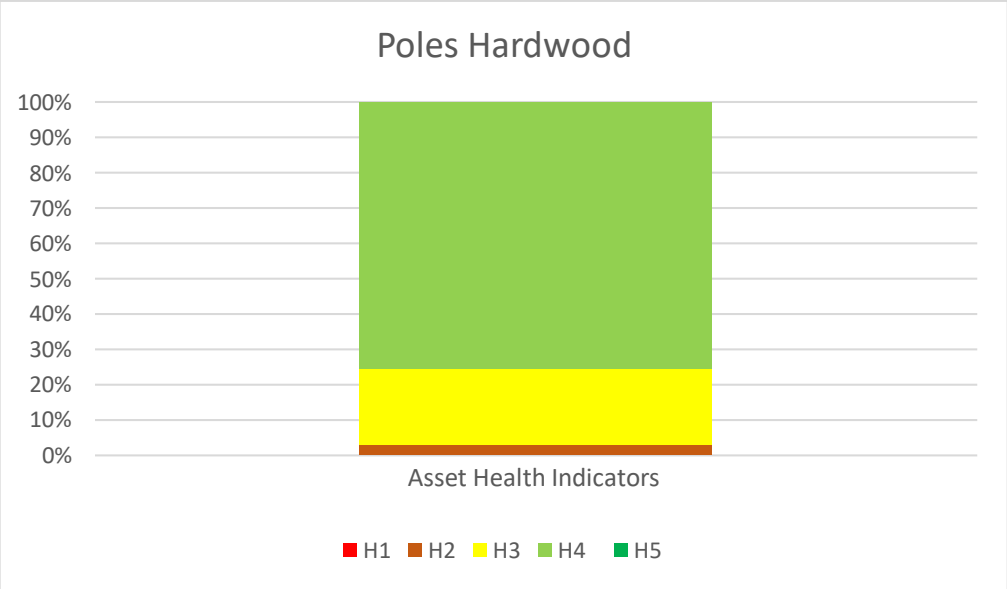
The hardwood pole asset health indicators show that that the majority of poles are in the H3 and H4 category, with an assessed condition not reflecting the advanced age of this pole population The management strategy of phasing them out of the network by condition is therefore appropriate and on the whole, urgent replacement of this pole type is not justified based on this data.

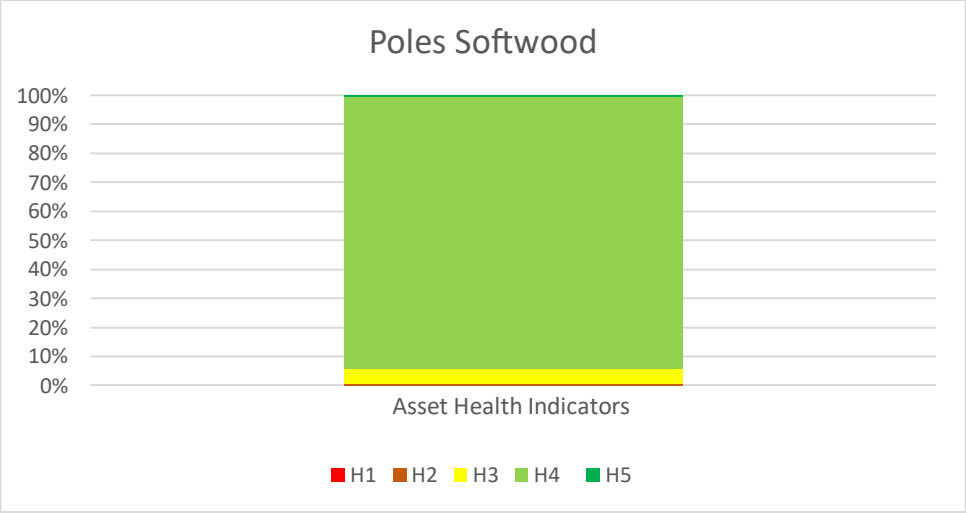
The softwood pole asset health indicators show that that the majority of poles are in the H4 category, reflecting the mid-life age of this pole population and the management strategy of phasing them out of the network by condition being appropriate.

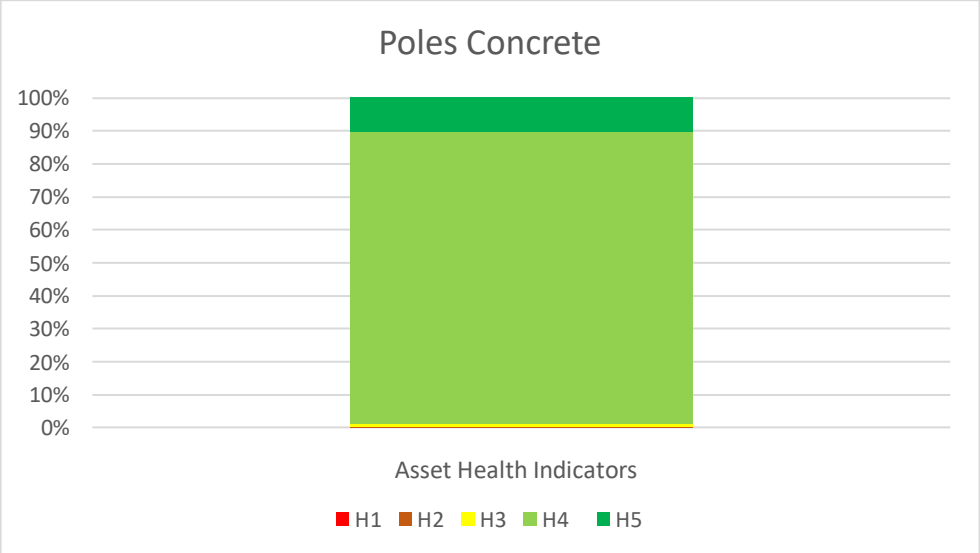
Waipa intends to replace deteriorating hardwood and larch poles identified by the visual surveys as being not fit for purpose and expected to potentially fail before the next scheduled survey, preferably with concrete poles if access permits.

The concrete pole asset health indicators show that that the majority of poles are in the H4 category, reflecting good serviceable condition of these poles despite the higher age of this pole population. Actual asset health indicator data was obtained for circa 80% of network poles in the aerial survey, which has provided a better view on the health of these assets than the earlier age-profile derived asset health indicators.

The steel pole asset health indicators show that that the majority of poles are in the H5 category, reflecting the near-new age of this pole population.


Poles Hardwood
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Asset Health Indicators
H1 H2 H3 H4 H5


Poles Softwood
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Asset Health Indicators
H1 H2 H3 H4 H5


Poles Concrete
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Asset Health Indicators
H1 H2 H3 H4 H5

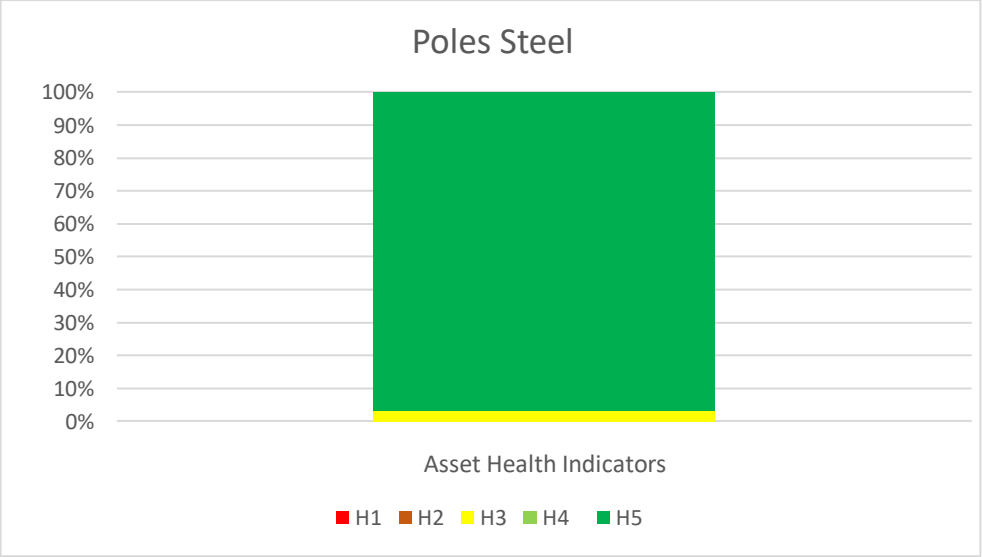


Figure 47: Distribution overhead structures by AHI score

The following figure shows the age profile of the rural pole assets combined with asset health indicator scores, derived from the aerial survey data. This profile shows that the majority of the pole population is in good condition, and even aging poles are not showing excessive poor condition scores. This is not unexpected given the dominance of concrete poles in the network.

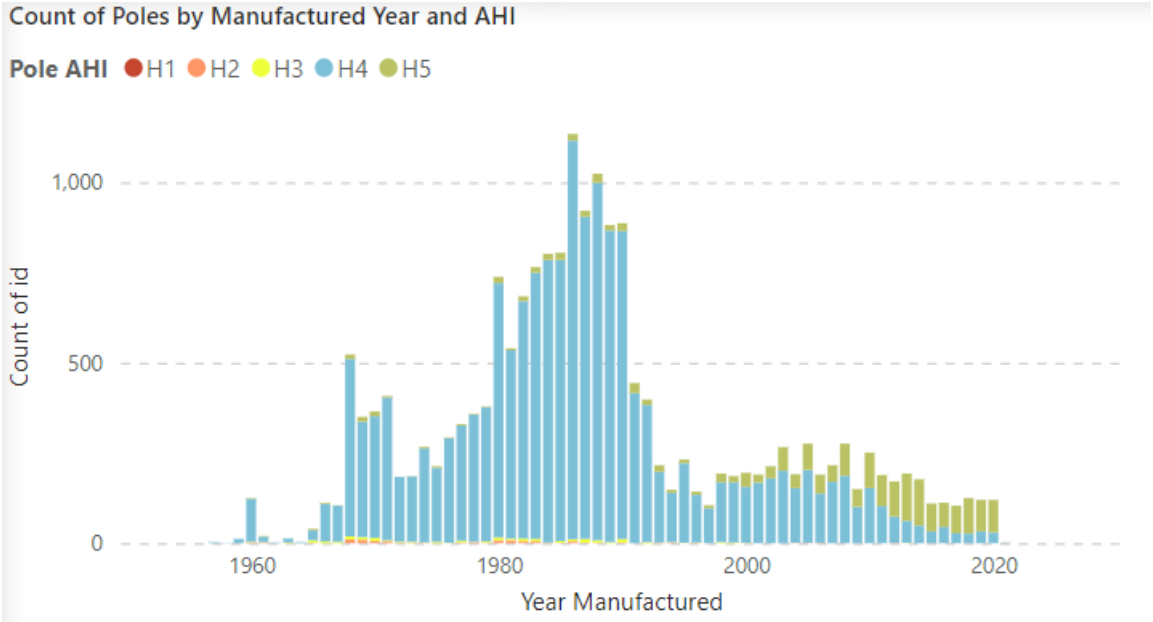


Figure 48: Pole age and AHI score profile

The following figure shows the age profile of the rural cross arm assets combined with asset health indicator scores, derived from the aerial survey data. This profile shows that the majority of the pole population is in good condition, and even some aging cross arms are not showing excessive poor condition scores. The H5 scores since 2012 are of the galvanised

steel cross arms installed since that date. This graph illustrates the aged cross arms with H1 and H2 scores that will require replacement in future years.

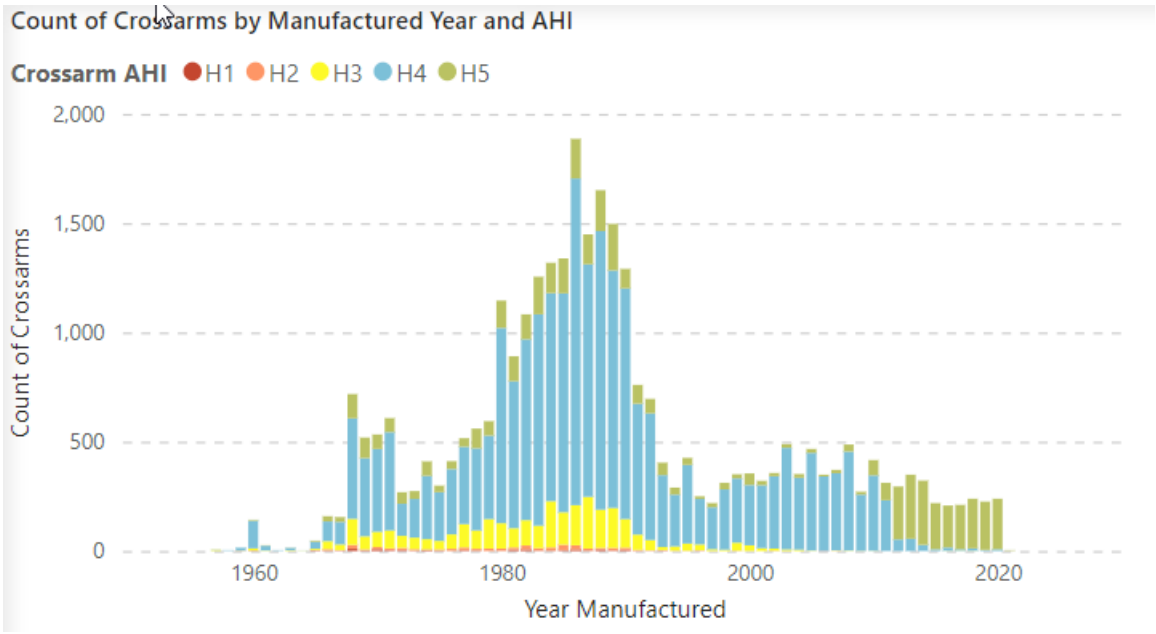


Figure 49: Cross arm age and AHI score profile

Design and construct

The 11kV line projects within the Waipa's network have the following main drivers:

- New connections – growth.
- The bulk replacement of poles that are reaching end of life – i.e., complete line rebuild (rare).
- Conductor upgrade for capacity increase – growth.
- Conductor upgrade for capacity increase – supply security.
- Reliability or safety hot-spotting.

Standard line hardware consists of prestressed concrete poles with galvanised steel cross arms and typically polymer insulators. Softwood treated poles are used in rare occasions where access prevents use of a concrete pole.

Operate and maintain

The risk of failure of the overhead multi-circuit feeders is managed by instigating an intensive maintenance regime. This will involve completing an acoustic and thermal survey of the lines to detect any incipient faults before failures occur. This additional maintenance cost was added to the operational budget from 2018/19.

The maintenance schedule for overhead structures is condition assessment, currently by high resolution photographs of concrete poles, and ground inspection of wood poles. The period of inspection is 5 years.

Renew or dispose

There are often economies of scale in replacing entire sections of line at the same time particularly in remote areas where crew transport and set- up costs are significant. Waipa generally seeks to resolve all defects in a switching module to reduce shutdown requirements to a minimum.

9.3 Overhead conductor

Asset management objectives

Apart from the fleet-wide asset management objectives of safety, lifecycle, reliability, etc., conductor renewal is often undertaken coincident with other works (such as pole replacements) where it is deemed economically beneficial to do so.

Fleet overview

Overhead conductors have been summarised by voltage in the following subsections. The disclosure schedule on asset condition data presents a summary of the conductors by AHI grade. The AHI grading that Waipa has applied is based on asset age, given the difficulty in assessing the condition of conductor.

The backbone of the distribution system is constructed at three phase 11kV. Most of the central area of the 11kV network is interconnected and capable of being ring-fed with supply available from at least one other feeder. This arrangement provides flexibility in the operation of the system and enables supply to be maintained to most consumers in urban areas during planned or unplanned outages. However, the edge portions of Waipa's network are supplied by radial spur lines which have no alternative supply options.

Most conductor is copper, with ACSR and aluminium also well represented. Some galvanised steel conductor remains in use on older lines and spur lines. These are generally in parts of the network where demand is relatively low and static. Galvanised steel conductor is renewed when found during visual inspections.

Due to replacement to increase capacity in the 1970s and 80s conductor is generally in good condition.

Populations and ages

Waipa does not have AHI data for overhead conductor because age data is not known.

Condition, performance and risks

The condition of the network's copper, aluminium and ACSR conductor is considered good. The poorer distribution conductor is predominantly galvanised steel. Conductor failures are predominantly caused by contact from foreign objects like trees or birds or from corrosion or fatigue.

Waipa's vegetation programme, noted elsewhere, has decreased (but not eliminated) the occurrences of these faults. However, the effects of corrosions and/or fatiguing can only be remedied by renewal. While Waipa's network is generally benign for steel corrosion,

corrosion still progresses, albeit at a slower rate than where the conductor is exposed to coastal wind. Conductor vibration and wind also contribute to metal fatigue. The effects of this are cumulative over time.

Design and construct

As a general guide, Waipa's standard line conductor specifications are:

- Primarily AAAC conductor – some AAC used on LV.
- ACSR where required (typically based on mechanical loading).
- Special consideration will be given to unique circumstances, if and when appropriate.

Periodic review identifies those areas where changes in demand may require upgrades to the capacity of the network, generally by way of increases in the conductor size.

Operate and maintain

Conductors are generally long-life assets, with little maintenance required. Corrosion from sea spray or fatigue from wind driven vibration can age the conductor.

Visual inspections are undertaken on the conductor heights at the same time as pole structure inspections, or this is achieved by LiDAR surveying. Following faults, field teams inspect the affected span to ensure any conductor defects are repaired at the time.

Where foreign object damage is a common failure mode, the conductor configuration may be redesigned or modified to mitigate the consequence of further contacts. Examples of this include utilisation of delta configurations, the application of insulated conductor systems.

The maintenance regime for conductor is a five yearly visual inspection.

Renew or dispose

Waipa will apply a condition and risk-based strategy to determine the priority for conductor replacements, but this is not a routine activity due to the network conductor being in serviceable condition. Galvanised steel conductor is considered to be high risk so is renewed when identified by inspection.

Drivers for conductor renewal are analysed alongside structure (pole and crossarm) renewal as these will often be actioned at the same time. However, conductor renewal usually requires renewal of the supporting structures (poles) and their components, as:

- Older conductor is generally strung on older poles.
- The replacement conductor is invariably heavier necessitating a line redesign to current code requirements.
- Remnant pole strengths of older poles are often unknown (unless proven by testing) so cannot be reutilised under the new line construction codes regardless of their condition.

Overhead conductor renewals forecast

Expenditure in this category is included with defect maintenance provided in the Expenditures section of this plan, since there is a low volume of conductor renewal.

9.4 Cables

Asset management objectives

Being an underground asset, public safety is less of a consideration with the main focus being on achieving lifecycle and reliability objectives.

Distribution cables

Fleet overview

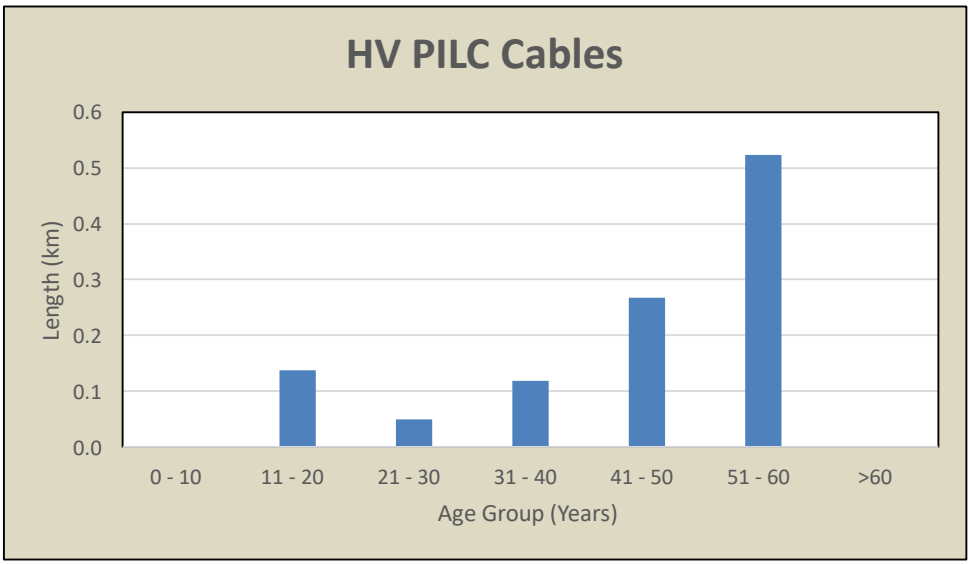
The Waipa fleet of distribution cables operates at 11kV and is 166km in length. The distribution cable system is largely installed within the major townships of Te Awamutu and Cambridge, in the CBD areas and in recent subdivisions, and to a lesser extent in Kihikihi. More recently longer lengths of cable have been run from the Cambridge and Te Awamutu GXPs as the first section of feeders and to increase the capacity that can be delivered to industrial customers like the APL glass factory.

Populations and ages

Waipa has 166km of cables on the network. There are two classes of cable, the original Paper Insulated Lead Cover (PILC) cable with an expected service life of 70 years, and the modern equivalent Cross-Linked Polyethylene (XLPE) cable with an expected service life of 45 years.

The cable distribution network is relatively young, with the bulk of this asset installed within the last 20 years – represented in Figure 50.

The key driver for installation of significant amounts of distribution cable in urban areas has been to increase network reliability, deliver increased capacity and aesthetics in built up areas.



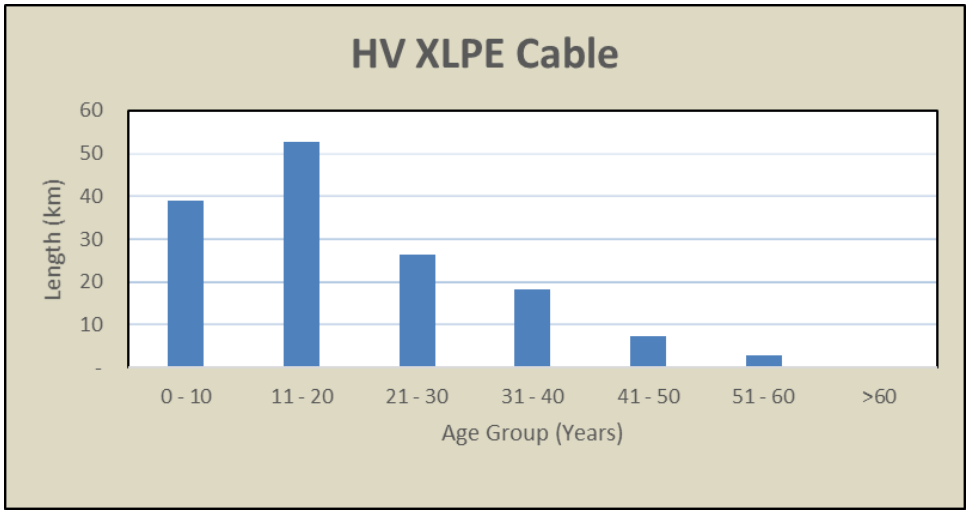


Figure 50: Distribution cable age profile

As work is performed on the urban distribution network such as circuit capacity upgrades, or transformer or ring main unit replacements, replacement of older generation distribution cable is performed simultaneously, where achievable. This has gradually seen a decline in first generation XLPE cables (e.g., CANZAC type) and PILC cables. However, there are still sections of cable that are approaching end of life that will need replacement over the planning period to avoid unreliability.

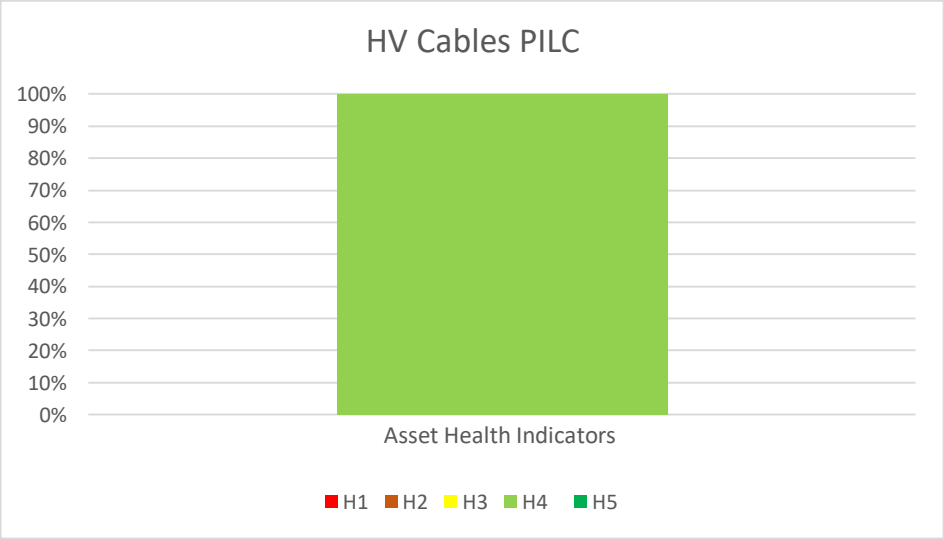
Condition, performance and risks

Cable degradation is impacted by the combination of a number of factors including:

- Design and manufacture including insulation material.
- Installation type and environment, particularly thermal heating.
- Electrical loading.
- Cable exposure.
- Cable age.
- External factors (third party damage, ground movement, etc).

Given the relatively new age of the distribution cable fleet, the majority utilises modern XLPE plastic insulation technologies including water blocking and water-tree retardant properties. This newer cable imposes minimal risk to network reliability until well beyond the current planning period. Overall, the distribution cable fleet is assessed as being in reasonable condition, depicted in Figure 51.

The XLPE cable asset health indicators show that that there is very little cable in the expected age for replacement. Closer inspection of the data shows that is a small amount of pre-1980 cables that are prone to the water-treeing failure mode and modern XLPE cable. Waipa is seeing some XLPE cable failures, but only the older XLPE type CANZAC cables are selected for a proactive replacement policy.



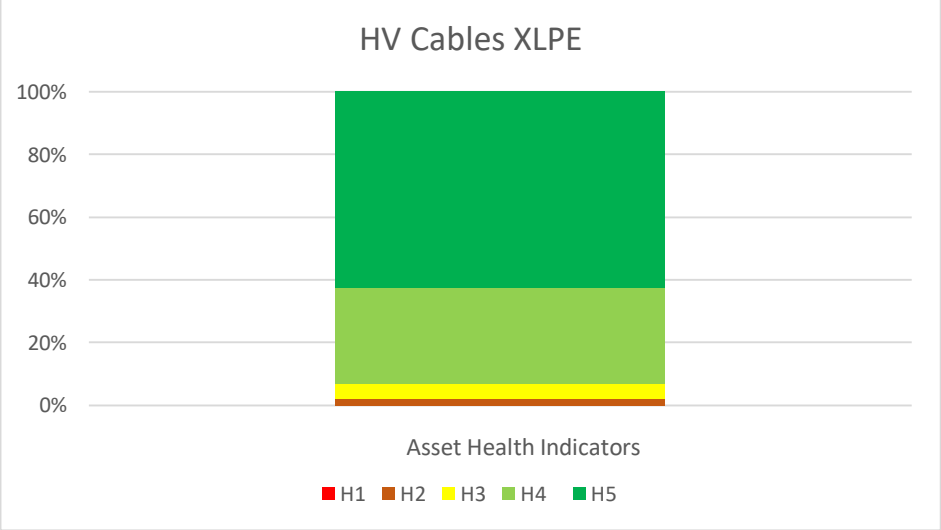


Figure 51: Distribution cable AHI summary

Design and construct

When installing new sections of underground distribution network during new-builds or cable replacement, Waipa has a standardised set of cable sizes. Waipa will utilise 35mm^2, 95mm^2, 185mm^2 or 300mm^2 multicore aluminium cables with XLPE insulation. Single core cables and other conductor sizes may be utilised for specific applications, such as when increased current ratings are demanded. Standardisation of cable size allows for the reduction in the requirements for critical spares, such as jointing kits, etc., as well as ensuring staff are competent in handling and working with regular sizes.

Operate and maintain

Cables are generally maintenance free as they are typically buried, with the only exposed sections being at the overhead to underground transitions, or at termination onto switchgear and other plant. Overhead connections are protected from lightning surges with surge arrestors.

Waipa regularly performs asset inspections, which includes visual inspection of cable termination poles and ground-mounted switchgear for obvious signs of wear or damage, including condition degradation due to exposure to UV.

Cable faults most commonly occur due to interference from third parties during activities such as excavation or underground thrusting. Where distribution cables have been damaged resulting in increased risk of failure, corrective action is immediately taken by Waipa to avoid a fault developing. Actions include:

- Replacement of mechanical protection on cable termination pole.
- Replacement of the cable termination due to degradation.
- Removal of failed/damaged section and cable replaced or jointed.

Renew or dispose

Waipa's renewal approach for distribution cables is to replace on condition (when and where known) and/or age. Assessing cables' condition through testing can be difficult (largely due to the time and cost involved, and the nature of the testing –some tests can "age" cables). The EEA AHI guide provides end of life drivers for cables based on known issues, loading history, partial discharge and failure history which can be used to deduce condition. Another of the key determinants of the life of a cable can be the manner of installation and the ground conditions within which it is installed.

Waipa will consider renewal of cables based on the condition values deduced based on the EEA AHI guide.

Low voltage cables

Fleet overview

This fleet includes low voltage cables, link boxes, cabinets and pillars.

The LV distribution network provides the typical interface between the distribution system and consumer installations. The typical consumer installation is supplied from either an overhead service line or from a service cable connected to an LV underground distribution box.

The Waipa LV cable fleet operates at 230V/400V. The main assets within this class are cables and LV boxes which include link boxes, LV cabinets, service boxes and pillar boxes.

Populations and ages

Waipa LV underground cable network consists of 413km of circuit length, including street light circuits. The bulk of the LV cable population has been installed within the last 25 years, during new subdivision installations or overhead to underground conversions. There are portions of the LV cable network that employ early types of XLPE or PILC insulated cables that are approaching end of life.

Figure 52 provides detail on the age profile of Waipa's LV cables.

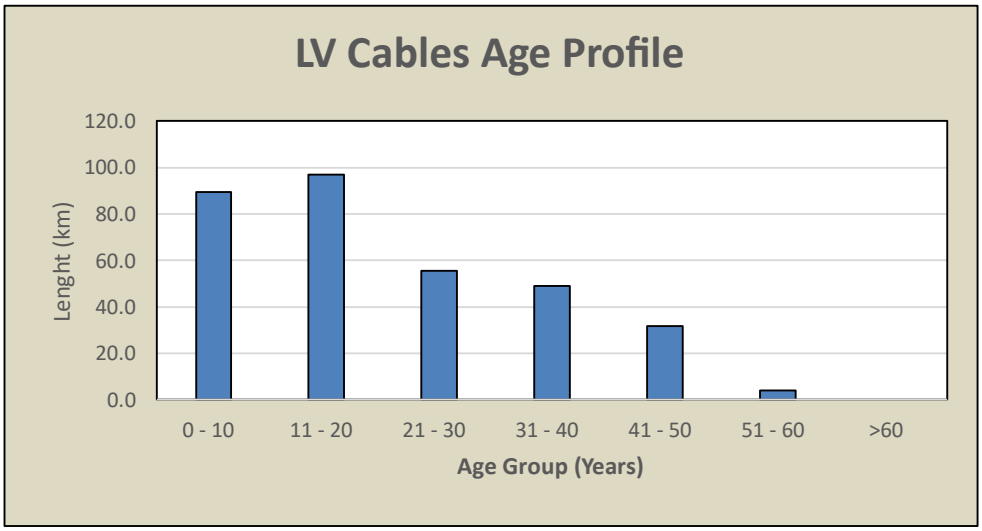


Figure 52: Low voltage cable age profile

Condition, performance and risks

Consumer service lines connect to the LV cable network from an LV service fuse (pillar) box (usually located on the property boundary or on the street frontage near the property).

When a portion of the LV network is approaching the end of its useful life and is supplying numerous consumers of high importance, such as in the CBD area, Waipa will give consideration to results of a condition assessment based on the AHI guide before renewing/replacing it. Repeated failures are a typical trigger for replacement.

LV cables are typically buried or surrounded by mechanical protection where the cable transitions above ground to overhead connections on a cable termination pole. As a result, excluding damage from third parties, LV cable failures are relatively rare. A large number of LV outages are typically be caused by failure at the transformer LV box from causes such as external interference including vehicle contact and vandalism, vermin or failure of terminations and joints. To overcome this, LV boxes are typically installed in protected areas, sheltered from external influences, and regular inspections are performed.

Design and construct

Waipa carries stock of numerous sizes of aluminium and copper cables for use on the LV cable network or to perform consumer work. Due to the simplicity of performing cable terminations on LV cables over that of distribution or sub-transmission, there is reduced need to standardise on a reduced selection of cable sizes. Irrespective, it is necessary to utilise the right size cable for the application required, considering voltage drop, continuous loading, fault current capacity and mechanical performance when selecting LV cable sizes.

LV box types are thoroughly scrutinised before being approved for use on the Waipa LV network. Considerations include the ability to cover metallic bus sections, ability to accept approved fuse carriers, mechanical performance, locking ability, ease of installation, connection and subsequent fault repairs etc. Recently Waipa has adopted a large urban type fibreglass LV box, to replace metallic types used on the network. This reduces the safety risk to field crews of working within a metallic LV box.

Operate and maintain

A pillar inspection programme has been instigated to survey and replace poor condition low voltage pillars. This will address the public safety risk of insecure pillars and the field crew safety risk of the "floating fuse" pillar type where the cable tap-offs are not terminated or secured in the pillar, but are "floating" with poor quality insulation tapes covering the joints. This is a risk to field crew opening the pillars. The programme will inspect the pillars over a period of years, commencing in Cambridge where the bulk of the issues are. The capital cost of replacing pillars has been added for the next four years, based on the cost of pillar replacements undertaken to date.

Renew or dispose

As mentioned above, renewal of LV cables is generally managed using a run to failure strategy, unless the cable supplies critical consumers where alternative supply options are limited or non-existent. LV cable renewal is expected to remain relatively minor and constant given the age and quantity of the existing LV cable population.

9.5 Distribution transformers and regulators

Asset management objectives

Distribution transformers convert electrical energy from the reticulated voltage of 11kV to low voltage 400/230V. Their effective performance is essential for maintaining a safe and reliable network at an appropriate voltage.

Transformers come in a variety of sizes, single or three phase, and ground- or pole-mounted. Waipa's transformers are oil filled. These have inherent environmental and fire risks. Managing the lifecycle and risks of distribution transformers assets, including correctly disposing of these assets when they are retired, is the key objective of this asset management strategy.

Pole mount transformers and regulators

Fleet overview

The majority of the transformer fleet is pole mounted, but larger ground mounted units are typically used for urban situations and for commercial customers requiring greater capacity. Larger pole-mounted transformers, particularly those serving urban areas, were historically mounted in a 2-pole configuration. Waipa is undertaking a programme of replacing those pole-mounted transformers due to the risk of structural or mechanical failure. As mentioned earlier as an Other Health, Safety and Environment initiative, two pole substations are being proactively phased out and only five installations remain, to be replaced during 2022/23.

Reactive replacement of pole-mounted transformers can usually be undertaken quickly, affecting a relatively low number of consumers. Suitable spare transformers are held in stock at Waipa's depot. This ensures a fast response time to return the supply service.

To maintain regulatory 11kV voltage on its feeders Waipa has a significant number of voltage regulator units in service on the distribution network. Voltage Regulators are used extensively on the Waipa distribution network with their effective performance being essential for

maintaining a safe and reliable network whilst maintaining 11kV within regulatory voltage limits.

The Voltage Regulators are located at key points in the network to maintain voltage under normal operating conditions and also support the voltage under backfeed situations as necessary.

Voltage Regulators are typically rated at 100, 200 or 300 amps at 11kV and are installed in an open delta (2 tank) or closed delta (3 tank) configuration. For new sites closed delta configuration is the preferred connection configuration.

Populations and ages

Waipa had 2,781 pole mounted transformer substations on the network. The age profile is shown in Figure 53. These assets are virtually a run to failure asset, with replacement triggered either by failure in service or due to lightning strikes, or defect replaced due to oil leaks or excessive rust.

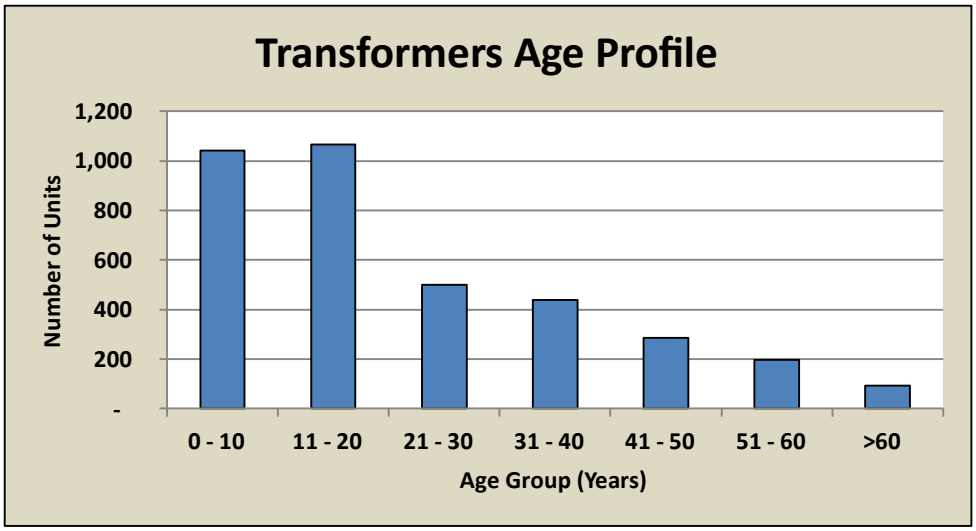


Figure 53: All distribution transformers age profile

Waipa has five ageing two pole hardwood platform transformer structures. While the hardwood platforms have been maintained as required over the years these assets are approaching the end of their economic life. Furthermore, this type of substation structure no longer conforms to modern industry standards. All of these two pole transformer structures will be replaced on a public risk and condition prioritised basis by either a single pole transformer substation or a pad mounted substation for staff and public safety by the end of 2022/23.

Table 43 summarises the population of distribution transformers by kVA rating as at March 2020. Many are very small, around 40% are 30kVA or smaller. A transformer of this size typically supplies one or two houses in a rural area.

Table 43: All distribution transformer population by kVA rating

Rating	Numbers of transformers	% of total
≤ 15kVA	511	14%
> 15 and ≤ 30kVA	970	26%
>30 and ≤ 100kVA	1663	45%
>100kVA	564	15%
Total	**3,708**	

The data in Table 44 shows Waipa's pole mounted distribution transformer age profile as at March 2020. The expected life of these units ranges from 45 to 60 years. Approximately 15% of Waipa's fleet is within this age group and is due for replacement based on age.

Table 44: Pole-mounted distribution transformer population by age

Age	Numbers of transformers	% of total
≤ 10 years	683	25%
> 10 and ≤ 20 years	725	27%
> 20 and ≤ 30 years	397	15%
> 30 and ≤ 40 years	429	16%
> 40 and ≤ 50 years	236	9%
> 50 and ≤ 60 years	217	8%
> 60 years	40	1%
Unknown age	20	1%
Total	**2,747**	

There are a total of 21 Voltage Regulator sites in operation with 16 on the Te Awamutu network and 6 on the Cambridge network with 42 and 16 Voltage Regulator Cans respectively.

Table 45: Voltage Regulator quantity

	Te Awamutu		Cambridge	
Size (amps)	Sites	Cans	Sites	Cans
100	2	5	2	4
200	9	23	3	9
300	5	14	1	3

The age profile for the Voltage Regulator fleet are shown below. The expected life is 55 years assuming good maintenance and servicing programmes. However, assets located in harsh coastal areas often require replacement before this time, although it should be noted that the

final replacement decisions are condition rather than age based. Control systems for voltage regulators have a shorter life and planned replacements are programmed to address this.

There are only two Voltage Regulator Cans in service (at one site) that is older than 40 years with the remainder of the assets being at or younger than 22 years old.

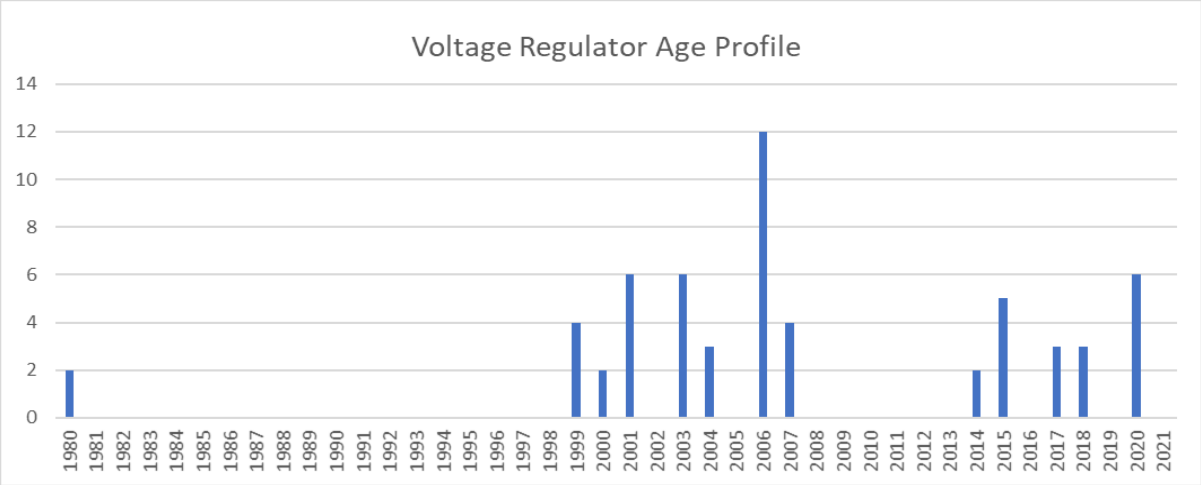


Figure 54: Voltage regulator age profile

Condition, performance and risks

The main reasons for replacing pole-mounted transformers are equipment degradation and unexpected failures, usually caused by third parties (e.g., vehicle accidents) or lightning strikes. The predominant causes of equipment degradation are:

- Deterioration of the insulation, windings and/or bushings.
- Moisture and contaminant concentrations in insulating oil.
- Thermal failure because of overloads.
- Mechanical loosening of internal components, including winding and core.
- Oil leaks through faulty seals or corrosion.
- External tank/enclosure damage and corrosion.
- Lightning strikes.

Distribution transformers are generally reliable and although the risks of oil fires and oil leakage are ever present, the incidence of such events is low especially with properly installed quality transformers. Waipa has oil spillage mitigations and Waipa's field crews are trained in their use.

Waipa Networks currently have 54 voltage regulators in service ensuring voltage limits are adhered to over the range of load conditions on mainly rural feeders. The large number of assets in the H1 and H2 asset health condition is due to the age of the fleet. Greater emphasis on the inspection programme for the voltage regulator fleet will ensure that actual asset condition is used to inform the asset maintenance and replacement programme. A fleet asset management plan to better manage the planned replacement of voltage regulators and seismic strength of voltage regulator structures has been developed in 2021/22 as part of the Asset Management Improvement Plan (AMIP).

Because of their significant impact on network operations if they malfunction voltage regulators will be inspected for external corrosion and damage and SCADA and communications will be inspected every.

While normal 11kV reinforcement techniques are economic, the network is running out of capacity due to voltage limitations on longer rural feeders, The 11kV reinforcement has mainly involved the traditional approach of:

- Upgrading all under sized feeder conductors to remove capacity constraints and improve delivered voltage.
- Relocating, enhancing, adding or removing voltage regulators or capacitors to ensure regulatory voltage is maintained at all times.
- Establishing new 11kV feeders and reallocating load between the new and existing feeders.
- Relocating, adding or removing line auto reclosers, sectionalisers, disconnectors and dropout fuses to satisfy system operating needs.

Waipa has a regulatory obligation to supply consumers' network connection point within specified voltage limits not withstanding momentary fluctuations. Waipa's load profile is typical of most EDBs with morning and evening peaks which occur for 6-8 hours each day. For the remaining 16 to 18 hours Waipa's urban and suburban pole line feeders operate well within their current rating capacity and deliver statutory voltage

However, during peak loading periods, the Waipa rural pole line feeders without enhancement cannot deliver regulatory voltage. The cost-effective solution is to install voltage regulators on these rural lines so that regulatory voltage is maintained at NCPs over peak periods. The use of capacitors as an alternative method of voltage support to augment voltage regulators has also been introduced.

Generally, all sites are of equal importance in that if there is an asset failure the network will be voltage constrained. Future analysis may show some heavily loaded locations are more critical and the impacts will be addressed as they are identified.

The biggest risk to site security is a significant car v pole incident, although unlikely, it needs to be planned for. Equipment spares will address this. Vandalism can also be a problem and manged by routine inspections and ensuring the integrity of cabinet locks.

Figure 55 presents a summary of the pole mounted transformer and regulator fleet condition scores, based on aerial photo surveys (rural pole transformers) and field inspection (voltage regulators).

The asset health of the transformer population is good, with only a small proportion of the assets in H1 and H2 requiring replacement. The overall health of the voltage regulator fleet is good, although three Cans at one site (V1) are in very poor condition. There is a plan in place to renew these units and relocate the site. The timing is to be confirmed.

The main failure modes for Voltage Regulators are equipment degradation such as:

- Deterioration of the insulation, windings, tap changing equipment and/or bushings.

- Moisture and contaminant concentrations in insulating oil.
- Thermal failure because of overloads.
- Mechanical loosening of internal components, including winding and core.
- Oil leaks through faulty seals
- External tank/enclosure damage and corrosion.
- Control system failure through ingress of moisture or vermin.

External factors that can result in failures lightning strikes and third parties (e.g., vehicle accidents) causing major damage to the structure.

Voltage Regulators are generally reliable and although the risks of oil fires and oil leakage are ever present, the incidence of such events is low. Waipa has oil spillage mitigations and Waipa's field crews are trained in their use.

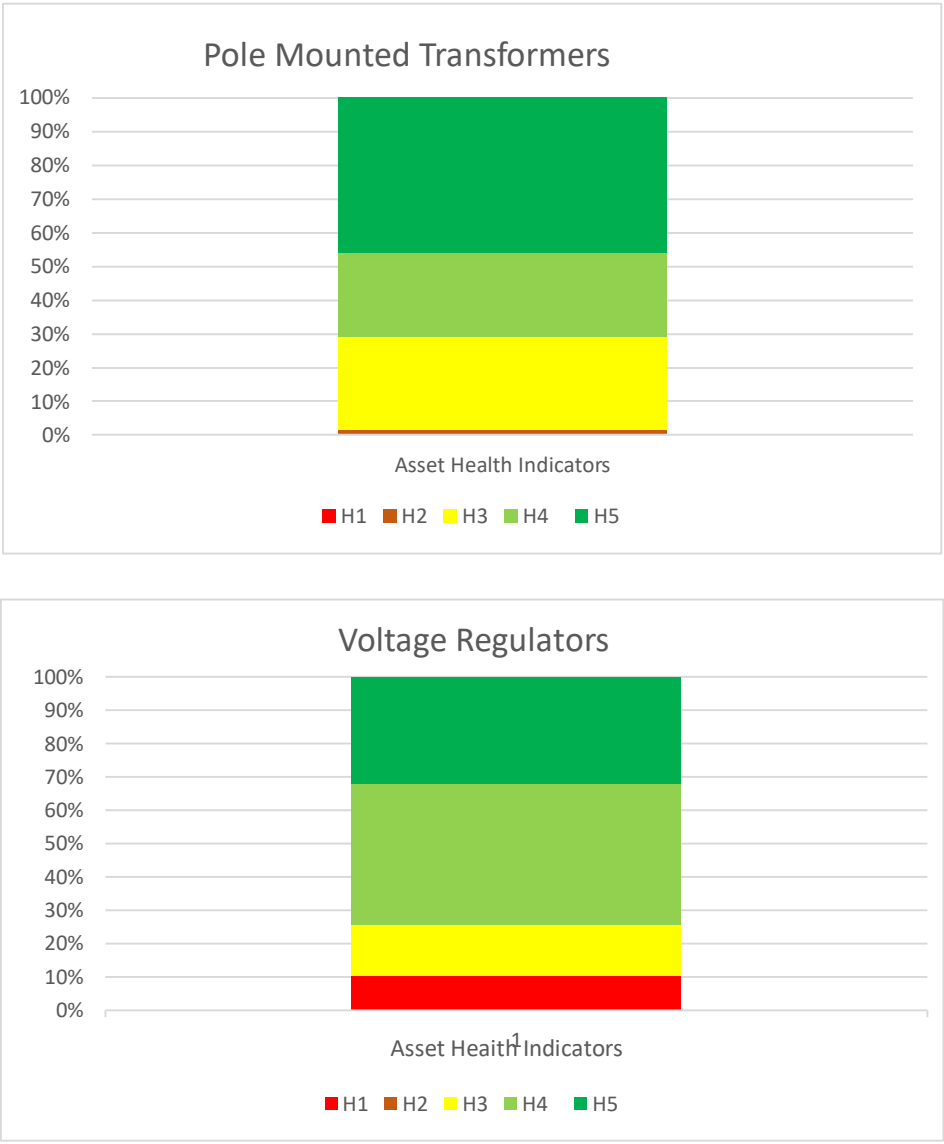


Figure 55: Pole mounted Transformer and regulator AHIs

The following figure shows the age profile of the rural pole mounted transformer assets combined with asset health indicator scores, derived from the aerial survey data. This profile

shows that the majority of the transformer population is in good condition (H3 to H5), and even aging transformers are not showing excessive poor condition scores.

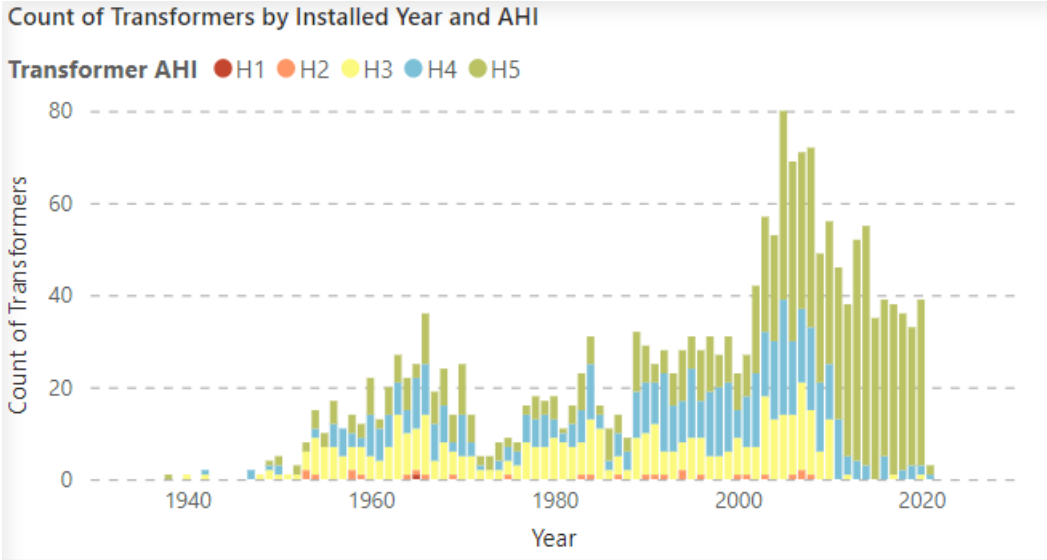


Figure 56: Rural pole transformer age and AHI profile

Design and construct

To improve resilience to major seismic events, new pole-mounted transformers are limited to 100kVA and below, with specific standard designs detailing pole and foundation requirements. Platform two pole transformer structures with larger transformers are being progressively replaced. Smaller pole-mounted transformers are replaced like-for-like, with pole upgrades depending on the standard design required.

Pole-mounted transformer renewal is primarily based on condition. The renewal need is often only identified when the transformer is close to failure and sometimes after they fail. In-service failure of smaller units is accepted because the consumer impact is limited, the cost of obtaining better condition information is high, and the maximum asset intrusive maintenance required. Maintenance is generally limited to visual inspections.

Waipa's preventive inspections for pole-mounted distribution transformers are visual inspections at five yearly intervals, the latest being via the aerial survey photos.

Renew or dispose

Repairs on existing voltage regulator installations will be completed in a timely manner after deterioration is detected. Routine maintenance will be conducted in accordance with the manufacturer's recommendations and operations counter. Voltage regulator refurbishments have not been keeping pace with the number of tap change operations units have been completing and a backlog has built up. The cost budgeted for refurbishments have been increased for the ten-year period to clear the backlog. A summary of the maintenance and refurbishment requirements for the existing Voltage Regulator fleet as a result of the November/December 2021 inspections and other assessments is shown in table below:

Table 46: Voltage regulator maintenance program

Voltage Regulator	Feeder	Corrective Action	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027
All		TjH2B oil test for each VR can and develop a refurburishment plan based on the results		x				
V1	C2772	Site relocation and replacement of the VR units			x			
V7	T0023	Further investigation into tapping issues		x				
V11	C2702	Rebuild structure at the same site				x		
V12	T2762	Assess for an upgrade and rebuild site					x	
V14	C2732	Assess requirement and rebuild site with refurbished cans		x				
V23	T2842	Remodel feeder and assess location				x		
V24	C2742	Vermin control in the comms box	x					
V27	T0027	Replace dial indicators, clean flaking paint and repaint			x			
V28	T2842	Replace sight glass covers and top umbilical plugs			x			
V29	T0022	Replace sight glass covers and top umbilical plugs Remove rust from VR units and repaint		x				
V30	T0027	Upgrade to closed delta site and with a CL7 multphase controller.				x		
V31	T0022	Replace dial indicators			x			
V33	T2762	Upgrade controllers to a CL7 multiphase.				x		
V34	T0022	Replace batteries	x					
V34	T0022	Upgrade controllers to a CL7 multiphase.				x		
V35	C2842	Complete the SCADA DNP map	x					
V36	T2752	Rebuild structure. Investigate and fix input voltage issue			x			
V38	T0023	Structural Enginer to reassess the foundations for overloading. Implement any recommendations		x				
Total			0	0	0	0	0	0

A detail fleet asset management has been developed for Voltage Regulators to produce a programme of renewal and prioritisation of structure rebuilds to make the voltage regulator structures seismically compliant.

Ground-mounted transformers

Fleet overview

Waipa currently have 839 pad mounted transformer substations on the network. While minor remedial work is carried out when a defect is detected, the asset is only replaced when it fails in service, significant tank defects are found or load growth requires larger capacity to be installed. Unsafe porcelain J type LV fuses are a safety defect that are a trigger for replacement of ground mount transformers. Ground mount transformers are generally also in good condition.

Ground-mounted transformers may be enclosed in a consumer's building, housed in a concrete block town substation, or berm mounted in a variety of enclosures. Ground-mounted transformers require seismically designed separate foundations (if not housed in a building), along with earthing and a LV panel.

Transformer capacity depends on load density but is generally 50kVA or 100kVA in lifestyle areas, 200kVA or 300kVA in newer suburban areas, and 500kVA to 1MVA in CBD areas or in industrial situations.

This fleet includes the kiosks and LV distribution panel (i.e., ground-mounted-substation).

Populations and ages

The data in Table 47 shows Waipa's ground-mounted distribution transformer age profile as at March 2020. The expected life of these units ranges from 45 to 60 years. Only 5% of the fleet is within this age group and are candidates for replacement.

Table 47: Ground-mounted distribution transformer by age

Age	Numbers of transformers	% of total
≤ 10 years	344	42%
> 10 and ≤ 20 years	290	35%
> 20 and ≤ 30 years	52	6%
> 30 and ≤ 40 years	64	8%
> 40 and ≤ 50 years	44	5%
> 50 and ≤ 60 years	6	1%
> 60 years	0	-
Unknown age	20	2%
Total	**820**	

Figure 57 shows the age profile. This shows that the ground mounted transformer ages are less than the industry average, in line with the strong growth in urban areas on the network in recent years.

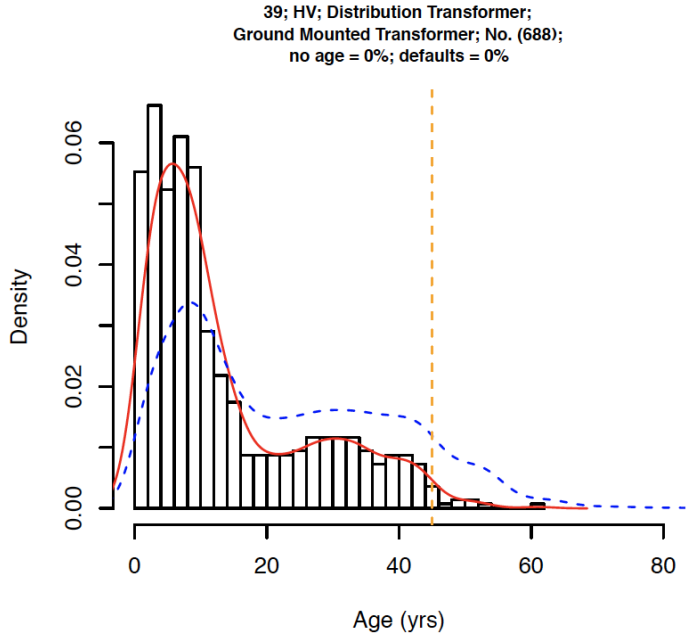


Figure 57: Ground mounted distribution transformer age profile

To interpret the above graph, age in years is on the x-axis and age distribution density on the y-axis. Density is used as the charts show the relative proportionality of asset quantities by age between Waipa (red line) and all NZ EDBs summed together (blue dashed line). The expected asset life is the yellow dashed line.

Condition, performance and risks

The main reasons for replacing ground-mounted transformers are equipment degradation and unexpected failures, sometimes caused by third parties (e.g., vehicle accidents) or through faults. The predominant causes of equipment degradation are:

- Deterioration of the insulation, windings and/or bushings.
- Moisture and contaminant concentrations in insulating oil.
- Thermal failure because of overloads.
- Mechanical loosening of components, including winding and core.
- Oil leaks through faulty seals or corrosion.
- External tank/enclosure damage and corrosion.
- Lightning strike.

Figure 58 presents a summary of the ground mounted transformer fleet condition scores, based on actual inspected condition. The asset health of the population is good, with only a modest proportion of the assets in H3 and H2.

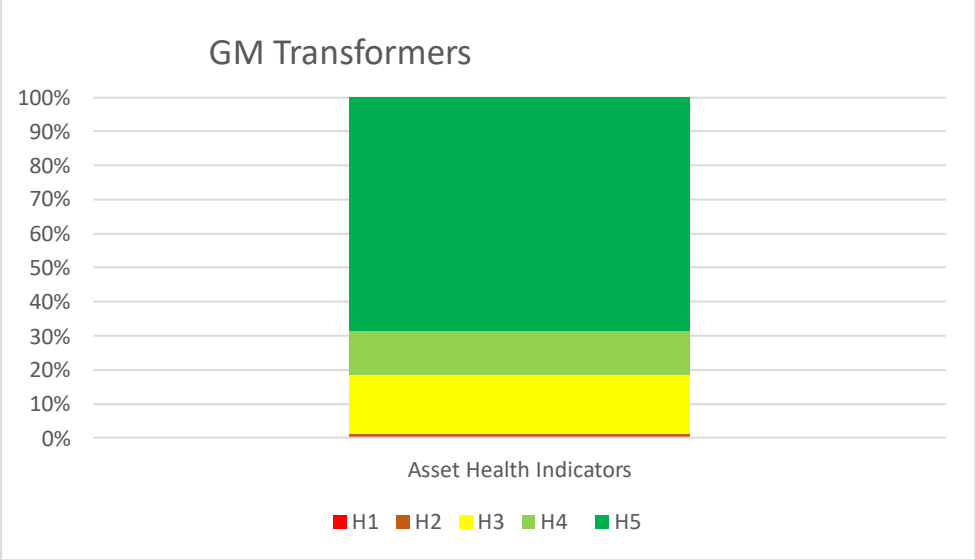


Figure 58: Ground mounted Transformer AHIs

Design and construct

Maximum Demand Indicator (MDI) readings are performed on all large distribution transformers to assess capacity usage. The frequency of the readings is three yearly unless triggered by a voltage complaint or similar. Waipa utilises electronic loggers for spot monitoring which provide load profile data together with MDIs which record peaks. A very limited number of transformers have time of use data logging for monitoring purposes.

Operate and maintain

Transformers used for large industrial loads can be exposed to more onerous load conditions than residential transformers, making critical that they are regularly visited and tested.

Waipa's routine inspections for the Fonterra Hautapu transformer fleet involve visual checks and DGA (dissolved gas analysis) and breakdown oil testing annually. This information assists in assessing internal health of transformer for remedial action.

Renew or dispose

Inspections have revealed the population of large transformers to be in relatively good condition. The oil tests within a few Hautapu transformers have raised issues, requiring repeat tests and ongoing monitoring of how condition is progressing.

Distribution transformers renewal forecast

Aside from the inspection and maintenance regime, transformers are generally run to failure unless potential problems or poor condition are detected from network surveillance. Failure rates are also monitored to look for any systemic problems with the transformer stock.

Renewal forecasts are based on historic renewal rates.

9.6 Distribution switchgear

Asset management objectives

The key asset management objectives for the distribution switchgear fleet are safety and lifecycle.

Ground-mounted switchgear

Fleet overview

Waipa's fleet of ring main unit (RMU) switches is deployed within the cable distribution network. Almost all the RMUs are located in the urban, newer residential and the industrial areas and as such they have significant public exposure.

Waipa Networks currently has 130 Ring Main Units (RMU) in service. The last oil filled RMU was replaced in 2013/14 as part of a safety improvement initiative. All ring main units are either SF_6 insulant or vacuum insulant and therefore these assets are in relatively young and in good condition.

Populations and ages

The fleet is relatively young, the age profile below is due to a safety initiative where older oil filled ring main units were replaced due to fire and explosion risk.

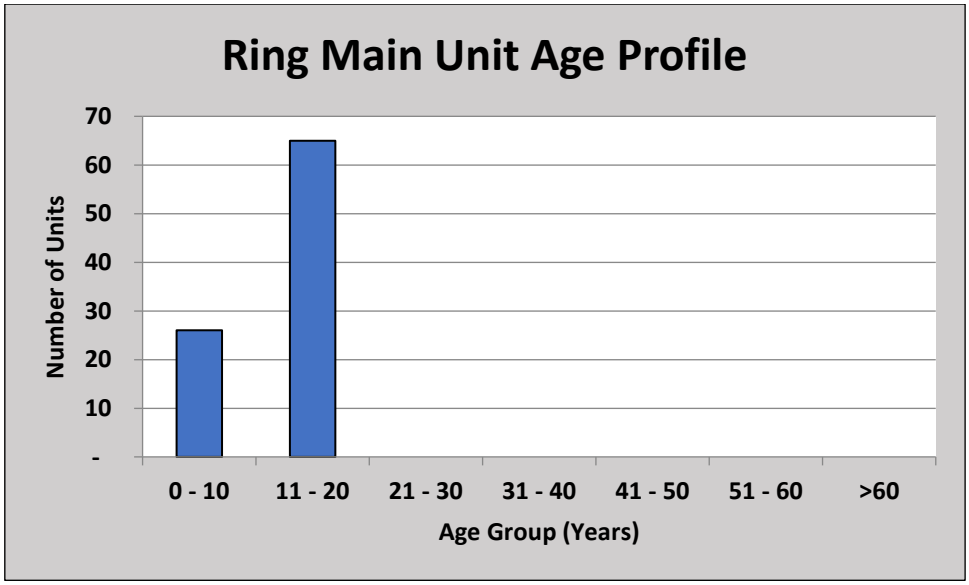


Figure 59: RMU age profile

Condition, performance and risk

Figure 60 summarises the RMUs condition-based AHI grades, obtained from the planned maintenance programme. The fleet is in very good condition due to its age, related to the replacement of all oil-filled RMU from the network for safety reasons. A small number of installations have been checked and tested related to the ABB Safelink overtravel to earth position issue. Due to the unpredictability of this failure mode, the suspect units have been tagged and field crews trained in the use of the correct way to operate these units safely to prevent overtravel.

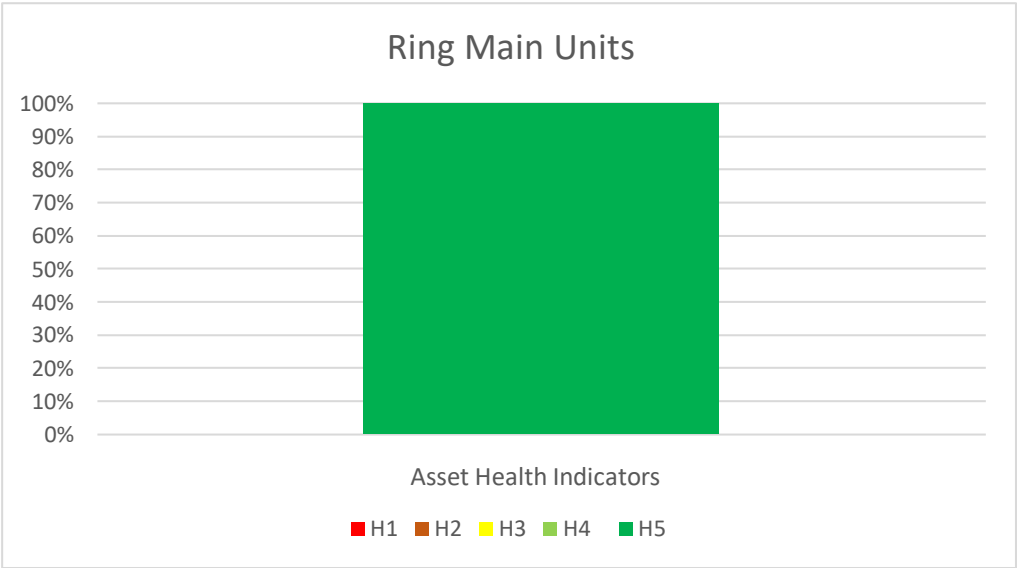


Figure 60: RMU condition based AHI

Design and construct

In keeping with public safety standards, Waipa has recently updated its purchase specification for ring main units to require a BLFR internal arc classification for both operator and public safety. This adequately contains internal arc energy so the equipment is safe for installation in public places.

Waipa installs only SF_6 switchgear currently. Waipa expects that these RMUs will not require major maintenance over their useful lives. Waipa will install vacuum RMUs or solid dielectric RMUs if cost effective in the future. “Solid insulated” vacuum Ring Main Units are becoming more readily available in New Zealand. However, their prices are not currently competitive. Waipa has installed two trial Halo Ring Main Unit in 2015/16 and this unit will be evaluated according to its on-going performance.

Operate and maintain

Visual inspections of RMUs are undertaken on a three-yearly basis. For efficiency, these inspections are combined with the inspection of any associated transformer.

Renew or dispose

The current fleet is near new and no replacement is budgeted.

Pole mount switches

Fleet overview

Waipa currently has 669 air break switches in service on the distribution network. These air break switches are either open air break switches or the modern equivalent enclosed load break switch type used to segment and isolate lines and provide inter-ties between feeders.

Previously these disconnectors were removed from service and refurbished. However, Waipa prefers to replace them because their most common mode of failure is to “freeze up” through infrequent use, their contacts weld together when they pass fault current or insulator failure occurs.

Defective air break switches are replaced when they fail in service or at the time the pole line is reconstructed with Entec Ecoswitch vacuum interrupting load break switches. The decision to replace open air break switches with enclosed load break switches was made in 2016 given that the capital cost increase for the enclosed type was modest, and better reliability, longer life and lower maintenance costs are expected. A fleet asset management plan to better manage the planned replacement of aging air break switches is intended to be written as part of the Asset Management Improvement Plan (AMIP).

Populations and ages

Figure 61 illustrates Waipa’s pole-mount switch age profile. The assumed age for switches of unknown age produces the significant single age range between 41 to 50 years. However, this is indicative of a large population of relatively aged disconnectors.

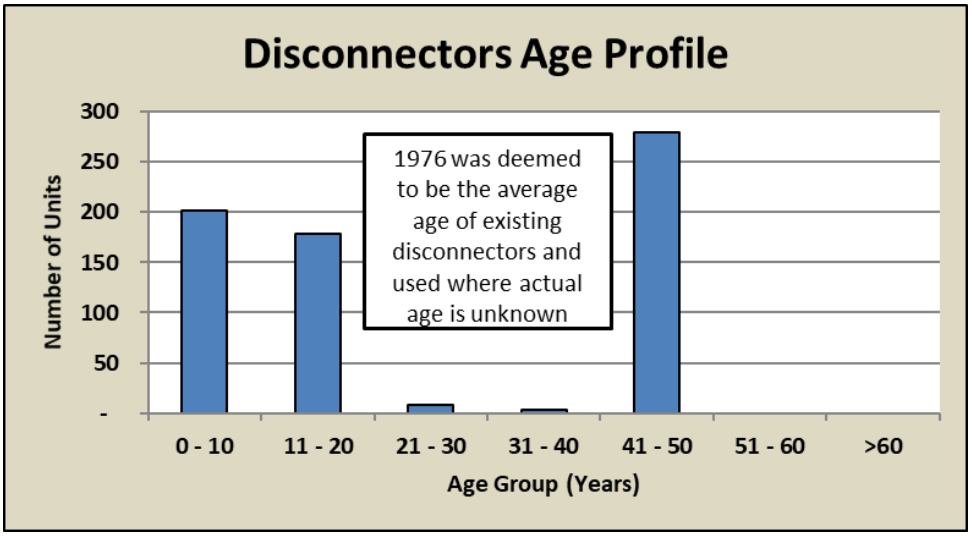


Figure 61: Pole mount switch age profile

Drop out fuses are used to clear faults from spur lines, protecting the main feeder, and to provide 11kV side protection for line connected distribution transformers. Waipa currently has 4,388 sets of 11kV pole fuses in service. Figure 62 illustrates Waipa's drop out fuse age profile, with a wide range illustrating the ubiquitous nature of this asset.

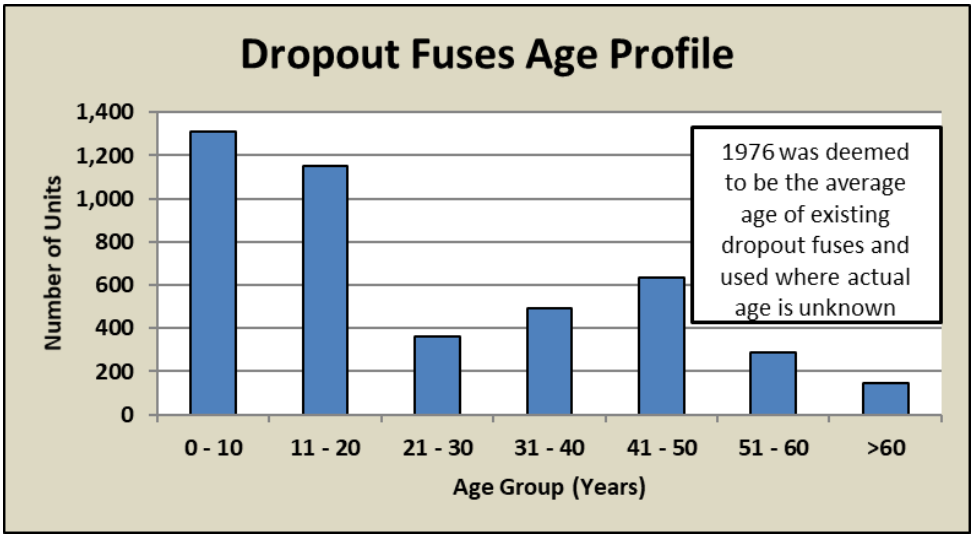


Figure 62: Drop out fuses age profile

Condition, performance and risks

Waipa has experienced a number of failures of ABSs, due to a range of failure modes as discussed above. The age profile and the age-based AHI of this fleet indicates that increased investment is due in this asset class. An ABS Fleet Asset Management Plan will be developed as part of the AMIP to better understand this fleet asset class and the expenditure profile required to reduce the failure risk, particularly in urban areas where public safety risk is higher and high SAIDI events would result from failures.

The older “Vulcan” drop out fuse sets comprise varnished paper insulating tubes and powder fuses which continue to deteriorate over time. Some newer sets were constructed using stainless steel brackets and galvanised nuts and bolts which have corroded and need replacing. Waipa will continue to replace these defective 11kV pole fuses with stainless steel assemblies when they fail in service and when they are identified as a defect during the programmed visual feeder asset surveys. A proactive programme to replace the powder fuse types prevalent in the Te Awamutu urban area has been programmed for the period 2020/21 to 2021/22.

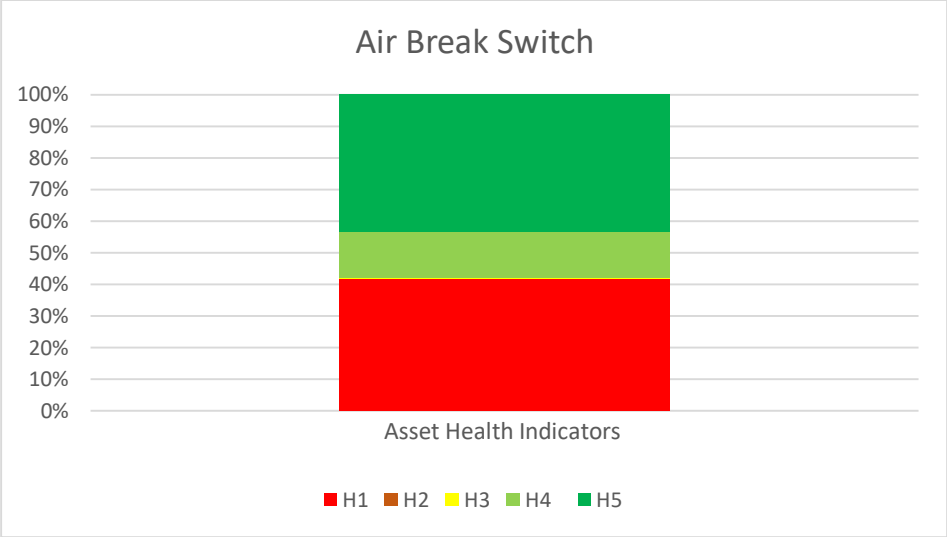


Figure 63: Air Break Switch age-based AHI

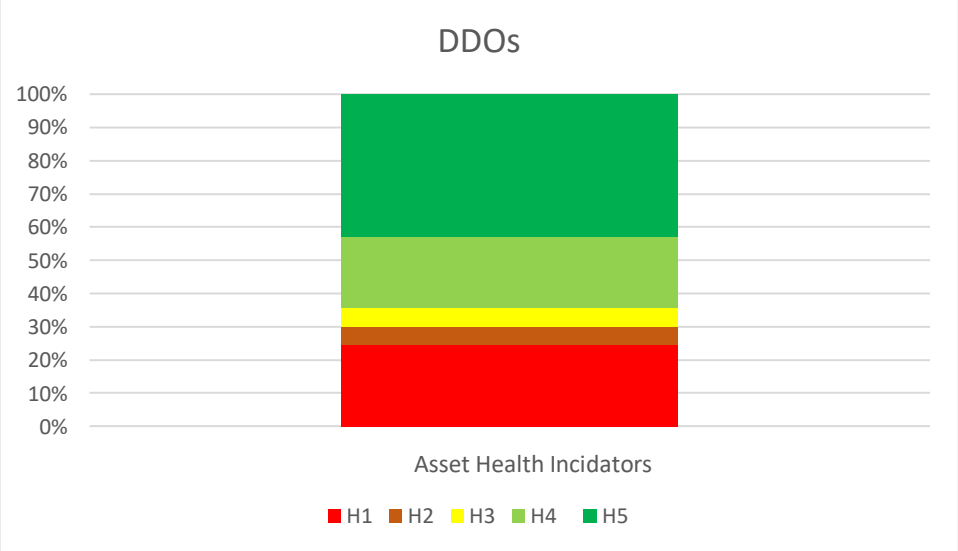


Figure 64: HV fuse age-based AHI

Design and construct

Waipa will generally use ABSs on distribution lines for:

- Sectionalising feeders to reduce outage impacts for construction, maintenance and fault work.
- Preventing ferro-resonance when installed at the overhead to underground interface.
- Normally open tie points within or between feeders.
- Bypass connections to facilitate maintenance of reclosers.

Waipa has successfully trialled G&W SF_6 disconnectors on the network over the past seven years. A recent cost review identified the Entec Ecoswitch with vacuum load break interrupters and solid resin insulation as being more cost effective than the SF_6 type. These types of disconnectors will be installed in place of air break switches in future, since the incremental capital cost is not large and enclosed load break switches are expected to be more reliable and have longer life with less maintenance costs. The ability to automate these switches to act as auto-sectionalisers or remote controlled open points provide a reliability improvement to the network.

Operate and maintain

Waipa does not undertake regular maintenance on the ABSs but the associated earthing systems are tested on a periodic basis.

Defect driven renewal replacement is the usual response to faults reported on ABSs when reported by field staff. Maintenance work is not considered economic given the often advanced age of the equipment.

Renew or dispose

ABSs are generally disposed of during the process of a line rebuild, or in the case of bypass ABS, when the primary equipment (recloser or voltage regulator) is being renewed. The new line will generally be specified with new ABSs located in positions appropriate to the new route configuration.

When a defective disconnector is identified, a review process is used to determine if the ABS disconnector is still required for network operations.

Reclosers

Fleet overview

Waipa Networks had 115 reclosers and sectionalisers in service to sectionalise the network for faults and limit the number of customers affected by network faults. A fleet asset management plan to better manage the planned replacement of reclosers is intended to be written as part of the Asset Management Improvement Plan (AMIP).

Populations and ages

Figure 65 summarises Waipa's reclosers and sectionalisers age profiles. This reflects the large installation programme of vacuum Noja reclosers installed over the last twenty years as a reliability improvement initiative. There are a small number of older devices on the network.

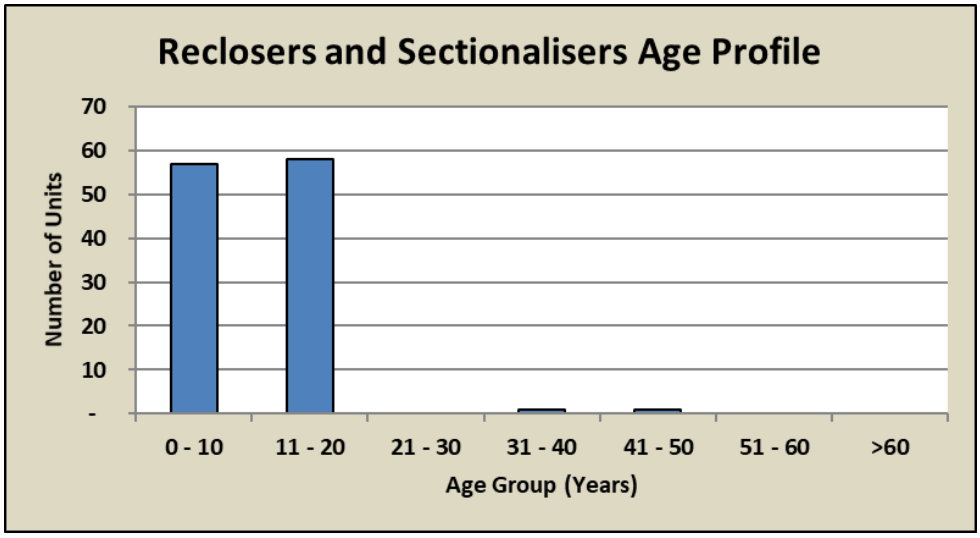


Figure 65: Reclosers and sectionalisers age profile

Condition, performance and risks

A summary of the age-based asset health profile for reclosers is summarised in Figure 66.

Because auto reclosers have a significant impact on network operations they will be inspected for control operation, external corrosion and damage every year. Repairs on existing Noja installations will be completed in a timely manner after deterioration is detected. Routine maintenance will be conducted in accordance with the manufacturer's recommendations and wear indication.

The small number of H2 condition scores reflects the satisfactory nature of our recloser fleet. Control unit failures and the unavailability of replacement parts is driving renewal of the control units. A programme of replacing RC1 control boxes with new RC15 control boxes will assist in maintaining the operation of the recloser fleet until ultimately the recloser circuit breaker units require replacement.

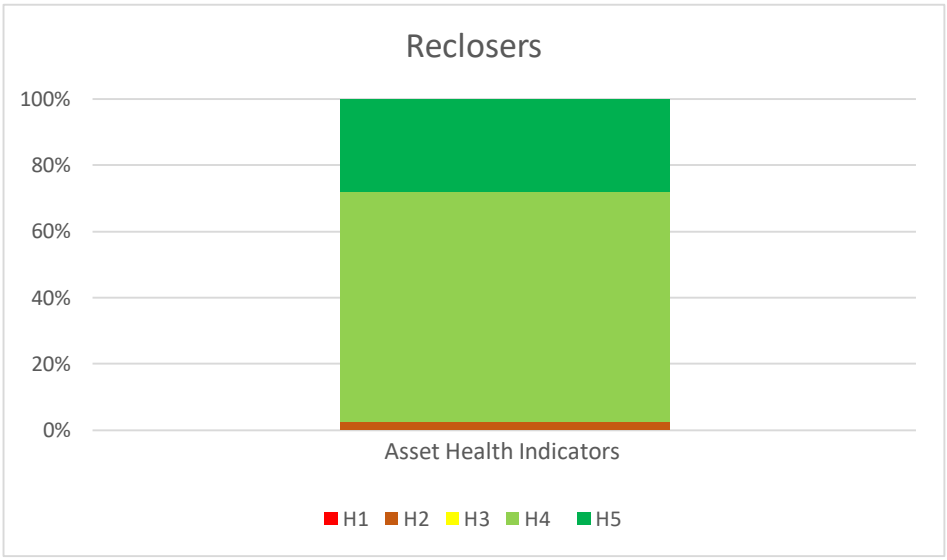


Figure 66: Recloser AHI

Design and construct

Reclosers are located in accordance with reliability criteria, to protect network sections containing 200 ICPs or 20km of distribution line. Positioning of reclosers considers operability and maintainability, to ensure ease of access to the site for field staff. Communications connectivity is a critical feature for new recloser sites because remote monitoring and control are important benefits gained from the installation of the recloser. Reclosers are also fitted with a backup battery system designed to provide eight hours of operability after loss of mains supply. Reclosers are installed with isolating links and bypass switches to facilitate maintenance.

Operate and maintain

Modern reclosers have online monitoring systems which reduces the requirement for site visits. Waipa is progressively rolling out remote engineering access for desktop maintenance and oversight of the control settings via the communications network. Visual inspections and battery checks are undertaken annually, with testing of the associated earth on a separate rotational maintenance programme with the rest of the feeder assets.

Renew or dispose

The fleet consists of vacuum reclosers, but older units suffer from issues related to poor coating systems and material selection that has caused corrosion. Control lead plugs are also prone to corrosion and deterioration. Control units deteriorate due to environmental factors including infestations of ants and age. A programme of replacement with a new controller while the recloser circuit breaker unit has remaining life is underway. This has the benefits of better protection functionality, monitoring and remote controllability as well as extending the life of the circuit breaker unit. The ability to remotely alter protection settings of reclosers is of particular benefit at times of high fire risk.

Replacement of a complete recloser unit is made on condition, with consideration given to reliability of the unit and the criticality of its location.

9.7 Earthing Systems

Fleet overview

Earthing systems provide three main functions:

- A voltage reference to earth for the power system.
- An effective fault return path, enabling protection to trip quickly.
- Reduce earth potential rise (EPR)[24] in the event of an earth fault on conventional circuits.

Every metal clad piece of network equipment that is installed at ground level or designed to be operated from the ground using uninsulated tools should be bonded to earth to protect both the public and Waipa's field crews from the risk of EPR.

As earthing systems may be shared between different assets at the same site and assets like transformers and switches may be replaced without affecting the earthing system, Waipa treats earthing systems as a separate asset class, with an associated programme of testing earthing effectiveness and undertaking repairs where required.

[24] EPR occurs when current returns via the earth rather than through a conductor. On conventional networks, this only occurs as intended through the earthing system at times of fault or when a conductor's insulation has failed.

Populations and ages

The age and population of earthing systems is not separately recorded. The age of the installation could be assumed to be that of the originally installed equipment, however over time earthing systems are upgraded if testing reveals high results, or the primary equipment is replaced.

Condition, performance and risks

Historically, Waipa has taken a conservative approach to the electrical requirements of earth grids and has ensured minimum regulatory requirements are met. Earthing systems are regularly checked. Overall, it can be said Waipa's earthing systems are in a good condition, however there are locations where dry or sandy ground conditions limit the performance of the earthing system.

From a materials perspective, the soils around Waipa's are generally benign. However, corrosion of earth grids, particularly older connection types has been observed. Testing of earth grids is considered to be the best renewal strategy for this asset class.

The most common cause of earthing system defects is from civil or horticultural conversion works on the land causing damage where the earthing system is located. To assist in preventing this Waipa has begun showing earthing zones around assets when underground service drawings are requested.

The EEA's Guide to Power System Earthing assesses the risk associated with an earthing system's EPR with a probabilistic methodology. This takes into account:

- The probability of human exposure to an EPR hazard at the site.
- The probability of an EPR event occurring.

Waipa will ensure that all its system earthing and bonding comply with AS/NZS 3000:2007 earthing standards and NZECP 35 New Zealand Electrical Code of Practice for Power System Earthing to ensure that Waipa personnel, contractors and the public are safe from "step and touch" potential rise. During 2021 Waipa will complete an external review of earthing design practice in line with the EEA earthing practice guide to ensure best practice is being followed.

The earth testing and repair programme is based on an even spread of earth banks requiring testing each year. The programme results in each system earth being checked every 8 years.

Waipa has experienced a growing number of copper earth thefts consistent with recent industry trends. Stolen copper earths are replaced immediately once they are discovered. Waipa is investigating alternative materials for earthing that will have a lower scrap value.

In 2011/2012 Waipa began installing Copper Clad Steel Conductor on new sites in vulnerable areas and replacing stolen copper earths with Copper Clad Steel Conductor.

The cost of installing Copper Clad Steel Conductor earths is comparable with pure copper earths, but has significantly lower scrap value. Freshly cut Copper Clad Steel Conductor is visually similar to pure copper conductor and is likely to be identifiable by scrap metal dealers only, which it is hoped will act as a deterrent to thieves.

Progress against targets for Waipa's 2020/21 earth testing and repair program is shown in the following table.

Table 48: Earth testing and repair programme progress

Earth Testing and Repair	Proposed 2020/21	Actual 2020/21
Pirongia	2nd Test & Repair	28 of 28 modules completed
French Pass	2nd Test & Repair	43 of 45 modules completed
Kawhia	2nd Test & Repair	61 of 61 modules completed
Roto-o-rangi	3rd Test & Repair	26 of 39 modules completed
Kiokio	2nd Test & Repair	1 of 37 modules completed
Waikeria	2nd Test & Repair	0 of 15 modules completed

Waipa completed 48% of its earth testing and repair program for 2020/21, after completion in prior years on partly completed feeders had been taken into account. Where a small number of modules remain on a feeder, this means that all testing has been completed and a small number of earth repairs remain for completion. The feeder is not marked as complete until all repairs have been completed. Focus in FY2020/21 was largely successful in closing out the outstanding repairs as well as progressing the earth testing programme. In FY2021/22 the focus has been divided between resolving earth repairs and maintaining progress on testing.

Design and construct

Waipa has a series of standard earthing designs for various asset classes. These are being externally reviewed in 2022 as discussed above. There are areas in Waipa's where the soil resistivity is not ideal for the construction of earthing systems. Waipa mitigates this risk by driving additional earth rods deeper than normal and stepping out more rods, as well as using conductivity enhancers around the earthing conductors.

Operate and maintain

The resistance of earthing systems is periodically tested at eight yearly intervals. The need for corrective maintenance is driven by the earth test results.

Emergency repairs are also made after damage by external parties.

Renew or dispose

Earthing systems are not generally renewed on age criteria but are improved or added to if the performance of the earth is subject to deterioration. The latter is determined by testing or effecting reinstatement after damage has occurred. In some cases, there may be a safety reason to rebuild the earthing system to improve the EPR exposure at the site.

Disposal of an earthing system may occur when an entire site is decommissioned – generally due to asset relocation.

Distribution earthing systems renewal forecast

Earthing systems are incrementally maintained rather than renewed. No capital expenditure is allocated against this fleet strategy.

9.8 Secondary systems (assets)

Asset management objectives

Secondary systems (such as protection systems) are a critical part of operating a safe and reliable electricity network. Their useful lives can be shorter than assets in other areas due to ongoing improvements in technology and a commitment to continually improve the performance of the network to meet reliability requirements. Assets in this class are growing in complexity due to the uptake in “smart grid” applications and typically have to be considered in conjunction with the operation of a number of network components.

Protection assets ensure the safe and correct operation of the electrical network. They detect network faults and operate circuit breakers to prevent harm to the public and staff, or damage within consumer installations or to network assets. In Waipa’s case the protection assets are associated with recloser and sectionaliser control, since as yet there are no zone substation or sub-transmission protection assets. The SCADA and communications assets provide network visibility and remote control, allowing Waipa’s operators to operate the network with a greater level of efficiency.

SCADA and communications

Fleet overview

The system has been designed to allow monitoring and remote control of devices in the network, including reclosers, sectionalisers, voltage regulators and the load management system.

A central server communicates with remote terminal units (RTUs) over UHF and VHF radio communications. The RTUs then interface with network equipment such as recloser control systems. DNP3.0 is Waipa’s standard communications protocol for RTUs, however, DNP is not fully utilised directly due to bandwidth limitations and this is being currently managed by converting DNP points to another proprietary protocol before being sending it out to the SCADA hub.

The communications network carries Waipa's SCADA system traffic as well as voice systems. Waipa's communications network consists of different data systems and physical infrastructure, including fibre optic circuits, UHF point-to-point digital radios, microwave point-to- point digital radios, point-to-multipoint UHF repeaters and cellular/ADSL circuits.

The communications fleet also covers the infrastructure that houses communication systems, including masts, huts, cabinets and RF equipment.

The SCADA system has been operating for approximately 20 years

The expansion of the SCADA coverage area has enabled the connection of a number of reclosers to Waipa's SCADA system, and this is continuing to be expanded to allow more automated devices thus enabling future application of network wide loop automation schemes.

Condition, performance and risks

The centralised SCADA system has had the following upgrades and enhancements in the last three years:

- Waipa replaced the PCs at Te Awamutu control room with two high performing new PCs. These new PCs host Master and backup SCADA.
- The software on these new PCs has been upgraded to Powerlink 3.80 (from 3.74) to provide better reliability and performance.
- Added three licenses for Abbey secure link client which allows Waipa engineers, faults and technical people to remotely view and monitor our remote devices in real time.
- Installed two SMS modems which automatically sends out text messages to our faults team and engineers for any critical alarms or events.
- As part of the upgrade and to enhance our SCADA capability further, Waipa also installed a second SCADA gateway and a new UHF radio.
- The SCADA system has been separated from the corporate IT system and improved cyber security measures have been implemented. Further cyber security review is underway in 2022.

The SCADA system remote terminal units fitted to various voltage regulators, 11kV auto reclosers and automated air break switches on the distribution network will be replaced as required.

Radio Network Communication Assets

Replacement of obsolete analogue repeaters and all analogue radios due for replacement with digital units was completed in 2019/20.

Waipa intends extending its analogue data radio network used by SCADA to communicate with remote terminal units for reclosers, voltage regulators, automated ABS and Transpower GXPs. This network currently manages 200 sites and was constrained prohibiting the connection of 12 new reclosers in 2015/16 and future additions. To overcome this Waipa installed another analogue data channel and reallocated a proportion of CBG RTUs including the CBG GXP RTU, and upgraded the existing Abbey SCADA serial Modulink communication modules with a new digital IP gateway communication module.

The key perceived risk from the SCADA system is the loss of network visibility and control. Waipa prefers to operate equipment remotely for a number of reasons, including safety, speed of operation and improved operator feedback. Enhanced status information from the field through the use of SCADA minimises outage durations and requires less staff on the ground and achieves faster response times.

A significant risk is a cyber-attack on the SCADA system where a party gains control of devices or blocks Waipa from controlling them. The increasing risk of a cyber-attack on Waipa's network requires ongoing vigilance and improvement to the security levels of Waipa's SCADA system, that are underway as noted above. The potential safety, reliability, cost and reputational consequences from an attack on the system is increasingly serious.

Design and construct

The latest standard RTU and recloser protection relays that are being installed provide remote engineering access. This allows technicians and engineers to access information remotely removing the need to download the data at the site. This reduces the time required to understand and react to a fault. A pilot installation on the APL and Cambridge North remote controlled RMUs was completed in 2019/20. Further extension of remote engineering access is on hold, as it is expected that the investment in the communications network will allow engineering access without additional field devices.

Operate and maintain

The SCADA system is continuously monitored through self-checking systems and a third-party monitoring system. The communications network is part of this monitoring system and alerts operators to communication failures or overloaded networks. Waipa's preventive maintenance schedule is outlined in Table 49.

Table 49: Maintenance schedule for SCADA and comms equipment

Asset type	Maintenance description	Frequency
Communications equipment	Visual inspection of radios, switches, antennas at automated devices and radio sites.	Yearly
SCADA master station	Software upgrades, database checks	3 monthly
SCADA master station	Hardware upgrades follows IT server replacements	5 Yearly

Renew or dispose

Securelink is a remote access software suite for Abbey's SCADA Aspex. Budget was allocated for 3 securelink software packages which includes test master to provide the ability to view, test and check real time data. The data includes network status, current and voltage data, trends, and any alarms or warnings that may be active. This part of the SCADA improvements project has been completed in 2018/19.

A project to interface the Waipa Networks Abbey SCADA system to the WEL GE Power-on SCADA system was completed using OPC server.

SCADA display and control will be required for the Cambridge Non-network Capacity Support project to provide control and visibility for the distributed generation, demand response and distributed energy resources required by that project. This will be achieved using the network connection recloser. Inspection of individual generator unit status will be via remote access to the proprietor's control system.

Load control relays

Fleet overview

Waipa operates a ripple control system for peak lopping of system load at certain periods of the year. Waipa owns all the ripple relays installed at ICPs on the network. In compliance with the Electricity Participation Code 2010 a provision has been made for the 10-year inspection and recertification of Cambridge ripple relays. A similar provision has also been made for the inspection and recertification of Te Awamutu ripple relays commencing in 2022/23.

Populations and ages

Cambridge Ripple Injection Plant

Waipa installed a new 283Hz Enermet static ripple injection plant in 1999/2000 to avoid propagation problems when the Cambridge GXP transformers were upgraded from two 20MVA to two 40MVA in July 2002. The Cambridge ripple converter panel failed in service in 2020 and has been replaced with a new converter panel.

Waipa has retired the new 297Hz coupling cell at Te Awamutu. In 2015/16 a project was completed to retune this coupling cell to 283Hz and use it to replace the existing 283Hz coupling cell at Cambridge which is nearing its full capacity. The recovered Cambridge 283Hz coupling cell will be scrapped as the intended use (Ngutunui 110/11kV point of supply) is no longer on the expected development path.

Te Awamutu Ripple Injection Plant

In 2007/08 Waipa installed a new 283Hz Enermet coupling cell for the Te Awamutu relay change programme and a new 297Hz Enermet coupling cell to replace the old 297Hz Landis and Gyr coupling cell.

All the existing 297Hz relays in the field have been replaced with new 283Hz ripple relays thus avoiding further degradation of signal strength for correct relay operation.

The Te Awamutu ripple converter panel was of a similar age and condition as the failed Cambridge panel, so it was replaced with a new converter panel in 2020/21.

Condition, performance and risks

Each GXP has one 283Hz ripple controller available for service. Should this fail, control signals could not be provided. The Cambridge ripple plant has two supply connections, one off each 11kV bus section so can still be operated in the event of a half switchboard outage.

The Te Awamutu ripple plant has a single supply connection, but there is a project for completion in 2021/22 to provide a second connection. Unavailability for service of the ripple plants will put Waipa at risk of exceeding the load target during shedding periods and risking load shedding should there be a coincident Transpower outage.

Waipa holds parts and the decommissioned ripple converter panels that can be used as a failure replacement, but due to the age of the equipment it may not work when called upon. A service agreement that provides annual condition monitoring and access to a contingency spare replacement converter panel and other strategic spares was entered into with Landis and Gyr. This should enable major faults to be rectified within 48 hours provided the failure was not catastrophic or involved the primary reactor or capacitor plant.

Design and construct

Waipa intends to continue with the existing frequencies.

Operate and maintain

Regular inspection and testing of the ripple injection system assets is undertaken to ensure their continued and reliable operation. The preventive maintenance schedule is outlined in Table 50.

Table 50: Maintenance schedule for load control relays

Maintenance description	Frequency
Onsite testing and physical inspection of ripple plant.	Yearly

Renew or dispose

The recent replacement of both ripple converter panels means that this asset is not expected to have renewal requirements in the term of this plan. In the absence of other technology developments, the ripple control system will be renewed to maintain this load management capability.

9.9 Non-Network assets

Information systems

Waipa has extensive IT systems which are critical to supporting the everyday business needs. IT systems cover all aspects of the business - payroll for staff, asset data management, monthly billing, GIS viewers, financial information, purchasing and stock, scheduling and estimating of work, storage of electronic files, and running engineering analysis of capacities and loads on the network for example – all related directly or indirectly to achieving Waipa's asset management objectives.

Waipa's IT infrastructure is generally managed by the Data and Information team. External consultants are engaged at times to assist the IT team as and when specific advice and input is required.

IT-related assets such as computer hardware and software have relatively short lifespans as new and improved technologies become readily available.

Waipa's forecast IT related capital expenditure is summarised in the regulatory schedule Report on Capital Expenditure (11a) which can be found in Section 12.

Vehicle fleet

Description

Waipa owns and manages a significant vehicle fleet across the business (including the contracting division). Vehicles are an essential asset to enable and facilitate Waipa's activities and to meet Waipa's asset management objectives. Waipa's vehicle fleet as at February 2021 includes:

- 28 utility vehicles (utes).
- 13 trucks (including crane, bucket and tipper trucks).
- 10 light vehicles (cars and SUV).
- 2 forklifts.
- 3 diggers/trenchers.
- 12 other (chippers, trailers etc).

When procuring vehicles, Waipa considers safety, environmental impacts (including fuel efficiency and electric or electric/hybrid motors if appropriate) and operational requirements (i.e., suitability for intended use).

Waipa's vehicle procurement policy is reviewed and updated when deemed necessary. The policy has developed to include greater focus on procuring vehicles, where appropriate, that are fully electric, or electric hybrid where the capital costs of doing so are not excessively higher.

Management

Records of Waipa's vehicles are maintained in the financial management system, the Smartrak fleet management and GPS tracking system and spreadsheets. Vehicles are split into various classes and categories, and relevant attributes are recorded against each vehicle. The records allow easy visibility and tracking of when maintenance activities are required against each vehicle.

Waipa's vehicles are regularly maintained to ensure operational effectiveness and to minimise the potential for componentry failure which could contribute to an accident or lessen reliability.

Waipa's utility vehicles (especially fault utes) travel the greatest distances. These vehicles are typically replaced between three to six years depending on the make and models, distance travelled and performance. Older fault vehicles are cascaded down the fleet to lower mileage roles to maximise utility from the asset before disposal. Other vehicles are replaced on a case-by-case basis.

Forecast costs

The expenditure on vehicles for FY2021/22 is high due to the purchase of more than typical numbers of light vehicles; a cable jointing van, six utes, one four wheel drive with an EWP and two trailers. Vehicle expenditure is forecast to remain generally at average levels over

the planning period. The annual expenditure on vehicles will be reviewed and any adjustments to forward forecasts will be made as appropriate, i.e., reflecting any changes in Waipa's vehicle requirements to support asset management objectives.

Buildings and land

Waipa owns and maintains non-network property and buildings, including the main office building and depot in Te Awamutu. This houses engineering, network, financial, commercial and corporate services staff. Waipa's contracting business (both the network lines and Waikato Tree Services for vegetation management) is located there and it comprises, electrical workshop, stores warehouse, plant and vehicle sheds, hazardous goods store and the yard housing materials and equipment. Contracting staff, including management, supervisors, engineering, design estimators, fault crew and administrative support staff are also based there.

Operations are being constrained by space due to equipment for renewal and expansion works (e.g., reclosers, voltage regulators and distribution transformers). There is insufficient bunded area for storage of transformers. An off-site storage area is being developed at 220 Racecourse Road, on land purchased next to the Te Awamutu GXP site.

Other non-network renewal forecast

Other non-network asset capital expenditure will cover plant, tools and equipment, and office and IT equipment. Expenditure for these assets is presented within the regulatory schedules in Section 12.

9.10 Operational expenditure

Overview

Operational expenditure (opex) includes work on the network such as restoration of network outages, inspections of assets, and vegetation management as well as non-network support activities, corporate and administrative costs, and vehicle operation costs for example.

Maintenance work on the network is split into reactive (reacting to network outages and incidents, repair to assets, or to make sites safe) and scheduled or planned maintenance (preventative and corrective). Routine and corrective maintenance and inspection includes visual surveillance of the network (e.g., wood pole inspections), corrective maintenance of survey defects, earth testing and other proactive maintenance on defects as found before failure. Corrective maintenance budget was reduced, as the policy has been changed from 2021/22 to capitalise the replacement of individual poles, pole top hardware and LV pillars, as a new asset is being created.

Waipa's opex is outlined in the following subsections. Further detail on the planned maintenance regimes can be found in Sections 6.5 to 6.7.

Vegetation management (network)

Details on Waipa's vegetation management strategy is presented in Section 6.6.

Up until 2016/17 the vegetation programme was based on even spread of kilometres of line being surveyed and historical incidents of tree interference each year. The programme

results in each feeder being systematically cleared every 8 years. However, indications from the amount of reactive tree trimming required outside of the programme and reliability issues caused by tree faults were that the vegetation management expenditure was not sufficient for the high tree growth rates experienced.

As a result, the annual expenditure on vegetation management was increased from $500k to $1,000k from 2016/17, and resourced by an expansion of Waipa's internal vegetation management team, augmented by contractors where required. At this level of expenditure, a six-year rotational trimming programme is planned and is expected to reduce the volume of reactive trimming required over time.

The tree legislation requiring EDBs to offer tree owners a 1st free cut then on the second cut the landowner meets the costs has resulted in an increasing number of trees being declared "no interest" by landowners on the second cut. At that point Waipa has a preference to completely remove the tree at our cost to avoid future issues rather than trimming the tree. The cost and time taken to remove a tree exceeds that taken to trim it and reduces the amount of network that can be cleared of trees without an increase in resources. Removal has proven to be more costly and time consuming than trimming. However, Waipa believes vegetation removal is a better long-term solution for improving network reliability.

It is clear from experience over three years with the new rotation programme, that there is more vegetation maintenance required than we have budget or resources for. There is a combination of reactive trimming on other-than-programmed feeders, and more trimming on the programmed feeders than originally estimated. Hence the AMP programme was revised from the 2020/21 year to a six-year rotational trim.

With the completion of the LiDAR aerial survey in 2021, comprehensive data on vegetation encroachment has been obtained for the entire network by mid-year. This will allow a completely risk-based approach to vegetation management to be applied, selecting the vegetation encroachments to trim based on criticality related to reliability exposure as well as operating experience of vegetation risk in different areas of the network. It is expected that this new approach will maximise the effectiveness of the vegetation expenditure in terms of reducing vegetation faults and the consequential reliability impact.

Hence the rotational trimming programme will be suspended while this new approach is trialled. At this point it is expected that ongoing LiDAR surveying for network conductor ECP 34 clearance monitoring will be required every five years. This is an extended interval between surveys for vegetation management. Therefore, the approach to vegetation surveying will be determined over the next several years as the new regime is evaluated.

Asset replacement and renewal (network)

This section of expenditure covers expenditure on transformers, voltage regulators and switchgear, including removal and relocation of assets, replacing of components and refurbishment of voltage regulator cans.

The amount forecast is based on historical levels of expenditure.

Systems operation and network support (network)

This expenditure covers contract services for network control and fault call answering services, temporary disconnections, voltage checks, switching and SCADA and load management.

Systems operation and network support (non-network)

This section of expenditure covers a range of management activities of the network. Some of the more significant activities falling under this section include:

- Policy, standard and manuals development and management.
- Outage recording and data management.
- Data recording and management, support (administration) and management of IT systems (including GIS, SCADA, equipment records and others).
- Asset management planning, load forecasting, network modelling, engineering design, technical advice, procurement, contract and inventory management, (excluding project costs capitalised).
- Health and safety, environmental and quality management.
- Training.
- Easements (creation of new and management of existing).
- Vehicle operation and management (maintenance).
- Consumer enquiries, records and other activities.

Business support (non-network)

This section of expenditure covers corporate activities including:

- CEO and director costs, legal services, non-engineering/technical consulting services.
- Commercial activities including pricing, billing, revenue collection and marketing/sponsorship.
- Compliance related activities (finance and regulation).
- HR and training (non-operational).
- Property management.
- Support services such as IT, secretarial etc.

Structural changes to this support function are forecast for 2022/23, related to increased promotions for community engagement.

10. Expenditure forecast

10.1 Overview

Assumptions on cost inflators

Waipa faces cost pressures from a number of sources, including labour, fuel, construction costs, and international commodities such as copper and aluminium. Exchange rates will also impact on the final prices Waipa pays for many inputs that are utilised into its business. Escalation in these cost drivers has not been included in Waipa's estimation of the nominal values of its cost forecasts over the planning period, but could be material in future years.

Rather than taking an overly complex approach to escalate expenditure forecasts from constant to nominal dollars given there are large inherent uncertainties, Waipa has instead applied an index based upon a long run CPI rate of 2%, consistent with the Reserve Bank of New Zealand's mid-point target.

This is a relatively straightforward approach and is considered unlikely to be materially different from an approach using a combination of Labour Cost, Producer Price and Capital Goods Price indices.

10.2 Capex

Waipa's capex is charted in Figure 67 over the period FY2022/23 to FY2031/32 (forecast). Values are expressed in constant prices dollars. A tabular presentation of the capital projects proposed is provided in Section 11.5 Appendix E. The ten-year forecast table is provided in Section 11.6 Appendix F.

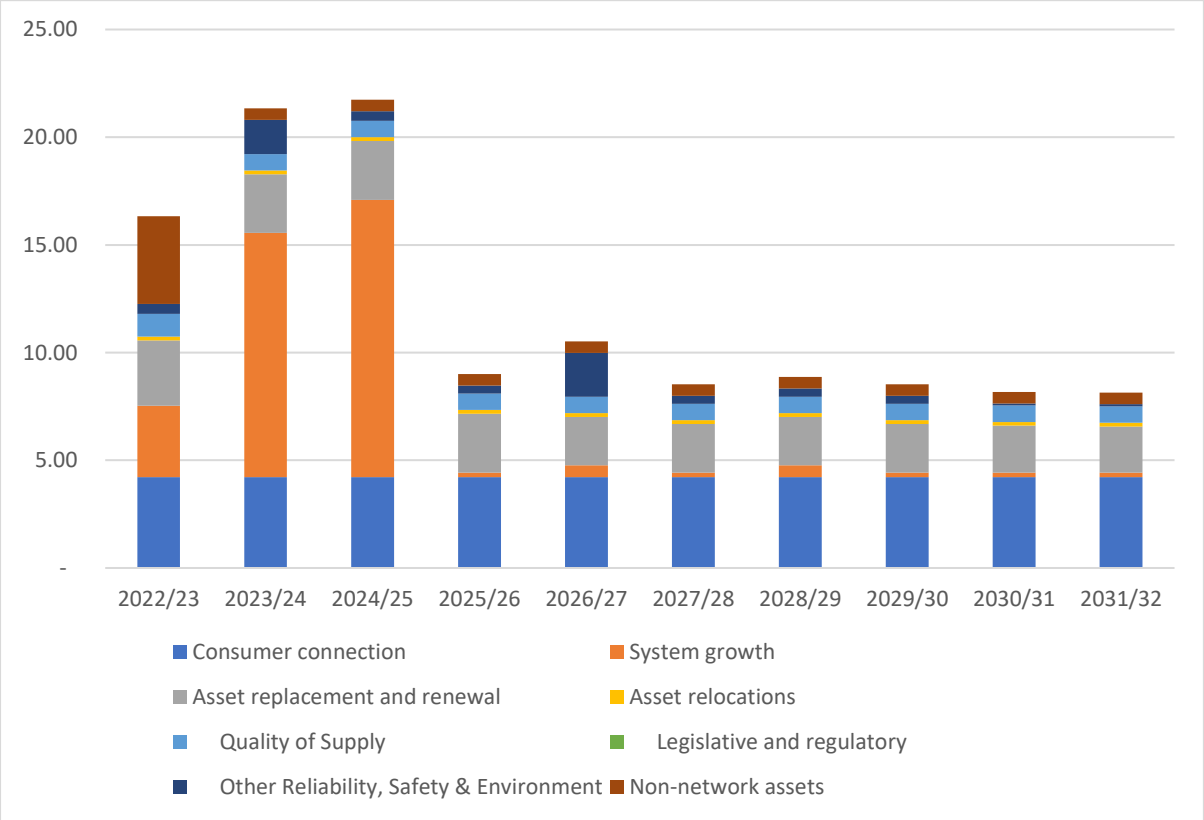


Figure 67: Summary of forecast capex ($m) by primary driver

This shows the network capex forecast increasing significantly in the first three years of the period from the normal level of $7-9m per annum. This reflects Waipa's expenditure on:

- Sub-transmission and zone substation investment in Cambridge to meet load growth and overcome network constraints. Any expenditure to meet load growth in Te Awamutu has been removed until the area development plan has been confirmed.
- Significant updates to information systems in the first three years of the period (categorised as Non-network assets) to replace out of date legacy systems and assist in efficient operation and asset management to meet modern regulatory and business requirements.

- Capitalisation of individual pole, pole top hardware and pillar replacements, previously this expenditure was treated as opex.
- Investment in communication system improvements, this is subject to a review of the benefits of migrating the SCADA communications to a digital radio network.

A further comparison between this ten-year capital forecast and the 2020/21 capital forecast is provided in Table 51 below. This quantifies the differences in the capital forecast, related to the factors listed above.

Table 51: Comparison between FY2020/21 and FY2021/22 10-year total capex forecasts

10-Year Capital Expenditure Forecast	2021/22	2022/23	inc/dec	%
	$k	$k	$k	
Consumer connection	37,380	42,180	4,800	11%
System growth	80,828	29,693	- 51,135	-172%
Asset replacement and renewal	23,620	24,501	881	4%
Asset relocations	1,780	1,780	-	0%
Reliability, safety and environment				
Quality of Supply	7,481	7,951	470	6%
Legislative and regulatory	-	-	-	
Other Reliability, Safety & Environment	5,192	6,214	1,022	16%
Total Reliability, safety and environment	12,673	14,165	1,492	11%
Expenditure on network assets	156,281	112,319	- 43,962	-39%
Non-network assets	8,148	8,888	740	8%
Expenditure on assets	172,433	121,207	- 51,226	-42%

Contribution to drivers

For accounting and regulatory disclosure, system capex projects and programmes are allocated over the eight regulatory categories.

Accounting allocation is against the category most applicable to the works expenditure. However, in most cases any particular project will impact across multiple objective drivers. For example, a line renewal may be driven by the age and condition of the line and therefore be allocated to replacement and renewal, but renewal will also impact the line reliability and safety implications from avoided faults. Generally, capital is allocated to the largest driver.

Line breakdowns of the capital expenditure are provided in Appendix E (project level) and the regulatory schedules included in Section 12 (regulatory category).

10.3 Opex

Waipa's opex forecast is discussed in section 9.10 and charted in Figure 68 for the period FY2021/22 to FY2030/31 (forecast). A tabular presentation of the ten-year forecast is provided in Section 11.7, Appendix G.

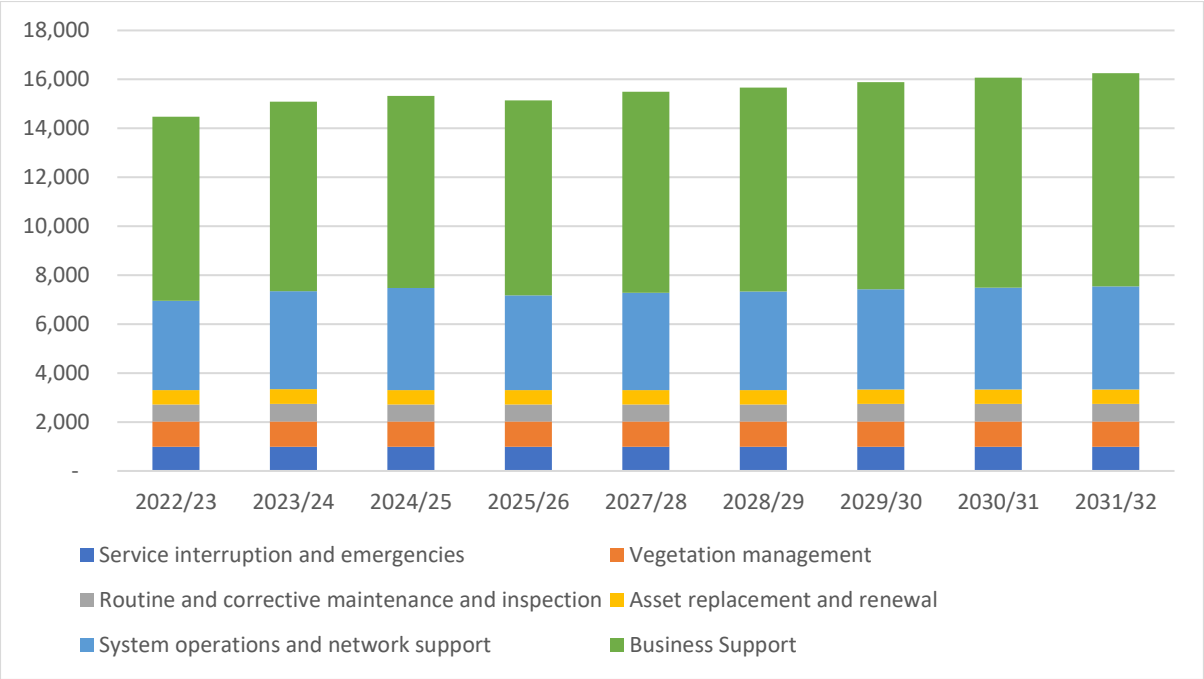


Figure 68: Summary of forecast opex (constant prices $000)

Network expenditure has been adjusted in recent years to match expected levels of activity in faults, corrective maintenance and asst replacement and renewal etc. This expenditure is expected to be relatively constant over the period in real terms. There is potential for more planned maintenance routines for zone sub-stations to increase costs in the second half of the period, this will be assessed in more detail in future.

At a high-level Waipa is seeking to hold non-network expenditure increases to a minimum where possible. However, the ADMS roadmap results in a step change in software licencing costs that ramps up to circa $1m per annum over the first three years of the plan. Additional staff to assist in operational delivery, increased resources in health and safety management and engineering for technical and asset management improvements also add to operational costs compared to levels seen in 2020/21. Waipa will be seeking to advance its asset management capability to make the best use of systems and processes and optimise future expenditure and network performance.

Movements in operational expenditure between FY2021/22 and FY2022/23 by category are shown in Table 55. This shows reductions in routine and corrective maintenance via transferring replacement of defected individual poles and pole top hardware to asset renewal capex and reducing the budget for inspections of ground mounted transformers and ring main units. Asset replacement and renewal opex is increased related to more inspection and maintenance of pillars. Significant increases in business support results from additional staff and promotions related to community engagement.

Table 52: Annual operational expenditure changes from FY2020/21 to FY2021/22

Annual Operational Expenditure	Change $k
Service interruption and emergencies	-$ 9
Vegetation management	$ 3
Routine and corrective maintenance and inspection	-$ 360
Asset replacement and renewal	$ 72
	$ -
Network Opex	-$ 294
	$ -
System operations and network support	$ 166
Business Support	$ 2,320
	$ -
Non-network Opex	$ 2,486
	$ -
Operational Expenditure	$ 2,192

10.4 Capex/opex trade-off

Some works, such as remote-controlled network switches, will reduce the need for manual switching and hence may reduce operational costs marginally. However, the capital programme set out in this plan does not encompass productivity improvement projects of any significance that would see an offset in opex costs. Waipa will always seek opportunities for productivity improvement but in this current round it has not identified projects that net benefits above costs in this area.

10.5 Capacity to deliver

The expenditure levels forecast in this AMP represent a significant change in capital due to customer growth in the development of the Cambridge sub-transmission network. Waipa Networks foresees no significant issues in managing and achieving the outcome expenditures set out in this plan related to normal operational and capital activities. The delivery of the planned 33kV sub-transmission and zone substation projects in Cambridge do pose a delivery challenge related to securing the internal and external resources required. Waipa will complete project planning in the coming year to test and develop how delivery of these large projects will be achieved.

Waipa has its own in-house contracting division that completes most of the maintenance, vegetation management and replacement upgrades on our network on a cost basis. Waipa utilises external resources as necessary to manage the peak workload. Examples of the use of external resources in recent years include:

- Undertaking packages of lines defect maintenance work.
- Installation of long 11kV cable installations, for example the St Kilda feeder cable, the APL feeder cable and the Waikeria project feeder cables.

Waipa believes maintaining its own contracting division enables it to maintain the resources it requires to manage and retain key staff and maintain standards and quality of workmanship. This approach also means it has control of the size of the workforce available to it and ensures the work plan can be delivered. It is doubtful given the small scale of work available in the Waipa network area and the travel costs for external contractors, that a competitive external contracting environment could be maintained.

Related to the delivery of the major sub-transmission and zone substation works forecast in this plan, project planning is underway to form an approach for the delivery of the design, procurement, construction and commissioning phases of the Cambridge sub-transmission projects. That project will be externally designed using a recognised industry design consultant, and competitively tendered for construction works for the 33kV sub-transmission cables and zone substations.

The concept plan for the Te Awamutu sub-transmission and zone substation project will be further refined in 2021, with engagement with Transpower regarding the available transmission capacity, and the GXP upgrade project. The network concept plan will explore circuit route selection, zone substation site options and the distribution network integration to ensure the scope has been well defined before proceeding to more detailed design and cost estimation.

11. Appendices

11.1 Appendix A: Network Feeder Asset Attributes (as at 31 March 2021)

TPNZ CB	Feeder type	Waipa Feeder Assets	Total 11kV km	Overhead 11kV km	Underground 11kV km	Total 400V km	Overhead 400V km	Underground 400V km	Number concrete poles	Number wooden poles	Number transformers	Transformer capacity kVA	Number ICPs
C2702	rural	Roto-O-Rangi	71.05	62.37	8.68	40.61	23.07	17.54	1,001	187	218	12,540	1,396
C2712	urban	Cambridge North	12.82	0.53	12.29	20.09	0.45	19.64	16	1	27	6,660	894
C2722	urban	Cambridge Town	11.06	3.15	7.91	20.14	4.69	15.45	167	27	49	14,151	1,109
C2732	rural	Kaipaki	42.22	35.82	6.40	26.84	17.54	9.30	618	68	142	16,336	681
C2742	rural	Pencarrow	51.39	37.44	13.95	37.72	15.31	22.42	688	64	193	17,276	1,023
C2762	rural	Hautapu A	6.97	5.78	1.18	0.08	0.00	0.08	44	1	0	0	0
C2772	rural	French Pass	81.09	74.34	6.75	40.46	26.43	14.03	1,076	202	270	14,398	1,030
C2802	urban	Leamington	21.45	11.52	9.93	42.40	14.88	27.51	395	101	58	11,530	2,392
C2812	rural	Hautapu B	7.59	5.81	1.78	0.00	0.00	0.00	48	0	-	-	0
C2832	urban	Cambridge East	14.67	6.53	8.14	38.77	16.00	22.77	392	135	37	8,350	1,964
C2842	rural	Tamahere	41.20	25.42	15.78	22.90	10.22	12.68	447	68	118	9,482	676
C2852	urban	St Kilda	47.67	35.49	12.18	27.44	11.03	16.41	547	63	159	11,623	849
C2862	rural	Monavale	45.62	34.29	11.32	28.64	10.63	18.00	590	28	170	15,211	1,140
C2872	urban	APL	6.55	0.00	6.55	0.00	0.00	0.00	0	0	1	100	0
		Subtotal	461.34	338.50	122.84	346.08	150.26	195.82	6,029	945	1,442	137,657	13,154
T0022	rural	Kawhia	198.93	195.82	3.11	54.76	43.23	11.53	2,375	175	301	12,503	1,341
T0023	rural	Kio Kio	91.11	89.07	2.05	38.66	33.98	4.69	1,488	13	253	11,245	803
T0024	urban	Te Awamutu West	20.94	15.03	5.90	46.85	18.70	28.15	450	88	61	9,695	2,081
T0025	rural	Pirongia	65.39	59.83	5.57	50.54	29.83	20.71	992	38	178	12,366	1,476
T2762	rural	Pukeatua	144.05	139.29	4.76	52.13	46.95	5.18	2,268	30	341	15,927	1,066
T0027	rural	Paterangi	102.80	100.70	2.10	49.52	44.25	5.27	1,716	25	263	13,212	911
T0029	rural	Waikeria	21.85	20.96	0.89	11.84	8.68	3.16	375	8	64	6,956	436
T2742	rural	Kihikihi	35.62	33.18	2.45	38.44	27.48	10.97	831	79	93	9,275	1,682
T2752	rural	Mystery Creek	42.17	40.91	1.26	21.75	18.05	3.70	700	18	105	6,675	529
T0026	urban	Hairini	24.87	19.42	5.45	34.32	13.32	21.00	403	40	79	12,260	1,487
T2782	urban	Fonterra A	2.00	0.00	2.00	0.00	0.00	0.00	-	-	-	-	-
T2802	urban	Fonterra B	2.04	0.00	2.04	0.00	0.00	0.00	-	-	-	-	-
T2822	rural	Ohaupo	44.03	41.73	2.31	30.77	22.95	7.82	827	13	109	7,665	827
T2832	urban	Te Awamutu East	6.08	3.24	2.84	16.64	4.33	12.31	108	37	27	8,000	965
T2842	rural	Pokuru	131.53	130.60	0.93	44.78	43.00	1.77	1,997	28	304	15,280	962
		Subtotal	933.41	889.77	43.64	491.00	354.74	136.25	14,530	592	2,178	141,059	14,566
		Total	1,394.75	1,228.26	166.49	837.08	505.00	332.07	20,559	1,537	3,620	278,715	27,720

11.2 Appendix B: Voltage Regulator Programme

TPNZ GXP	TPNZ CB	Feeder Type	Waipa Feeder Asset	2022/23	2023/24	2024/25	2025/26	2026/27	2027/2028	2028/29	2029/30	2030/31	2031/32
Cambridge	C2702	rural	Roto-O-Rangi	750kVAr Cap V11 rebuild									
Cambridge	C2712	urban	Cambridge North										
Cambridge	C2722	urban	Cambridge Town										
Cambridge	C2862	rural	Monavale										
Cambridge	C2742	rural	Pencarrow	750kVAr Cap									
Cambridge	C2762	urban	Hautapu A										
Cambridge	C2772	rural	French Pass										
Cambridge	C2802	urban	Leamington	300A VR									
Cambridge	C2812	urban	Hautapu B										
Cambridge	C2832	urban	Cambridge East										
Cambridge	C2842	rural	Tamahere										
Cambridge	C2852	urban	St Kilda										
Cambridge	C2732	rural	Kaipaki	V14 rebuild									
Cambridge	C22872	rural	APL										
Te Awamutu	T0022	rural	Kawhia		300A VR								
Te Awamutu	T0023	rural	Kio Kio										
Te Awamutu	T0024	urban	Te Awamutu West										
Te Awamutu	T0025	rural	Pirongia		300A VR								
Te Awamutu	T0026	urban	Hairini										
Te Awamutu	T0027	rural	Paterangi										
Te Awamutu	T0029	rural	Waikeria										
Te Awamutu	T2742	rural	Kihikihi										
Te Awamutu	T2752	rural	Mystery Creek	V36 rebuild									
Te Awamutu	T2762	rural	Pukeatua		V12 rebuild 300A?								
Te Awamutu	T2782	urban	Fonterra A										
Te Awamutu	T2802	urban	Fonterra B										
Te Awamutu	T2822	rural	Ohaupo			300A VR							
Te Awamutu	T2832	urban	Te Awamutu East										
Te Awamutu	T2842	rural	Pokuru		2 x 300A VR								
Unallocated			Unallocated	Spares 100A, 300A		300A VR		300A VR		300A VR			
		Cost	$k per unit	2022/23	2023/24	2024/25	2025/26	2026/27	2027/2028	2028/29	2029/30	2030/31	2031/32
		100A VR	240										
		200A VR	270										
		300A VR	330	330	1,650	660		330		330			
		200A VR spares	135	135									
		300A VR spares	200	200									
		New 2 pole structure 200A, 300A	139	278	278	278	278	278	278	278	278		
		New 2 pole structure 100A	136										
		Fixed Capacitor	33										
		Switched Capacitor	63	126									
		Controller, SA Spares	39	117	156	156	156	78	78	78	78		
			Total $k AMP	1,186	2,084	1,094	434	686	356	686	356	-	-

11.3 Appendix C: Automated Open Point Switches & Recloser Renewal Programme

The Automated open Point Switches Programme consists of 10 switches at a cost of $570k per annum over the 10 year AMP period.
The following table sets out the initial renewal programme for the recloser fleet, consisting of RC1 to RC10 controller upgrades and complete recloser replacements driven by condition. This programme will be further updated in AMP 2023 based on the inspected condition and asset health of the recloser fleet.

TPNZ GXP	TPNZ CB	Feeder Type	Waipa Feeder Asset	2022/23	2023/24	2024/25	2025/26	2026/27	2027/2028	2028/29	2029/30	2030/31	2031/32
Cambridge	C2702	rural	Roto-O-Rangi										
Cambridge	C2712	urban	Cambridge North										
Cambridge	C2722	urban	Cambridge Town										
Cambridge	C2862	rural	Monavale										
Cambridge	C2742	rural	Pencarrow										
Cambridge	C2762	urban	Hautapu A										
Cambridge	C2772	rural	French Pass	New Recloser									
Cambridge	C2802	urban	Leamington										
Cambridge	C2812	urban	Hautapu B										
Cambridge	C2832	urban	Cambridge East										
Cambridge	C2842	rural	Tamahere	New Recloser									
Cambridge	C2852	urban	St Kilda										
Cambridge	C2732	rural	Kaipaki										
Cambridge	C22872	rural	APL										
Te Awamutu	T0022	rural	Kawhia	New Recloser									
Te Awamutu	T0023	rural	Kio Kio	New Recloser									
Te Awamutu	T0024	urban	Te Awamutu West										
Te Awamutu	T0025	rural	Pirongia										
Te Awamutu	T0026	urban	Hairini										
Te Awamutu	T0027	rural	Paterangi	New Recloser									
Te Awamutu	T0029	rural	Waikeria										
Te Awamutu	T2742	rural	Kihikihi										
Te Awamutu	T2752	rural	Mystery Creek	New Recloser									
Te Awamutu	T2762	rural	Pukeatua	RC10 Controller									
Te Awamutu	T2782	urban	Fonterra A										
Te Awamutu	T2802	urban	Fonterra B										
Te Awamutu	T2822	rural	Ohaupo										
Te Awamutu	T2832	urban	Te Awamutu East	RC10 Controller									
Te Awamutu	T2842	rural	Pokuru										
		Cost	$k per unit	2022/23	2023/24	2024/25	2025/26	2026/27	2027/2028	2028/29	2029/30	2030/31	2031/32
		RC1 to RC10	15	90	90	90	90	90	90	90	90	90	90
		New Relcoser	41	246	246	246	246						
		DDO Isolation	10	60	60	60	60						
		Spares	75										
			Total $k	396	396	396	396	90	90	90	90	90	90

11.4 Appendix D: Earth Testing and Repair Programme

TPNZ GXP	TPNZ CB	Feeder Type	Waipa Feeder Asset	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
Cambridge	C2702	rural	Roto-O-Rangi							T&R4			
Cambridge	C2712	urban	Cambridge North	T&R2								T&R3	
Cambridge	C2722	urban	Cambridge Town		T&R3								T&R3
Cambridge	C2862	rural	Monavale								T&R4		
Cambridge	C2742	rural	Pencarrow					T&R3					
Cambridge	C2762	urban	Hautapu A	T&R3								T&R4	
Cambridge	C2772	rural	French Pass					T&R3					
Cambridge	C2802	urban	Leamington		T&R3								T&R3
Cambridge	C2812	urban	Hautapu B	T&R3								T&R4	
Cambridge	C2832	urban	Cambridge East		T&R3								T&R3
Cambridge	C2842	rural	Tamahere					T&R3					
Cambridge	C2852	urban	St Kilda		T&R1								T&R3
Cambridge	C2732	rural	Kaipaki								T&R4		
Cambridge	C22872	rural	APL							T&R1			
Te Awamutu	T0022	rural	Kawhia						T&R3				
Te Awamutu	T0023	rural	Kio Kio							T&R3			
Te Awamutu	T0024	urban	Te Awamutu West				T&R3						
Te Awamutu	T0025	rural	Pirongia				T&R3						
Te Awamutu	T0026	urban	Hairini			T&R3							
Te Awamutu	T0027	rural	Paterangi		T&R3								T&R3
Te Awamutu	T0029	rural	Waikeria							T&R3			
Te Awamutu	T2742	rural	Kihikihi								T&R4		
Te Awamutu	T2752	rural	Mystery Creek			T&R3							
Te Awamutu	T2762	rural	Pukeatua				T&R3						
Te Awamutu	T2782	urban	Fonterra A										
Te Awamutu	T2802	urban	Fonterra B										
Te Awamutu	T2822	rural	Ohaupo								T&R4		
Te Awamutu	T2832	urban	Te Awamutu East				T&R3						
Te Awamutu	T2842	rural	Pokuru	T&R3								T&R4	
Feeder Length for Earth Testing (km)				143	157	180	98	137	196	151	145	143	288
Earth Testing & Repair Budget ($k)				$ 191	$ 191	$ 191	$ 191	$ 191	$ 191	$ 191	$ 191	$ 191	$ 191

11.5 Appendix E: Capital Works

Capital Works	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
General Relays Additions	130	130	130	130	130	130	130	130	130	130
Transformer & Sub Additions	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273
General Extensions	2,597	2,597	2,597	2,597	2,597	2,597	2,597	2,597	2,597	2,597
Ring Main Unit Switchgear Additions	154	154	154	154	154	154	154	154	154	154
Disconnector Switchgear Additions	14	14	14	14	14	14	14	14	14	14
Dropout Fuse Switchgear Additions	50	50	50	50	50	50	50	50	50	50
Cambridge West Zone Substation	455	2,875	4,313	-	-	-	-	-	-	-
Bardowie Zone Substation	-	2,556	3,807	-	-	-	-	-	-	-
Bardowie Zone subtransmission circuits	-	2,156	3,235	-	-	-	-	-	-	-
Leamington Zone Substation land	-	260	-	-	-	-	-	-	-	-
New Voltage Regulators & Capacitors	456	1,651	660	-	330	-	330	-	-	-
Transformer & Sub Enhancements	214	214	214	214	214	214	214	214	214	214
Te Awamutu GXP Feeder Cable Upgrade	1,755	-	-	-	-	-	-	-	-	-
Replace One Pole Transformers and Sub Structures	455	455	455	455	455	455	455	455	455	455
Switchgear Replacement Disconnectors	380	380	380	380	380	380	380	380	380	380
Switchgear Replacement Noja Control Boxes & Reclosers	514	514	514	514	117	117	117	117	117	78
Voltage Regulator can replacement and controls renewal	452	156	156	156	78	78	78	78	-	-
Replace Ground Mounted Transformer Sub Structures	286	286	286	286	286	286	286	286	286	286
Replace Crossarms and insulators	694	694	694	694	694	694	694	694	694	694
Replace Pillar Boxes	240	240	240	240	240	240	240	240	240	240
SCADA Disaster Recovery Facility	117	-	-	-	-	-	-	-	-	-
Future Digital Data Communications Network	325	1,623	649	-	-	-	-	-	-	-
Install 11kV Dropout Fuses Spurs & Services	195	195	195	195	195	195	195	195	195	195
Te Awamutu Ripple Plant RMU alternate supply	300	-	-	-	-	-	-	-	-	1
Install Remote Control Switches/Loop Automation	570	570	570	570	570	570	570	570	570	570
Replace Two Pole Transformers and Sub Structures	117	-	-	-	-	-	-	-	-	-
Live Network State (transformer monitoring to SCADA)	-	1,242	97	97	97	97	97	97	97	97
Seismic strengthening of VR structures	278	278	278	278	278	278	278	278	-	-
High Load Crossings - underground conversions	65	65	65	-	-	-	-	-	-	-
High Resolution Photo Survey	-	-	-	-	1,660	-	-	-	-	-
NZTA & District Council relocations	178	178	178	178	178	178	178	178	178	178
Total Capital Budget	12,264	20,806	21,204	8,475	9,990	8,000	8,330	8,000	7,644	7,606
Motor vehicles, fleet and plant	958	350	350	350	350	350	350	350	350	350
Office furniture and plant	1,160	125	125	125	125	125	125	125	125	125
Computer equipment	1,925	60	60	60	60	60	60	60	60	60
Land and buildings	30	-	-	-	-	-	-	-	-	-
Total Non-network Capital	4,073	535	535	535	535	535	535	535	535	535

11.6 Appendix F: Capital Expenditure Forecast

Capital Expenditure Forecast	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Consumer connection	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218
System growth	3,322	11,335	12,878	214	544	214	544	214	214	214
Asset replacement and renewal	3,021	2,725	2,725	2,725	2,250	2,250	2,250	2,250	2,172	2,133
Asset relocations	178	178	178	178	178	178	178	178	178	178
Reliability, safety and environment										
Quality of Supply	1,065	765	765	765	765	765	765	765	765	766
Legislative and regulatory	0	0	0	0	0	0	0	0	0	0
Other Reliability, Safety & Environment	460	1,585	440	375	2,035	375	375	375	97	97
Total Reliability, safety and environment	1,525	2,350	1,205	1,140	2,800	1,140	1,140	1,140	862	863
Expenditure on network assets	12,264	20,806	21,204	8,475	9,990	8,000	8,330	8,000	7,644	7,606
Non-network assets	3,798	535	535	535	535	535	535	535	535	535
Expenditure on assets	16,062	21,341	21,739	9,010	10,525	8,535	8,865	8,535	8,179	8,141

11.7 Appendix G: Operational Expenditure Forecast

Operational Expenditure Forecast ($,000)	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
Service interruption and emergencies	994	994	994	994	994	994	994	994	994	994
Vegetation management	1,034	1,031	1,031	1,031	1,031	1,034	1,031	1,031	1,031	1,031
Routine and corrective maintenance and inspection	689	723	689	689	723	689	689	723	723	723
Asset replacement and renewal	591	591	591	588	588	588	588	588	588	588
Network Opex	3,308	3,339	3,305	3,302	3,336	3,305	3,302	3,336	3,336	3,336
System operations and network support	3,648	4,012	4,170	3,873	3,926	3,980	4,035	4,091	4,148	4,206
Business Support	7,520	7,733	7,849	7,967	8,086	8,207	8,330	8,455	8,582	8,711
Non-network Opex	11,168	11,745	12,019	11,839	12,012	12,188	12,366	12,547	12,731	12,917
Operational Expenditure	14,476	15,084	15,324	15,141	15,348	15,493	15,668	15,883	16,067	16,253

11.8 Appendix H: Capital and Operational Expenditure Reconciliations for 2019/20

Company Name	**Waipa Networks Limited**
For Year Ended	**31 March 2021**

SCHEDULE 7: COMPARISON OF FORECASTS TO ACTUAL EXPENDITURE

This schedule compares actual revenue and expenditure to the previous forecasts that were made for the disclosure year. Accordingly, this schedule requires the forecast revenue and expenditure information from previous disclosures to be inserted.
EDBs must provide explanatory comment on the variance between actual and target revenue and forecast expenditure in Schedule 14 (Mandatory Explanatory Notes). This information is part of the audited disclosure information (as defined in section 1.4 of the ID determination), and so is subject to the assurance report required by section 2.8. For the purpose of this audit, target revenue and forecast expenditures only need to be verified back to previous disclosures.

sch ref				
7	**7(i): Revenue**	**Target ($000) [1]**	**Actual ($000)**	**% variance**
8	Line charge revenue	31,493	26,873	(15%)
9	**7(ii): Expenditure on Assets**	**Forecast ($000) [2]**	**Actual ($000)**	**% variance**
10	Consumer connection	3,738	3,098	(17%)
11	System growth	3,138	2,526	(19%)
12	Asset replacement and renewal	4,541	3,061	(33%)
13	Asset relocations	178	69	(61%)
14	Reliability, safety and environment:			
15	Quality of supply	1,474	109	(93%)
16	Legislative and regulatory	–	–	–
17	Other reliability, safety and environment	588	802	36%
18	**Total reliability, safety and environment**	2,062	910	(56%)
19	**Expenditure on network assets**	13,657	9,665	(29%)
20	Expenditure on non-network assets	4,442	1,918	(57%)
21	Expenditure on assets	18,099	11,583	(36%)
22	**7(iii): Operational Expenditure**			
23	Service interruptions and emergencies	1,003	1,451	45%
24	Vegetation management	1,060	1,013	(4%)
25	Routine and corrective maintenance and inspection	1,478	966	(35%)
26	Asset replacement and renewal	621	579	(7%)
27	**Network opex**	4,162	4,009	(4%)
28	System operations and network support	2,437	2,839	16%
29	Business support	3,117	2,445	(22%)
30	**Non-network opex**	5,554	5,284	(5%)
31	**Operational expenditure**	9,716	9,293	(4%)
32	**7(iv): Subcomponents of Expenditure on Assets (where known)**			
33	Energy efficiency and demand side management, reduction of energy losses		–	–
34	Overhead to underground conversion		519	–
35	Research and development		–	–
36				
37	**7(v): Subcomponents of Operational Expenditure (where known)**			
38	Energy efficiency and demand side management, reduction of energy losses		–	–
39	Direct billing		N/A	–
40	Research and development		N/A	–
41	Insurance		–	–
42				
43	*1 From the nominal dollar target revenue for the disclosure year disclosed under clause 2.4.3(3) of this determination*			
44	*2 From the CY+1 nominal dollar expenditure forecasts disclosed in accordance with clause 2.6.6 for the forecast period starting at the beginning of the disclosure year (the second to last disclosure of Schedules 11a and 11b)*			

11.9 Appendix I: Electricity Distribution Information Disclosure Determination 2012 Reference Table

Regulatory Requirement **(As set out in Electricity Information Disclosure Determination, Attachment A Asset Management Plans)**	**Corresponding AMP Section(s)**
3.1 A summary that provides a brief overview of the contents and highlights information that the EDB considers significant;	1. Summary
3.2 Details of the background and objectives of the EDB's asset management and planning processes;	6 Asset management strategy
3.3 A purpose statement which- 3.3.1 makes clear the purpose and status of the AMP in the EDB's asset management practices. The purpose statement must also include a statement of the objectives of the asset management and planning processes; 3.3.2 states the corporate mission or vision as it relates to asset management; 3.3.3 identifies the documented plans produced as outputs of the annual business planning process adopted by the EDB; 3.3.4 states how the different documented plans relate to one another, with particular reference to any plans specifically dealing with asset management; and 3.3.5 includes a description of the interaction between the objectives of the AMP and other corporate goals, business planning processes, and plans;	2.1 Purpose of this AMP 2.2 Basis of AMP 2.4 Link to other documents 4.3 Strategic Planning Documents 4.3 Interaction between Planning Documents
3.4 Details of the AMP planning period, which must cover at least a projected period of 10 years commencing with the disclosure year following the date on which the AMP is disclosed;	2.5 Period covered
3.5 The date that it was approved by the directors;	2.5 Period covered
3.6 A description of stakeholder interests (owners, consumers etc) which identifies important stakeholders and indicates- 3.6.1 how the interests of stakeholders are identified 3.6.2 what these interests are; 3.6.3 how these interests are accommodated in asset management practices; and 3.6.4 how conflicting interests are managed;	4 Stakeholder interests and objectives alignment

Regulatory Requirement **(As set out in Electricity Information Disclosure Determination, Attachment A Asset Management Plans)**	**Corresponding AMP Section(s)**
3.7 A description of the accountabilities and responsibilities for asset management on at least 3 levels, including- 3.7.1 governance—a description of the extent of director approval required for key asset management decisions and the extent to which asset management outcomes are regularly reported to directors; 3.7.2 executive—an indication of how the in-house asset management and planning organisation is structured; and 3.7.3 field operations—an overview of how field operations are managed, including a description of the extent to which field work is undertaken in-house and the areas where outsourced contractors are used;	6.2 Accountabilities and responsibilities for Asset Management
3.8 All significant assumptions- 3.8.1 quantified where possible;	6.13 Key assumptions
3.8.2 clearly identified in a manner that makes their significance understandable to interested persons, including- 3.8.3 a description of changes proposed where the information is not based on the EDB's existing business; 3.8.4 the sources of uncertainty and the potential effect of the uncertainty on the prospective information; and 3.8.5 the price inflator assumptions used to prepare the financial information disclosed in nominal New Zealand dollars in the Report on Forecast Capital Expenditure set out in Schedule 11a and the Report on Forecast Operational Expenditure set out in Schedule 11b;	6.13 Key assumptions
3.9 A description of the factors that may lead to a material difference between the prospective information disclosed and the corresponding actual information recorded in future disclosures. ;	1.1 Highlights of this AMP
3.10 An overview of asset management strategy and delivery; To support the Report on Asset Management Maturity disclosure and assist interested persons to assess the maturity of asset management strategy and delivery, the AMP should identify- • how the asset management strategy is consistent with the EDB's other strategy and policies; • how the asset strategy takes into account the life cycle of the assets; • the link between the asset management strategy and the AMP; and • processes that ensure costs, risks and system performance will be effectively controlled when the AMP is implemented.	6 Asset management strategy 6.15 Asset management maturity assessment

Regulatory Requirement (As set out in Electricity Information Disclosure Determination, Attachment A Asset Management Plans)	Corresponding AMP Section(s)
3.11 An overview of systems and information management data; To support the Report on Asset Management Maturity disclosure and assist interested persons to assess the maturity of systems and information management, the AMP should describe- • the processes used to identify asset management data requirements that cover the whole of life cycle of the assets; • the systems used to manage asset data and where the data is used, including an overview of the systems to record asset conditions and operation capacity and to monitor the performance of assets; • the systems and controls to ensure the quality and accuracy of asset management information; and • the extent to which these systems, processes and controls are integrated.	6.3 Systems and information management
3.12 A statement covering any limitations in the availability or completeness of asset management data and disclose any initiatives intended to improve the quality of this data;	6.3 Data limitations and 6.16 Asset management improvement
3.13 A description of the processes used within the EDB for- 3.13.1 managing routine asset inspections and network maintenance; 3.13.2 planning and implementing network development projects; and 3.13.3 measuring network performance;	6.6 Lifecycle management and 9. Fleet management 6.9 Network development strategy 5 Network performance and service levels
3.14 An overview of asset management documentation, controls and review processes.	6 Asset management strategy and 6.2 Accountabilities and responsibilities for Asset Management
3.15 An overview of communication and participation processes;	4 Stakeholder interests and objectives alignment and 6 Asset management strategy and 6.2 Accountabilities and responsibilities for Asset Management

Regulatory Requirement **(As set out in Electricity Information Disclosure Determination, Attachment A Asset Management Plans)**	**Corresponding AMP Section(s)**
3.16 The AMP must present all financial values in constant price New Zealand dollars except where specified otherwise; and 3.17 The AMP must be structured and presented in a way that the EDB considers will support the purposes of AMP disclosure set out in clause 2.6.2 of the determination.	10 Expenditure forecasts; and throughout
The AMP must provide details of the assets covered, including- 4.1 a high-level description of the service areas covered by the EDB and the degree to which these are interlinked, including- 4.1.1 the region(s) covered; 4.1.2 identification of large consumers that have a significant impact on network operations or asset management priorities; 4.1.3 description of the load characteristics for different parts of the network; 4.1.4 peak demand and total energy delivered in the previous year, broken down by sub-network, if any.	3 Network overview
4.2 a description of the network configuration, including- 4.2.1 identifying bulk electricity supply points and any distributed generation with a capacity greater than 1 MW. State the existing firm supply capacity and current peak load of each bulk electricity supply point; 4.2.2 a description of the sub-transmission system fed from the bulk electricity supply points, including the capacity of zone substations and the voltage(s) of the sub-transmission network(s). The AMP must identify the supply security provided at individual zone substations, by describing the extent to which each has n-x sub-transmission security or by providing alternative security class ratings; 4.2.3 a description of the distribution system, including the extent to which it is underground; 4.2.4 a brief description of the network's distribution substation arrangements; 4.2.5 a description of the low voltage network including the extent to which it is underground; and 4.2.6 an overview of secondary assets such as protection relays, ripple injection systems, SCADA and telecommunications systems. To help clarify the network descriptions, network maps and a single line diagram of the sub-transmission network should be made available to interested persons. These may be provided in the AMP or, alternatively, made available upon request with a statement to this effect made in the AMP.	3.3 Supply within Waipa

Regulatory Requirement (As set out in Electricity Information Disclosure Determination, Attachment A Asset Management Plans)	Corresponding AMP Section(s)
4.3 4.3 If sub-networks exist, the network configuration information referred to in clause 4.2 must be disclosed for each sub-network.	N/A
Network assets by category 4.4 The AMP must describe the network assets by providing the following information for each asset category- 4.4.1 voltage levels; 4.4.2 description and quantity of assets; 4.4.3 age profiles; and 4.4 a discussion of the condition of the assets, further broken down into more detailed categories as considered appropriate. Systemic issues leading to the premature replacement of assets or parts of assets should be discussed.	9 Fleet management
4.5 The asset categories discussed in clause 4.4 should include at least the following- 4.5.1 the categories listed in the Report on Forecast Capital Expenditure in Schedule 11a(iii); 4.5.2 assets owned by the EDB but installed at bulk electricity supply points owned by others; 4.5.3 EDB owned mobile substations and generators whose function is to increase supply reliability or reduce peak demand; and other generation plant owned by the EDB.	9 Fleet management 7.3 Cambridge area plan

11.10 Appendix J: Risk Management Matrix

This risk management matrix is further described in Waipa Networks' Risk Management Manual.

RISK ASSESSMENT MATRIX				CONSEQUENCE					
				Severity	**Low**	**Minor**	**Moderate**	**Major**	**Critical**
					1	**2**	**3**	**4**	**5**
				People	*First Aid*	*Medical Treatment*	*Serious Harm*	*Permanent Disability*	*Fatality*
				Environment	*No effect*	*Minor effect*	*Moderate effect*	*Major effect*	*Massive effect*
				Property	*Insignificant Damage*	*Minimal Damage*	*Moderate Damage*	*Significant Damage*	*Extensive Damage*
				Reputation	*Minimally affected*	*Adversely affected*	*External reputation damaged*	*Severe damage*	*Irrevocable damage*
				Financial	*Loss less than $5,000*	*Loss less than $60,000*	*Loss less than $250,0000*	*Loss less than $1,000,0000*	*Loss greater than $1,000,0000*
LIKELIHOOD	**Almost certain**	*100%*	5	*Expected to occur regularly under normal circumstances*	**5**	**10**	**15**	**20**	**25**
	Likely	20%	4	*Expected to occur at some time*	**4**	**8**	**12**	**16**	**20**
	Possible	10%	3	*Distinct possibility of it happening*	**3**	**6**	**9**	**12**	**15**
	Unlikely	4%	2	*Not likely to occur in normal circumstances*	**2**	**4**	**6**	**8**	**10**
	Rare	2%	1	*Could happen, but probably never will*	**1**	**2**	**3**	**4**	**5**

>=15	**HIGH**	**Work is unable to proceed without management approval**
10-14	**SERIOUS**	Review and introduce additional controls
5-9	**MODERATE**	Monitor/maintain control measures – follow procedures
<=4	**INSIGNIFICANT**	Manage with routine procedures

12. Schedules

Schedule 11a: Report on Forecast Capital Expenditure
Schedule 11b: Report on Forecast Operational Expenditure
Schedule 12a: Report on Asset Condition
Schedule 12b: Report on Asset Capacity
Schedule 12c: Report on Forecast Network Demand
Schedule 12d: Report on Forecast Interruptions and Duration
Schedule 13: Report on Asset Management Maturity
Schedule 17: Certification for Year-beginning Disclosures

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

sch ref			Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
8		for year ended	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28	31 Mar 29	31 Mar 30	31 Mar 31	31 Mar 32
9	**11a(i): Expenditure on Assets Forecast**		**$000 (in nominal dollars)**										
10	Consumer connection		3,738	4,218	4,302	4,388	4,476	4,566	4,657	4,750	4,845	4,942	5,041
11	System growth		5,701	3,322	11,562	13,398	227	589	236	613	246	251	256
12	Asset replacement and renewal		2,481	3,021	2,780	2,835	2,892	2,435	2,484	2,534	2,585	2,545	2,549
13	Asset relocations		178	178	182	185	189	193	197	200	204	209	213
14	Reliability, safety and environment:												
15	Quality of supply		1,298	1,065	780	796	812	828	845	862	879	896	915
16	Legislative and regulatory		-	-	-	-	-	-	-	-	-	-	-
17	Other reliability, safety and environment		1,321	460	1,617	458	398	406	414	422	431	114	116
18	**Total reliability, safety and environment**		2,619	1,525	2,397	1,254	1,210	1,234	1,259	1,284	1,310	1,010	1,031
19	**Expenditure on network assets**		14,717	12,264	21,222	22,061	8,994	9,017	8,833	9,381	9,189	8,956	9,090
20	Expenditure on non-network assets		3,333	4,103	546	557	568	579	591	602	615	627	639
21	**Expenditure on assets**		18,050	16,367	21,768	22,617	9,561	9,596	9,423	9,983	9,804	9,583	9,729
22													
23	*plus* Cost of financing												
24	*less* Value of capital contributions		2,926	3,286	3,352	3,419	3,487	3,557	3,628	3,701	3,775	3,850	3,927
25	*plus* Value of vested assets												
26													
27	**Capital expenditure forecast**		15,124	13,081	18,416	19,199	6,074	6,039	5,795	6,283	6,029	5,733	5,802
28													
29	Assets commissioned		15,124	13,081	18,416	19,199	6,074	6,039	5,795	6,283	6,029	5,733	5,802

			Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
31		for year ended	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28	31 Mar 29	31 Mar 30	31 Mar 31	31 Mar 32
32			**$000 (in constant prices)**										
33	Consumer connection		3,738	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218
34	System growth		5,701	3,322	11,335	12,878	214	544	214	544	214	214	214
35	Asset replacement and renewal		2,481	3,021	2,725	2,725	2,725	2,250	2,250	2,250	2,250	2,172	2,133
36	Asset relocations		178	178	178	178	178	178	178	178	178	178	178
37	Reliability, safety and environment:												
38	Quality of supply		1,298	1,065	765	765	765	765	765	765	765	765	766
39	Legislative and regulatory		-	-	-	-	-	-	-	-	-	-	-
40	Other reliability, safety and environment		1,321	460	1,585	440	375	375	375	375	375	97	97
41	**Total reliability, safety and environment**		2,619	1,525	2,350	1,205	1,140	1,140	1,140	1,140	1,140	862	863
42	**Expenditure on network assets**		14,717	12,264	20,806	21,204	8,475	8,330	8,000	8,330	8,000	7,644	7,606
43	Expenditure on non-network assets		3,333	4,103	535	535	535	535	535	535	535	535	535
44	**Expenditure on assets**		18,050	16,367	21,341	21,739	9,010	8,865	8,535	8,865	8,535	8,179	8,141
45													
46	**Subcomponents of expenditure on assets (where known)**												
47	Energy efficiency and demand side management, reduction of energy losses		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
48	Overhead to underground conversion		-	-	-	-	-	-	-	-	-	-	-
49	Research and development		-	-	-	-	-	-	-	-	-	-	-

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
	for year ended	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28	31 Mar 29	31 Mar 30	31 Mar 31	31 Mar 32
	Difference between nominal and constant price forecasts	**$000**										
	Consumer connection	-	-	84	170	258	348	439	532	627	724	823
	System growth	-	-	227	520	13	45	22	69	32	37	42
	Asset replacement and renewal	-	-	55	110	167	185	234	284	335	373	416
	Asset relocations	-	-	4	7	11	15	19	22	26	31	35
	Reliability, safety and environment:											
	Quality of supply	-	-	15	31	47	63	80	97	114	131	149
	Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
	Other reliability, safety and environment	-	-	32	18	23	31	39	47	56	17	19
	Total reliability, safety and environment	-	-	47	49	70	94	119	144	170	148	168
	Expenditure on network assets	-	-	416	857	519	687	833	1,051	1,189	1,312	1,484
	Expenditure on non-network assets	-	-	11	22	33	44	56	67	80	92	104
	Expenditure on assets	-	-	427	878	551	731	888	1,118	1,269	1,404	1,588

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
	for year ended	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27
	11a(ii): Consumer Connection						
	*Consumer types defined by EDB**	**$000 (in constant prices)**					
	Customer Connection	3,738	4,218	4,218	4,218	4,218	4,218
	**include additional rows if needed*						
	Consumer connection expenditure	3,738	4,218	4,218	4,218	4,218	4,218
less	Capital contributions funding consumer connection	2,837	3,197	3,197	3,197	3,197	3,197
	Consumer connection less capital contributions	901	1,021	1,021	1,021	1,021	1,021
	11a(iii): System Growth						
	Subtransmission		-	2,156	3,235	-	-
	Zone substations	195	455	5,691	8,120	-	-
	Distribution and LV lines						
	Distribution and LV cables	1,727	1,755	-	-	-	-
	Distribution substations and transformers	214	214	214	214	214	214
	Distribution switchgear						
	Other network assets	3,565	898	3,274	1,309	-	330
	System growth expenditure	5,701	3,322	11,335	12,878	214	544
less	Capital contributions funding system growth	-	-	-	-	-	-
	System growth less capital contributions	5,701	3,322	11,335	12,878	214	544

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

sch ref

11a(iv): Asset Replacement and Renewal

			Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
		for year ended	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**
		$000 (in constant prices)						
	Subtransmission							
	Zone substations							
	Distribution and LV lines							
	Distribution and LV cables							
	Distribution substations and transformers		741	741	741	741	741	741
	Distribution switchgear		1,047	894	894	894	894	497
	Other network assets		693	1,386	1,090	1,090	1,090	1,012
	Asset replacement and renewal expenditure		2,481	3,021	2,725	2,725	2,725	2,250
less	Capital contributions funding asset replacement and renewal		-	-	-	-	-	-
	Asset replacement and renewal less capital contributions		2,481	3,021	2,725	2,725	2,725	2,250

11a(v): Asset Relocations

		Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
	for year ended	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**
	*Project or programme**	**$000 (in constant prices)**					
	NZTA and District Council Relocations	178	178	178	178	178	178
	**include additional rows if needed*						
	All other project or programmes - asset relocations						
	Asset relocations expenditure	178	178	178	178	178	178
less	Capital contributions funding asset relocations	89	89	89	89	89	89
	Asset relocations less capital contributions	89	89	89	89	89	89

11a(vi): Quality of Supply

		Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
	for year ended	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**
	*Project or programme**	**$000 (in constant prices)**					
	Install 11kV Dropout Fuses Spurs & Services	117	195	195	195	195	195
	Install Remote Control Switches	570	570	570	570	570	570
	Te Awamutu Ripple Plant RMU alternate supply	611	300	-	-	-	-
	**include additional rows if needed*						
	All other projects or programmes - quality of supply	-	-	-	-	-	-
	Quality of supply expenditure	1,298	1,065	765	765	765	765
less	Capital contributions funding quality of supply	-	-	-	-	-	-
	Quality of supply less capital contributions	1,298	1,065	765	765	765	765

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

sch ref

11a(vii): Legislative and Regulatory

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
	for year ended	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27
	*Project or programme**	$000 (in constant prices)					
	Nil						
	*include additional rows if needed						
	All other projects or programmes - legislative and regulatory						
	Legislative and regulatory expenditure	-	-	-	-	-	-
less	Capital contributions funding legislative and regulatory						
	Legislative and regulatory less capital contributions	-	-	-	-	-	-

11a(viii): Other Reliability, Safety and Environment

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
	for year ended	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27
	*Project or programme**	$000 (in constant prices)					
	Replace Two Pole Transformers and Sub Structures	312	117	-	-	-	-
	Network monintoring - St Kilda & Cambridge Park Gridkey	-	-	1,242	97	97	97
	LiDAR and High Resolution Photo Survey	886	-	-	-	-	-
	Siesmic strengthening of VR structures	45	278	278	278	278	278
	High Load Crossings - underground conversions	65	65	65	65	-	-
	*include additional rows if needed						
	All other projects or programmes - other reliability, safety and environment	13	-	-	-	-	-
	Other reliability, safety and environment expenditure	1,321	460	1,585	440	375	375
less	Capital contributions funding other reliability, safety and environment	-	-	-	-	-	-
	Other reliability, safety and environment less capital contributions	1,321	460	1,585	440	375	375

11a(ix): Non-Network Assets

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
	for year ended	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27
	Routine expenditure						
	*Project or programme**	$000 (in constant prices)					
	Motor vehicles, fleet and plant	1,553	958	350	350	350	350
	Office furniture and plant	763	1,160	125	125	125	125
	Computer equipment	131	1,925	60	60	60	60
	Land and buildings		30	-	-	-	-
		-	-	-	-	-	-
	*include additional rows if needed	-	-	-	-	-	-
	All other projects or programmes - routine expenditure		30	-	-	-	-
	Routine expenditure	2,447	4,103	535	535	535	535
	Atypical expenditure						
	*Project or programme**						
	240 Harrison Drive Depot Extension	886		-	-	-	-
			-	-	-	-	-
	*include additional rows if needed						
	All other projects or programmes - atypical expenditure						
	Atypical expenditure	886	-	-	-	-	-
	Expenditure on non-network assets	3,333	4,103	535	535	535	535

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 11b: REPORT ON FORECAST OPERATIONAL EXPENDITURE

This schedule requires a breakdown of forecast operational expenditure for the disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms.
EDBs must provide explanatory comment on the difference between constant price and nominal dollar operational expenditure forecasts in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref												
7		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
8	for year ended	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**	**31 Mar 32**
9	**Operational Expenditure Forecast**	**$000 (in nominal dollars)**										
10	Service interruptions and emergencies	1,003	994	1,014	1,034	1,055	1,076	1,097	1,119	1,142	1,165	1,188
11	Vegetation management	1,031	1,034	1,052	1,073	1,094	1,116	1,142	1,161	1,184	1,208	1,232
12	Routine and corrective maintenance and inspection	1,049	689	737	717	731	783	761	776	830	847	864
13	Asset replacement and renewal	519	591	603	615	624	636	649	662	675	689	703
14	**Network Opex**	3,602	3,308	3,406	3,439	3,504	3,611	3,649	3,719	3,832	3,909	3,987
15	System operations and network support	3,482	3,648	4,092	4,338	4,110	4,250	4,395	4,544	4,700	4,860	5,026
16	Business support	5,200	7,520	7,887	8,166	8,454	8,753	9,062	9,381	9,713	10,055	10,410
17	**Non-network opex**	8,682	11,168	11,979	12,504	12,564	13,003	13,456	13,926	14,412	14,916	15,437
18	**Operational expenditure**	12,284	14,476	15,385	15,943	16,068	16,614	17,105	17,644	18,244	18,825	19,424

19		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
20	for year ended	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**	**31 Mar 32**
21		**$000 (in constant prices)**										
22	Service interruptions and emergencies	1,003	994	994	994	994	994	994	994	994	994	994
23	Vegetation management	1,031	1,034	1,031	1,031	1,031	1,031	1,034	1,031	1,031	1,031	1,031
24	Routine and corrective maintenance and inspection	1,049	689	723	689	689	723	689	689	723	723	723
25	Asset replacement and renewal	519	591	591	591	588	588	588	588	588	588	588
26	**Network Opex**	3,602	3,308	3,339	3,305	3,302	3,336	3,305	3,302	3,336	3,336	3,336
27	System operations and network support	3,482	3,648	4,012	4,170	3,873	3,926	3,980	4,035	4,091	4,148	4,206
28	Business support	5,200	7,520	7,733	7,849	7,967	8,086	8,207	8,330	8,455	8,582	8,711
29	**Non-network opex**	8,682	11,168	11,745	12,019	11,839	12,012	12,188	12,366	12,547	12,731	12,917
30	**Operational expenditure**	12,284	14,476	15,084	15,324	15,141	15,348	15,493	15,668	15,883	16,067	16,253
31	**Subcomponents of operational expenditure (where known)**											
32	Energy efficiency and demand side management, reduction of energy losses	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	Direct billing*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	Research and Development	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
36	Insurance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

37 ** Direct billing expenditure by suppliers that direct bill the majority of their consumers*

38

39		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
40	for year ended	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**	**31 Mar 32**
41	**Difference between nominal and real forecasts**	**$000**										
42	Service interruptions and emergencies	-	-	20	40	61	82	103	125	148	171	194
43	Vegetation management	-	-	21	42	63	85	108	130	153	177	201
44	Routine and corrective maintenance and inspection	-	-	14	28	42	60	72	87	107	124	141
45	Asset replacement and renewal	-	-	12	24	36	48	61	74	87	101	115
46	**Network Opex**	-	-	67	134	202	275	344	417	496	573	651
47	System operations and network support	-	-	80	168	237	324	414	509	608	712	821
48	Business support	-	-	155	317	488	667	854	1,051	1,257	1,473	1,699
49	**Non-network opex**	-	-	235	486	725	990	1,269	1,560	1,866	2,185	2,520
50	**Operational expenditure**	-	-	302	619	927	1,265	1,612	1,977	2,362	2,758	3,171

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref					Asset condition at start of planning period (percentage of units by grade)							
	Voltage	**Asset category**	**Asset class**	**Units**	**H1**	**H2**	**H3**	**H4**	**H5**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
10	All	Overhead Line	Concrete poles / steel structure	No.	0.10%	0.40%	0.70%	87.60%	11.20%	-	3	4.90%
11	All	Overhead Line	Wood poles	No.	-	1.10%	10.00%	88.40%	0.50%	-	3	1.70%
12	All	Overhead Line	Other pole types	No.							N/A	
13	HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km							N/A	
14	HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km				2.50%	97.50%	-	3	-
15	HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km							N/A	
16	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km							N/A	
17	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km							N/A	
18	HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km							N/A	
19	HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km							N/A	
20	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km							N/A	
21	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km							N/A	
22	HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km							N/A	
23	HV	Subtransmission Cable	Subtransmission submarine cable	km							N/A	
24	HV	Zone substation Buildings	Zone substations up to 66kV	No.							N/A	
25	HV	Zone substation Buildings	Zone substations 110kV+	No.							N/A	
26	HV	Zone substation switchgear	22/33kV CB (Indoor)	No.							N/A	
27	HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.							N/A	
28	HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.							N/A	
29	HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.							N/A	
30	HV	Zone substation switchgear	33kV RMU	No.							N/A	
31	HV	Zone substation switchgear	50/66/110kV CB (Indoor)	No.							N/A	
32	HV	Zone substation switchgear	50/66/110kV CB (Outdoor)	No.							N/A	
33	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.							N/A	
34	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.							N/A	

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref					Asset condition at start of planning period (percentage of units by grade)							
	Voltage	**Asset category**	**Asset class**	**Units**	**H1**	**H2**	**H3**	**H4**	**H5**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
39	HV	Zone Substation Transformer	Zone Substation Transformers	No.							N/A	
40	HV	Distribution Line	Distribution OH Open Wire Conductor	km	0.50%	4.20%	73.20%	20.80%	1.30%	-	3	0.50%
41	HV	Distribution Line	Distribution OH Aerial Cable Conductor	km							N/A	
42	HV	Distribution Line	SWER conductor	km							N/A	
43	HV	Distribution Cable	Distribution UG XLPE or PVC	km	-	-	-	100.00%	-	-	1	1.50%
44	HV	Distribution Cable	Distribution UG PILC	km	-	-	72.10%	15.40%	12.50%	-	1	1.50%
45	HV	Distribution Cable	Distribution Submarine Cable	km							N/A	
46	HV	Distribution switchgear	3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers	No.	-	2.70%	-	69.30%	28.00%	-	3	2.70%
47	HV	Distribution switchgear	3.3/6.6/11/22kV CB (Indoor)	No.							N/A	
48	HV	Distribution switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.	26.70%	4.90%	4.90%	20.50%	43.00%	-	1	3.60%
49	HV	Distribution switchgear	3.3/6.6/11/22kV Switch (ground mounted) - except RMU	No.							N/A	
50	HV	Distribution switchgear	3.3/6.6/11/22kV RMU	No.	-	-	-	-	100.00%	-	3	-
51	HV	Distribution Transformer	Pole Mounted Transformer	No.	0.16%	1.36%	27.60%	24.68%	46.20%	-	3	4.20%
52	HV	Distribution Transformer	Ground Mounted Transformer	No.	-	1.10%	17.40%	13.00%	68.50%	-	3	1.10%
53	HV	Distribution Transformer	Voltage regulators	No.	8.62%	-	15.52%	43.10%	32.76%	-	3	6.38%
54	HV	Distribution Substations	Ground Mounted Substation Housing	No.							N/A	
55	LV	LV Line	LV OH Conductor	km	-	2.00%	77.10%	20.80%	0.10%	-	3	0.50%
56	LV	LV Cable	LV UG Cable	km	1.30%	10.40%	16.10%	21.30%	50.90%		1	-
57	LV	LV Streetlighting	LV OH/UG Streetlight circuit	km	0.40%	8.70%	46.10%	16.10%	28.70%	-	1	-
58	LV	Connections	OH/UG consumer service connections	No.	19.00%	18.60%	18.90%	17.20%	26.30%	-	1	2.50%
59	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.	-	-	-	72.00%	28.00%	-	1	3.00%
60	All	SCADA and communications	SCADA and communications equipment operating as a single system	Lot	-	-	100.00%	-	-	-	1	2.00%
61	All	Capacitor Banks	Capacitors including controls	No.							N/A	
62	All	Load Control	Centralised plant	Lot	-	-	100.00%	-	-	-	1	-
63	All	Load Control	Relays	No.	0.30%	1.60%	46.80%	39.60%	11.70%	-	1	2.00%
64	All	Civils	Cable Tunnels	km							N/A	

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref					Asset condition at start of planning period (percentage of units by grade)							
	Voltage	**Asset category**	**Asset class**	**Units**	**H1**	**H2**	**H3**	**H4**	**H5**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
10	All	Overhead Line	Concrete poles / steel structure	No.	0.10%	0.40%	0.70%	87.60%	11.20%	-	3	4.90%
11	All	Overhead Line	Wood poles	No.	-	1.10%	10.00%	88.40%	0.50%	-	3	1.70%
12	All	Overhead Line	Other pole types	No.							N/A	
13	HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km							N/A	
14	HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km				2.50%	97.50%	-	3	-
15	HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km							N/A	
16	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km							N/A	
17	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km							N/A	
18	HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km							N/A	
19	HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km							N/A	
20	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km							N/A	
21	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km							N/A	
22	HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km							N/A	
23	HV	Subtransmission Cable	Subtransmission submarine cable	km							N/A	
24	HV	Zone substation Buildings	Zone substations up to 66kV	No.							N/A	
25	HV	Zone substation Buildings	Zone substations 110kV+	No.							N/A	
26	HV	Zone substation switchgear	22/33kV CB (Indoor)	No.							N/A	
27	HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.							N/A	
28	HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.							N/A	
29	HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.							N/A	
30	HV	Zone substation switchgear	33kV RMU	No.							N/A	
31	HV	Zone substation switchgear	50/66/110kV CB (Indoor)	No.							N/A	
32	HV	Zone substation switchgear	50/66/110kV CB (Outdoor)	No.							N/A	
33	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.							N/A	
34	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.							N/A	

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref					Asset condition at start of planning period (percentage of units by grade)							
	Voltage	**Asset category**	**Asset class**	**Units**	**H1**	**H2**	**H3**	**H4**	**H5**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
39	HV	Zone Substation Transformer	Zone Substation Transformers	No.							N/A	
40	HV	Distribution Line	Distribution OH Open Wire Conductor	km	0.50%	4.20%	73.20%	20.80%	1.30%	-	3	0.50%
41	HV	Distribution Line	Distribution OH Aerial Cable Conductor	km							N/A	
42	HV	Distribution Line	SWER conductor	km							N/A	
43	HV	Distribution Cable	Distribution UG XLPE or PVC	km	-	-	-	100.00%	-	-	1	1.50%
44	HV	Distribution Cable	Distribution UG PILC	km	-	-	72.10%	15.40%	12.50%	-	1	1.50%
45	HV	Distribution Cable	Distribution Submarine Cable	km							N/A	
46	HV	Distribution switchgear	3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers	No.	-	2.70%	-	69.30%	28.00%	-	3	2.70%
47	HV	Distribution switchgear	3.3/6.6/11/22kV CB (Indoor)	No.							N/A	
48	HV	Distribution switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.	26.70%	4.90%	4.90%	20.50%	43.00%	-	1	3.60%
49	HV	Distribution switchgear	3.3/6.6/11/22kV Switch (ground mounted) - except RMU	No.							N/A	
50	HV	Distribution switchgear	3.3/6.6/11/22kV RMU	No.	-	-	-	-	100.00%	-	3	-
51	HV	Distribution Transformer	Pole Mounted Transformer	No.	0.16%	1.36%	27.60%	24.68%	46.20%	-	3	4.20%
52	HV	Distribution Transformer	Ground Mounted Transformer	No.	-	1.10%	17.40%	13.00%	68.50%	-	3	1.10%
53	HV	Distribution Transformer	Voltage regulators	No.	8.62%	-	15.52%	43.10%	32.76%	-	3	6.38%
54	HV	Distribution Substations	Ground Mounted Substation Housing	No.							N/A	
55	LV	LV Line	LV OH Conductor	km	-	2.00%	77.10%	20.80%	0.10%	-	3	0.50%
56	LV	LV Cable	LV UG Cable	km	1.30%	10.40%	16.10%	21.30%	50.90%		1	-
57	LV	LV Streetlighting	LV OH/UG Streetlight circuit	km	0.40%	8.70%	46.10%	16.10%	28.70%	-	1	-
58	LV	Connections	OH/UG consumer service connections	No.	19.00%	18.60%	18.90%	17.20%	26.30%	-	1	2.50%
59	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.	-	-	-	72.00%	28.00%	-	1	3.00%
60	All	SCADA and communications	SCADA and communications equipment operating as a single system	Lot	-	-	100.00%	-	-	-	1	2.00%
61	All	Capacitor Banks	Capacitors including controls	No.							N/A	
62	All	Load Control	Centralised plant	Lot	-	-	100.00%	-	-	-	1	-
63	All	Load Control	Relays	No.	0.30%	1.60%	46.80%	39.60%	11.70%	-	1	2.00%
64	All	Civils	Cable Tunnels	km							N/A	

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**

SCHEDULE 12C: REPORT ON FORECAST NETWORK DEMAND

This schedule requires a forecast of new connections (by consumer type), peak demand and energy volumes for the disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumptions used in developing the expenditure forecasts in Schedule 11a and Schedule 11b and the capacity and utilisation forecasts in Schedule 12b.

sch ref

12c(i): Consumer Connections

Number of ICPs connected in year by consumer type

Number of connections

		Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
	for year ended	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**
	*Consumer types defined by EDB**						
	Residential	426	441	441	460	503	503
	General	95	99	99	99	92	92
	Unmetered	2	2	2	2	2	2
	11kV	-	-	-	-	-	-
	Connections total	523	542	542	561	597	597

**include additional rows if needed*

Distributed generation

	Number of connections	100	100	100	100	100	100
	Capacity of distributed generation installed in year (MVA)	0	0	0	0	0	0

12c(ii) System Demand

		Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
	for year ended	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**
	Maximum coincident system demand (MW)						
	GXP demand	90	100	108	117	137	145
plus	Distributed generation output at HV and above	-	-	-	-	-	-
	Maximum coincident system demand	90	100	108	117	137	145
less	Net transfers to (from) other EDBs at HV and above	-	-	-	-	-	-
	Demand on system for supply to consumers' connection points	90	100	108	117	137	145
	Electricity volumes carried (GWh)						
	Electricity supplied from GXPs	436	486	521	568	665	704
less	Electricity exports to GXPs	-	-	-	-	-	-
plus	Electricity supplied from distributed generation	1	1	1	1	1	1
less	Net electricity supplied to (from) other EDBs	1	1	1	1	1	1
	Electricity entering system for supply to ICPs	436	486	521	568	665	703
less	Total energy delivered to ICPs	412	459	492	537	629	665
	Losses	24	27	29	31	37	39
	Load factor	55%	55%	55%	55%	55%	55%
	Loss ratio	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%

Company Name	**Waipa Networks Limited**
AMP Planning Period	**1 April 2022 – 31 March 2032**
Asset Management Standard Applied	**Based on PAS 55**

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	3	The Asset Management Policy was developed and authorised by the CEO as the overriding statement on asset management of Waipa Networks for reference when preparing the Asset Management Plan. This policy has been promulgated by placement in reception for visitors, Company intranet, website for other stakeholders, interested parties and Commerce Commission. The recent December 2021 review of the policy was approved by the Asset and Risk Management sub-committee of the Board.	The Network Asset Manager and the Asset Strategy Manager were responsible for completing this question assessment, referring questions as required to other representatives in the organisation.	Widely used AM practice standards require an organisation to document, authorise and communicate its asset management policy (eg, as required in PAS 55 para 4.2 i). A key pre-requisite of any robust policy is that the organisation's top management must be seen to endorse and fully support it. Also vital to the effective implementation of the policy, is to tell the appropriate people of its content and their obligations under it. Where an organisation outsources some of its asset-related activities, then these people and their organisations must equally be made aware of the policy's content. Also, there may be other stakeholders, such as regulatory authorities and shareholders who should be made aware of it.	Top management. The management team that has overall responsibility for asset management.	The organisation's asset management policy, its organisational strategic plan, documents indicating how the asset management policy was based upon the needs of the organisation and evidence of communication.
10	Asset management strategy	What has the organisation done to ensure that its asset management strategy is consistent with other appropriate organisational policies and strategies, and the needs of stakeholders?	3	The annual SCI and KPIs form the "contract" between Company Directors and the Waipa Networks Consumer Trust. The AMP is borne out of the Company's Annual Strategic Plan agreed with Directors, including an Annual Business Plan and strategies to achieve specified outcomes in the SCI. The outcomes of the Strategic Plan and Business Plan are promulgated to staff. The AMP ("blue print" of capital and maintenance activity) is promulgated as appropriate to	The Asset strategies are now explicitly discussed as they relate to organisation strategies.	In setting an organisation's asset management strategy, it is important that it is consistent with any other policies and strategies that the organisation has and has taken into account the requirements of relevant stakeholders. This question examines to what extent the asset management strategy is consistent with other organisational policies and strategies (eg, as required by PAS 55 para 4.3.1 b) and has taken account of stakeholder requirements as required by PAS 55 para 4.3.1 c). Generally, this will take into account the same polices, strategies and stakeholder requirements as covered in drafting the asset management policy but at a greater level of detail.	Top management. The organisation's strategic planning team. The management team that has overall responsibility for asset management.	The organisation's asset management strategy document and other related organisational policies and strategies. Other than the organisation's strategic plan, these could include those relating to health and safety, environmental, etc. Results of stakeholder consultation.
11	Asset management strategy	In what way does the organisation's asset management strategy take account of the lifecycle of the assets, asset types and asset systems over which the organisation has stewardship?	2.5	Refer to AMP, Sec 1.9 Life-Cycle Asset Management, Sec 6.6 Life Cycle Management, Sec 6.7 Vegetation Management, Sec 9. Fleet Management (the lifecycle of all fleet assets are considered at a high level).	Further improvements to fleet management are planned, through progressive production of fleet asset management plans.	Good asset stewardship is the hallmark of an organisation compliant with widely used AM standards. A key component of this is the need to take account of the lifecycle of the assets, asset types and asset systems. (For example, this requirement is recognised in 4.3.1 d) of PAS 55). This question explores what an organisation has done to take lifecycle into account in its asset management strategy.	Top management. People in the organisation with expert knowledge of the assets, asset types, asset systems and their associated life-cycles. The management team that has overall responsibility for asset management. Those responsible for developing and adopting methods and processes used in asset management	The organisation's documented asset management strategy and supporting working documents.
26	Asset management plan(s)	How does the organisation establish and document its asset management plan(s) across the life cycle activities of its assets and asset systems?	2.5	Refer to AMP, Sec 7 Network Development, Sec 11.2 Appendix B: Voltage Regulator Programme, Sec 13.3 Appendix C: Automated Open Point Switches and Recloser Renewal Programme, Sec 11.4 Appendix D: Earth Testing and Repair Programme, Sec 11.5 Appendix E: Capital Works, Sec 11.6 Capital Expenditure Forecast, Sec 11.7 Appendix G: Operational Expenditure Forecast.	Progress in asset health indicators has been made through aerial survey and condition assessment of the rural overhead network. Further work is planned.	The asset management strategy need to be translated into practical plan(s) so that all parties know how the objectives will be achieved. The development of plan(s) will need to identify the specific tasks and activities required to optimize costs, risks and performance of the assets and/or asset system(s), when they are to be carried out and the resources required.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers.	The organisation's asset management plan(s).

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	The organisation does not have a documented asset management policy.	The organisation has an asset management policy, but it has not been authorised by top management, or it is not influencing the management of the assets.	The organisation has an asset management policy, which has been authorised by top management, but it has had limited circulation. It may be in use to influence development of strategy and planning but its effect is limited.	The asset management policy is authorised by top management, is widely and effectively communicated to all relevant employees and stakeholders, and used to make these persons aware of their asset related obligations.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
10	Asset management strategy	What has the organisation done to ensure that its asset management strategy is consistent with other appropriate organisational policies and strategies, and the needs of stakeholders?	The organisation has not considered the need to ensure that its asset management strategy is appropriately aligned with the organisation's other organisational policies and strategies or with stakeholder requirements. OR The organisation does not have an asset management strategy.	The need to align the asset management strategy with other organisational policies and strategies as well as stakeholder requirements is understood and work has started to identify the linkages or to incorporate them in the drafting of asset management strategy.	Some of the linkages between the long-term asset management strategy and other organisational policies, strategies and stakeholder requirements are defined but the work is fairly well advanced but still incomplete.	All linkages are in place and evidence is available to demonstrate that, where appropriate, the organisation's asset management strategy is consistent with its other organisational policies and strategies. The organisation has also identified and considered the requirements of relevant stakeholders.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
11	Asset management strategy	In what way does the organisation's asset management strategy take account of the lifecycle of the assets, asset types and asset systems over which the organisation has stewardship?	The organisation has not considered the need to ensure that its asset management strategy is produced with due regard to the lifecycle of the assets, asset types or asset systems that it manages. OR The organisation does not have an asset management strategy.	The need is understood, and the organisation is drafting its asset management strategy to address the lifecycle of its assets, asset types and asset systems.	The long-term asset management strategy takes account of the lifecycle of some, but not all, of its assets, asset types and asset systems.	The asset management strategy takes account of the lifecycle of all of its assets, asset types and asset systems.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
26	Asset management plan(s)	How does the organisation establish and document its asset management plan(s) across the life cycle activities of its assets and asset systems?	The organisation does not have an identifiable asset management plan(s) covering asset systems and critical assets.	The organisation has asset management plan(s) but they are not aligned with the asset management strategy and objectives and do not take into consideration the full asset life cycle (including asset creation, acquisition, enhancement, utilisation, maintenance decommissioning and disposal).	The organisation is in the process of putting in place comprehensive, documented asset management plan(s) that cover all life cycle activities, clearly aligned to asset management objectives and the asset management strategy.	Asset management plan(s) are established, documented, implemented and maintained for asset systems and critical assets to achieve the asset management strategy and asset management objectives across all life cycle phases.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
27	Asset management plan(s)	How has the organisation communicated its plan(s) to all relevant parties to a level of detail appropriate to the receiver's role in their delivery?	2.5	Refer AMP Sec 6.2 Accountabilities and Responsibilities for Asset Management. The Network Asset Manager has overall responsibility for the Asset Management Plan implementation. The Network Asset Manager delegates appropriate Sections of the AMP works program to appropriate planning and engineering staff and supervisors for implementation. The Network Asset Manager's Position Description includes the responsibility for implementation of the Asset Management Plan and KPIs. The Network Asset Manager reports at Board Meetings on progress against the Asset Management Plan.	An Asset Strategy Manager has been appointed to focus on asset management improvement and the collation of the annual AMP update. Annual programmes of work (capital projects or maintenance programmes) are communicated to the Operations team for completion.	Plans will be ineffective unless they are communicated to all those, including contracted suppliers and those who undertake enabling function(s). The plan(s) need to be communicated in a way that is relevant to those who need to use them.	The management team with overall responsibility for the asset management system. Delivery functions and suppliers.	Distribution lists for plan(s). Documents derived from plan(s) which detail the receivers role in plan delivery. Evidence of communication.
29	Asset management plan(s)	How are designated responsibilities for delivery of asset plan actions documented?	2.5	Refer to AMP Sec 6.2. Resourcing Asset Management. There is a national shortage of experienced personnel with asset management skills, and turnover of engineering staff has been constant. The Company has appointed an increased number of electrical engineering staff who are being trained with the appropriate asset management skills. Other functions of the Company are currently adequately resourced except for line mechanic field staff. Detailed programming of AMP works have not been rigorously resource forecast in terms of human resource.	Additional resources are being recruited to enable further documentation of processes and complete engineering tasks. Action plans for Asset Management Improvement Plan (AMIP) projects have been developed.	The implementation of asset management plan(s) relies on (1) actions being clearly identified, (2) an owner allocated and (3) that owner having sufficient delegated responsibility and authority to carry out the work required. It also requires alignment of actions across the organisation. This question explores how well the plan(s) set out responsibility for delivery of asset plan actions.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team.	The organisation's asset management plan(s). Documentation defining roles and responsibilities of individuals and organisational departments.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

31	Asset management plan(s)	What has the organisation done to ensure that appropriate arrangements are made available for the efficient and cost effective implementation of the plan(s)? (Note this is about resources and enabling support)	2.5	The Network Asset Manager delegates appropriate Sections of the AMP works program to Design Planners, Field Services and the Projects Planning Manager. The Company holds monthly Operational Meetings for all Supervisors to co-ordinate implementation of the Asset Management Plan . Planners prepare "Orange" project folders for all capital and maintenance works identified in the current AMP. Project folders are implemented by field staff through the Supervisors.	The understanding and engagement of staff through senior management communication is demonstrated in improvements made in the AMP. Network Management Report produced monthly to detail progress with the various AMP planned works, and circulated to relevant managers.	It is essential that the plan(s) are realistic and can be implemented, which requires appropriate resources to be available and enabling mechanisms in place. This question explores how well this is achieved. The plan(s) not only need to consider the resources directly required and timescales, but also the enabling activities, including for example, training requirements, supply chain capability and procurement timescales.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team. If appropriate, the performance management team. Where appropriate the procurement team and service providers working on the organisation's asset-related activities.	The organisation's asset management plan(s). Documented processes and procedures for the delivery of the asset management plan.
33	Contingency planning	What plan(s) and procedure(s) does the organisation have for identifying and responding to incidents and emergency situations and ensuring continuity of critical asset management activities?	2	Refer AMP Sec 6.2 Resourcing Asset Management. WEL Networks for Control Room Services, Call Care for customer enquiry and dispatch services and Abbey for SCADA services have contracts which include performance KPI's. All works performed by service providers for SCADA, Radio Systems, Traffic Management on State Highways and directional drilling are contracted on an as required basis and are managed directly by Company Supervisors.	There has been an external review of efficiency and programming. Increased resource to both inspect and repair defects has been budgeted. A revised set of Emergency Management System procedures and business continuity plans are under development.	Widely used AM practice standards require that an organisation has plan(s) to identify and respond to emergency situations. Emergency plan(s) should outline the actions to be taken to respond to specified emergency situations and ensure continuity of critical asset management activities including the communication to, and involvement of, external agencies. This question assesses if, and how well, these plan(s) triggered, implemented and resolved in the event of an incident. The plan(s) should be appropriate to the level of risk as determined by the organisation's risk assessment methodology. It is also a requirement that relevant personnel are competent and trained.	The manager with responsibility for developing emergency plan(s). The organisation's risk assessment team. People with designated duties within the plan(s) and procedure(s) for dealing with incidents and emergency situations.	The organisation's plan(s) and procedure(s) for dealing with emergencies. The organisation's risk assessments and risk registers.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
27	Asset management plan(s)	How has the organisation communicated its plan(s) to all relevant parties to a level of detail appropriate to the receiver's role in their delivery?	The organisation does not have plan(s) or their distribution is limited to the authors.	The plan(s) are communicated to some of those responsible for delivery of the plan(s). OR Communicated to those responsible for delivery is either irregular or ad-hoc.	The plan(s) are communicated to most of those responsible for delivery but there are weaknesses in identifying relevant parties resulting in incomplete or inappropriate communication. The organisation recognises improvement is needed as is working towards resolution.	The plan(s) are communicated to all relevant employees, stakeholders and contracted service providers to a level of detail appropriate to their participation or business interests in the delivery of the plan(s) and there is confirmation that they are being used effectively.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
29	Asset management plan(s)	How are designated responsibilities for delivery of asset plan actions documented?	The organisation has not documented responsibilities for delivery of asset plan actions.	Asset management plan(s) inconsistently document responsibilities for delivery of plan actions and activities and/or responsibilities and authorities for implementation inadequate and/or delegation level inadequate to ensure effective delivery and/or contain misalignments with organisational accountability.	Asset management plan(s) consistently document responsibilities for the delivery of actions but responsibility/authority levels are inappropriate/ inadequate, and/or there are misalignments within the organisation.	Asset management plan(s) consistently document responsibilities for the delivery actions and there is adequate detail to enable delivery of actions. Designated responsibility and authority for achievement of asset plan actions is appropriate.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

31	Asset management plan(s)	What has the organisation done to ensure that appropriate arrangements are made available for the efficient and cost effective implementation of the plan(s)? (Note this is about resources and enabling support)	The organisation has not considered the arrangements needed for the effective implementation of plan(s).	The organisation recognises the need to ensure appropriate arrangements are in place for implementation of asset management plan(s) and is in the process of determining an appropriate approach for achieving this.	The organisation has arrangements in place for the implementation of asset management plan(s) but the arrangements are not yet adequately efficient and/or effective. The organisation is working to resolve existing weaknesses.	The organisation's arrangements fully cover all the requirements for the efficient and cost effective implementation of asset management plan(s) and realistically address the resources and timescales required, and any changes needed to functional policies, standards, processes and the asset management information system.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
33	Contingency planning	What plan(s) and procedure(s) does the organisation have for identifying and responding to incidents and emergency situations and ensuring continuity of critical asset management activities?	The organisation has not considered the need to establish plan(s) and procedure(s) to identify and respond to incidents and emergency situations.	The organisation has some ad-hoc arrangements to deal with incidents and emergency situations, but these have been developed on a reactive basis in response to specific events that have occurred in the past.	Most credible incidents and emergency situations are identified. Either appropriate plan(s) and procedure(s) are incomplete for critical activities or they are inadequate. Training/ external alignment may be incomplete.	Appropriate emergency plan(s) and procedure(s) are in place to respond to credible incidents and manage continuity of critical asset management activities consistent with policies and asset management objectives. Training and external agency alignment is in place.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
37	Structure, authority and responsibilities	What has the organisation done to appoint member(s) of its management team to be responsible for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s)?	3	Refer AMP Sec 6.2 Accountabilities and Responsibilities for Asset Management. The Network Asset Manager has overall responsibility for the Asset Management Plan implementation. The Network Asset Manager delegates appropriate Sections of the AMP works program to appropriate planning and engineering staff and supervisors for implementation. The Network Asset Manager's Position Description includes the responsibility for implementation of the Asset Management Plan and KPIs. The Network Asset Manager reports at Board Meetings on progress against the Asset Management Plan.	An Asset Strategy Manager has been appointed to focus on asset management improvement and the collation of the annual AMP update.	In order to ensure that the organisation's assets and asset systems deliver the requirements of the asset management policy, strategy and objectives responsibilities need to be allocated to appropriate people who have the necessary authority to fulfil their responsibilities. (This question, relates to the organisation's assets eg, para b), s 4.4.1 of PAS 55, making it therefore distinct from the requirement contained in para a), s 4.4.1 of PAS 55).	Top management. People with management responsibility for the delivery of asset management policy, strategy, objectives and plan(s). People working on asset-related activities.	Evidence that managers with responsibility for the delivery of asset management policy, strategy, objectives and plan(s) have been appointed and have assumed their responsibilities. Evidence may include the organisation's documents relating to its asset management system, organisational charts, job descriptions of post-holders, annual targets/objectives and personal development plan(s) of post-holders as appropriate.
40	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	2.5	Refer to AMP Sec 6.2. Resourcing Asset Management. There is a national shortage of experienced personnel with asset management skills, and turnover of engineering staff has been constant. The Company has appointed an increased number of electrical engineering staff who are being trained with the appropriate asset management skills. Other functions of the Company are currently adequately resourced except for line mechanic field staff. Detailed programming of AMP works have not been rigorously resource forecast in terms of human resource.	Additional resources are being recruited to enable further documentation of processes and complete engineering tasks. Action plans for Asset Management Improvement Plan (AMIP) projects have been developed.	Optimal asset management requires top management to ensure sufficient resources are available. In this context the term 'resources' includes manpower, materials, funding and service provider support.	Top management. The management team that has overall responsibility for asset management. Risk management team. The organisation's managers involved in day-to-day supervision of asset-related activities, such as frontline managers, engineers, foremen and chargehands as appropriate.	Evidence demonstrating that asset management plan(s) and/or the process(es) for asset management plan implementation consider the provision of adequate resources in both the short and long term. Resources include funding, materials, equipment, services provided by third parties and personnel (internal and service providers) with appropriate skills competencies and knowledge.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	2.5	The Network Asset Manager delegates appropriate Sections of the AMP works program to planners. The Company holds monthly Operational Meetings for all Supervisors to co-ordinate implementation of the Asset Management Plan. A monthly Network Management report is prepared by the Network Asset Manager for operational and asset management staff to review progress against asset management KPIs and programmes of work. Planners prepare "Orange" project folders for all capital and maintenance works identified in the current AMP. Project folders are implemented by field staff through the Supervisors.	The understanding and engagement of staff through senior management communication is demonstrated in improvements made in the AMP.	Widely used AM practice standards require an organisation to communicate the importance of meeting its asset management requirements such that personnel fully understand, take ownership of, and are fully engaged in the delivery of the asset management requirements (eg, PAS 55 s 4.4.1 g).	Top management. The management team that has overall responsibility for asset management. People involved in the delivery of the asset management requirements.	Evidence of such activities as road shows, written bulletins, workshops, team talks and management walk-abouts would assist an organisation to demonstrate it is meeting this requirement of PAS 55.
45	Outsourcing of asset management activities	Where the organisation has outsourced some of its asset management activities, how has it ensured that appropriate controls are in place to ensure the compliant delivery of its organisational strategic plan, and its asset management policy and strategy?	2.5	Refer AMP Sec 6.2 Resourcing Asset Management. WEL Networks for Control Room Services, Call Care for customer enquiry and dispatch services and Abbey for SCADA services have contracts which include performance KPI's. All works performed by service providers for SCADA, Radio Systems, Traffic Management on State Highways and directional drilling are contracted on an as required basis and are managed directly by Company Supervisors.	There has been an external review of efficiency and programming. Increased resource to both inspect and repair defects has been budgeted. Construction Manual network standards used to ensure contracted works are constructed to appropriate standard. More work required in contractor management.	Where an organisation chooses to outsource some of its asset management activities, the organisation must ensure that these outsourced process(es) are under appropriate control to ensure that all the requirements of widely used AM standards (eg, PAS 55) are in place, and the asset management policy, strategy objectives and plan(s) are delivered. This includes ensuring capabilities and resources across a time span aligned to life cycle management. The organisation must put arrangements in place to control the outsourced activities, whether it be to external providers or to other in-house departments. This question explores what the organisation does in this regard.	Top management. The management team that has overall responsibility for asset management. The manager(s) responsible for the monitoring and management of the outsourced activities. People involved with the procurement of outsourced activities. The people within the organisations that are performing the outsourced activities. The people impacted by the outsourced activity.	The organisation's arrangements that detail the compliance required of the outsourced activities. For example, this this could form part of a contract or service level agreement between the organisation and the suppliers of its outsourced activities. Evidence that the organisation has demonstrated to itself that it has assurance of compliance of outsourced activities.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
37	Structure, authority and responsibilities	What has the organisation done to appoint member(s) of its management team to be responsible for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s)?	Top management has not considered the need to appoint a person or persons to ensure that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s).	Top management understands the need to appoint a person or persons to ensure that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s).	Top management has appointed an appropriate people to ensure the assets deliver the requirements of the asset management strategy, objectives and plan(s) but their areas of responsibility are not fully defined and/or they have insufficient delegated authority to fully execute their responsibilities.	The appointed person or persons have full responsibility for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s). They have been given the necessary authority to achieve this.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
40	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	The organisation's top management has not considered the resources required to deliver asset management.	The organisations top management understands the need for sufficient resources but there are no effective mechanisms in place to ensure this is the case.	A process exists for determining what resources are required for its asset management activities and in most cases these are available but in some instances resources remain insufficient.	An effective process exists for determining the resources needed for asset management and sufficient resources are available. It can be demonstrated that resources are matched to asset management requirements.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	The organisation's top management has not considered the need to communicate the importance of meeting asset management requirements.	The organisations top management understands the need to communicate the importance of meeting its asset management requirements but does not do so.	Top management communicates the importance of meeting its asset management requirements but only to parts of the organisation.	Top management communicates the importance of meeting its asset management requirements to all relevant parts of the organisation.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
45	Outsourcing of asset management activities	Where the organisation has outsourced some of its asset management activities, how has it ensured that appropriate controls are in place to ensure the compliant delivery of its organisational strategic plan, and its asset management policy and strategy?	The organisation has not considered the need to put controls in place.	The organisation controls its outsourced activities on an ad-hoc basis, with little regard for ensuring for the compliant delivery of the organisational strategic plan and/or its asset management policy and strategy.	Controls systematically considered but currently only provide for the compliant delivery of some, but not all, aspects of the organisational strategic plan and/or its asset management policy and strategy. Gaps exist.	Evidence exists to demonstrate that outsourced activities are appropriately controlled to provide for the compliant delivery of the organisational strategic plan, asset management policy and strategy, and that these controls are integrated into the asset management system	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
48	Training, awareness and competence	How does the organisation develop plan(s) for the human resources required to undertake asset management activities - including the development and delivery of asset management strategy, process(es), objectives and plan(s)?	2.5	During the budget process a GAP analysis is completed to ensure appropriate resources are available either internal or external. The Company Training Matrix and Individual Personal Development Plans are used to increase skills of current staff as a first option and secondly employing additional staff for long term needs or contractors for short term.	An Asset Management Improvement Plan has been developed and an ISSP is in development. Resources are planned to enable implementation.	There is a need for an organisation to demonstrate that it has considered what resources are required to develop and implement its asset management system. There is also a need for the organisation to demonstrate that it has assessed what development plan(s) are required to provide its human resources with the skills and competencies to develop and implement its asset management systems. The timescales over which the plan(s) are relevant should be commensurate with the planning horizons within the asset management strategy considers e.g. if the asset management strategy considers 5, 10 and 15 year time scales then the human resources development plan(s) should align with these. Resources include both 'in house' and external resources who undertake asset management activities.	Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers.	Evidence of analysis of future work load plan(s) in terms of human resources. Document(s) containing analysis of the organisation's own direct resources and contractors resource capability over suitable timescales. Evidence, such as minutes of meetings, that suitable management forums are monitoring human resource development plan(s). Training plan(s), personal development plan(s), contract and service level agreements.
49	Training, awareness and competence	How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies?	2	The Company Training Matrix and Individual Personal Development Plans are used to identify maintain and increase skills of current staff. However, an Asset Management competency framework has not been developed to guide training requirements.	Processes are in place to insure additional resources are trained appropriately.	Widely used AM standards require that organisations to undertake a systematic identification of the asset management awareness and competencies required at each level and function within the organisation. Once identified the training required to provide the necessary competencies should be planned for delivery in a timely and systematic way. Any training provided must be recorded and maintained in a suitable format. Where an organisation has contracted service providers in place then it should have a means to demonstrate that this requirement is being met for their employees. (eg, PAS 55 refers to frameworks suitable for identifying competency requirements).	Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers.	Evidence of an established and applied competency requirements assessment process and plan(s) in place to deliver the required training. Evidence that the training programme is part of a wider, co-ordinated asset management activities training and competency programme. Evidence that training activities are recorded and that records are readily available (for both direct and contracted service provider staff) e.g. via organisation wide information system or local records database.
50	Training, awareness and competence	How does the organization ensure that persons under its direct control undertaking asset management related activities have an appropriate level of competence in terms of education, training or experience?	2	As per our Heath, Safety and Environmental requirements all contractors are inducted to work on our network. The Company assesses the competence of service providers under its direct control by observing the quality of the work performed and checking if any industry competencies that are required for the work, are held by the staff doing the work. Competencies for fault staff to operate on the network are defined and new fault staff are assessed and signed off.	The employment of well trained staff as Design Planners who prepare and mange job packs, review quality and conduct inspection including packaging, leads to good outcomes. Competent contractors are engaged. Review of contract management frameworks is planned.	A critical success factor for the effective development and implementation of an asset management system is the competence of persons undertaking these activities. organisations should have effective means in place for ensuring the competence of employees to carry out their designated asset management function(s). Where an organisation has contracted service providers undertaking elements of its asset management system then the organisation shall assure itself that the outsourced service provider also has suitable arrangements in place to manage the competencies of its employees. The organisation should ensure that the individual and corporate competencies it requires are in place and actively monitor, develop and maintain an appropriate balance of these competencies.	Managers, supervisors, persons responsible for developing training programmes. Staff responsible for procurement and service agreements. HR staff and those responsible for recruitment.	Evidence of a competency assessment framework that aligns with established frameworks such as the asset management Competencies Requirements Framework (Version 2.0); National Occupational Standards for Management and Leadership; UK Standard for Professional Engineering Competence, Engineering Council, 2005.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
48	Training, awareness and competence	How does the organisation develop plan(s) for the human resources required to undertake asset management activities - including the development and delivery of asset management strategy, process(es), objectives and plan(s)?	The organisation has not recognised the need for assessing human resources requirements to develop and implement its asset management system.	The organisation has recognised the need to assess its human resources requirements and to develop a plan(s). There is limited recognition of the need to align these with the development and implementation of its asset management system.	The organisation has developed a strategic approach to aligning competencies and human resources to the asset management system including the asset management plan but the work is incomplete or has not been consistently implemented.	The organisation can demonstrate that plan(s) are in place and effective in matching competencies and capabilities to the asset management system including the plan for both internal and contracted activities. Plans are reviewed integral to asset management system process(es).	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
49	Training, awareness and competence	How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies?	The organisation does not have any means in place to identify competency requirements.	The organisation has recognised the need to identify competency requirements and then plan, provide and record the training necessary to achieve the competencies.	The organisation is the process of identifying competency requirements aligned to the asset management plan(s) and then plan, provide and record appropriate training. It is incomplete or inconsistently applied.	Competency requirements are in place and aligned with asset management plan(s). Plans are in place and effective in providing the training necessary to achieve the competencies. A structured means of recording the competencies achieved is in place.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
50	Training, awareness and competence	How does the organization ensure that persons under its direct control undertaking asset management related activities have an appropriate level of competence in terms of education, training or experience?	The organization has not recognised the need to assess the competence of person(s) undertaking asset management related activities.	Competency of staff undertaking asset management related activities is not managed or assessed in a structured way, other than formal requirements for legal compliance and safety management.	The organization is in the process of putting in place a means for assessing the competence of person(s) involved in asset management activities including contractors. There are gaps and inconsistencies.	Competency requirements are identified and assessed for all persons carrying out asset management related activities - internal and contracted. Requirements are reviewed and staff reassessed at appropriate intervals aligned to asset management requirements.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
53	Communication, participation and consultation	How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers?	2.5	AMP Service Levels, Financial Targets and works programmes are communicated to Company Trust members, Directors, Managers and Supervisors by way of hard copy. The AMP is accessible on the Company intranet for all staff and website for other stakeholders, interested parties and Commerce Commission. The Company has internal planning, procurement, stores and field crew resources. Planners prepare "Orange" project folders for all capital and maintenance works identified in the AMP. Materials are procured by the stores team. Work is undertaken by the field crews. Project quality and costs are audited and reported on when jobs are completed. The financials of network projects are reported on at Directors' monthly Board Meetings. SCADA, radio, directional	Further stakeholder engagement is underway, by sending our AMP to district councils and major industrial customers and inviting feedback or engagement.	Widely used AM practice standards require that pertinent asset management information is effectively communicated to and from employees and other stakeholders including contracted service providers. Pertinent information refers to information required in order to effectively and efficiently comply with and deliver asset management strategy, plan(s) and objectives. This will include for example the communication of the asset management policy, asset performance information, and planning information as appropriate to contractors.	Top management and senior management representative(s), employee's representative(s), employee's trade union representative(s); contracted service provider management and employee representative(s); representative(s) from the organisation's Health, Safety and Environmental team. Key stakeholder representative(s).	Asset management policy statement prominently displayed on notice boards, intranet and internet; use of organisation's website for displaying asset performance data; evidence of formal briefings to employees, stakeholders and contracted service providers; evidence of inclusion of asset management issues in team meetings and contracted service provider contract meetings; newsletters, etc.
59	Asset Management System documentation	What documentation has the organisation established to describe the main elements of its asset management system and interactions between them?	2	Refer to whole of AMP . The Design Manual and Construction Manual which has been issued in hard copy to all Manager, Supervisors, Planners and Foreman and has been placed on the intranet for all staff and on the website for contracted services providers, other stakeholders, interested parties and Commerce Commission. The Health and Safety at Work and Environmental Management System, the Public Safety Management System and the Risk Management Manual and risk register are used to document those aspects of the management system and	The Asset Management Improvement Plan details documentation improvements.	Widely used AM practice standards require an organisation maintain up to date documentation that ensures that its asset management systems (ie, the systems the organisation has in place to meet the standards) can be understood, communicated and operated. (eg, s 4.5 of PAS 55 requires the maintenance of up to date documentation of the asset management system requirements specified throughout s 4 of PAS 55).	The management team that has overall responsibility for asset management. Managers engaged in asset management activities.	The documented information describing the main elements of the asset management system (process(es)) and their interaction.

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62	Information management	What has the organisation done to determine what its asset management information system(s) should contain in order to support its asset management system?	2	Refer AMP Sec 6.3 Systems and Information Management. The Network Asset Manager and Network Information Specialists determine the data that is held in the Asset Management Enterprise Information Systems. When new requirements are identified the Network Asset Manager and Network Information Specialists request improvements that are designed and implemented by IT and the Operations Committee offers feedback in this iterative process.	The development of an Information Systems Strategic Plan is underway and the first systems are in development in 2021/22.	Effective asset management requires appropriate information to be available. Widely used AM standards therefore require the organisation to identify the asset management information it requires in order to support its asset management system. Some of the information required may be held by suppliers. The maintenance and development of asset management information systems is a poorly understood specialist activity that is akin to IT management but different from IT management. This group of questions provides some indications as to whether the capability is available and applied. Note: To be effective, an asset information management system requires the mobilisation of technology, people and process(es) that create, secure, make available and destroy the information required to support the asset management system.	The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Operations, maintenance and engineering managers	Details of the process the organisation has employed to determine what its asset information system should contain in order to support its asset management system. Evidence that this has been effectively implemented.
63	Information management	How does the organisation maintain its asset management information system(s) and ensure that the data held within it (them) is of the requisite quality and accuracy and is consistent?	3	Refer AMP Sec 6.3 Systems and Information Management. The Network Information Officer populates the Asset Equipment Data Bases and inputs are audited for errors and irregularities. The Network Asset Manager and Network Information Specialists request improvements that are designed and implemented by IT and the Operations Committee offers feedback in this iterative process. External audit is completed on information disclosure reporting to ensure that information reported out of the systems is accurate.	Data in multiple locations is effectively managed but is a risk for the future. The development of an Information Systems Strategic Plan is underway and the first systems are in development in 2021/22. Implementation of the ESRI Arcview GIS during 2022 will input data into a Utility Network Common Information Model format, allowing subsequent asset information systems to draw on the same data and avoid multiple entry.	The response to the questions is progressive. A higher scale cannot be awarded without achieving the requirements of the lower scale. This question explores how the organisation ensures that information management meets widely used AM practice requirements (eg, s 4.4.6 (a), (c) and (d) of PAS 55).	The management team that has overall responsibility for asset management. Users of the organisational information systems.	The asset management information system, together with the policies, procedure(s), improvement initiatives and audits regarding information controls.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
53	Communication, participation and consultation	How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers?	The organisation has not recognised the need to formally communicate any asset management information.	There is evidence that the pertinent asset management information to be shared along with those to share it with is being determined.	The organisation has determined pertinent information and relevant parties. Some effective two way communication is in place but as yet not all relevant parties are clear on their roles and responsibilities with respect to asset management information.	Two way communication is in place between all relevant parties, ensuring that information is effectively communicated to match the requirements of asset management strategy, plan(s) and process(es). Pertinent asset information requirements are regularly reviewed.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
59	Asset Management System documentation	What documentation has the organisation established to describe the main elements of its asset management system and interactions between them?	The organisation has not established documentation that describes the main elements of the asset management system.	The organisation is aware of the need to put documentation in place and is in the process of determining how to document the main elements of its asset management system.	The organisation in the process of documenting its asset management system and has documentation in place that describes some, but not all, of the main elements of its asset management system and their interaction.	The organisation has established documentation that comprehensively describes all the main elements of its asset management system and the interactions between them. The documentation is kept up to date.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

62	Information management	What has the organisation done to determine what its asset management information system(s) should contain in order to support its asset management system?	The organisation has not considered what asset management information is required.	The organisation is aware of the need to determine in a structured manner what its asset information system should contain in order to support its asset management system and is in the process of deciding how to do this.	The organisation has developed a structured process to determine what its asset information system should contain in order to support its asset management system and has commenced implementation of the process.	The organisation has determined what its asset information system should contain in order to support its asset management system. The requirements relate to the whole life cycle and cover information originating from both internal and external sources.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
63	Information management	How does the organisation maintain its asset management information system(s) and ensure that the data held within it (them) is of the requisite quality and accuracy and is consistent?	There are no formal controls in place or controls are extremely limited in scope and/or effectiveness.	The organisation is aware of the need for effective controls and is in the process of developing an appropriate control process(es).	The organisation has developed a controls that will ensure the data held is of the requisite quality and accuracy and is consistent and is in the process of implementing them.	The organisation has effective controls in place that ensure the data held is of the requisite quality and accuracy and is consistent. The controls are regularly reviewed and improved where necessary.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
64	Information management	How has the organisation's ensured its asset management information system is relevant to its needs?	2	Refer AMP Sec 6.3 Systems and Information Management. The Network Asset Manager and Network Information Specialist request improvements that are designed and implemented by IT and the Operations Committee offers feedback in this iterative process. Implementation of the ESRI Arcview GIS during 2022 will input data into a Utility Network Common Information Model format, allowing subsequent asset information systems to draw on the same data and avoid multiple entry. GIS functionality will allow improved reporting and inform asset management decisions. The Aerial Survey (LiDAR and pole top photos) of the rural overhead network has provided significant asset condition information for identification of defects and confirmation of expenditure levels.	The development of an Information Systems Strategic Plan is underway and the first systems are in development in 2021/22.	Widely used AM standards need not be prescriptive about the form of the asset management information system, but simply require that the asset management information system is appropriate to the organisations needs, can be effectively used and can supply information which is consistent and of the requisite quality and accuracy.	The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Users of the organisational information systems.	The documented process the organisation employs to ensure its asset management information system aligns with its asset management requirements. Minutes of information systems review meetings involving users.
69	Risk management process(es)	How has the organisation documented process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle?	3	Refer to AMP Sec 6.5 Risk Management. Refer to AMP Sec 6.6 Life Cycle Management. Refer to Public Safety Management System Sec 6.4 Compliance, Sec 3 Network Overview, WN Risk Management Manual. Refer to "minutes" of Health, Safety & Environment Committee monthly meetings where incidents and accidents are analysed (E,I,M). Refer to Company Risk Register. Refer to relevant Board Meeting "minutes" example accelerated removal of oil filled switchgear.	An integrated risk management system compliant with ISO31000 has been introduced, with consideration of network asset related risks. With the documentation of some risk areas such as fleet plans WN will have practical risk managements systems. The risk management system is consistent with the H&S system, the same risk matrix is used to assess organisation wide risks.	Risk management is an important foundation for proactive asset management. Its overall purpose is to understand the cause, effect and likelihood of adverse events occurring, to optimally manage such risks to an acceptable level, and to provide an audit trail for the management of risks. Widely used standards require the organisation to have process(es) and/or procedure(s) in place that set out how the organisation identifies and assesses asset and asset management related risks. The risks have to be considered across the four phases of the asset lifecycle (eg, para 4.3.3 of PAS 55).	The top management team in conjunction with the organisation's senior risk management representatives. There may also be input from the organisation's Safety, Health and Environment team. Staff who carry out risk identification and assessment.	The organisation's risk management framework and/or evidence of specific process(es) and/ or procedure(s) that deal with risk control mechanisms. Evidence that the process(es) and/or procedure(s) are implemented across the business and maintained. Evidence of agendas and minutes from risk management meetings. Evidence of feedback in to process(es) and/or procedure(s) as a result of incident investigation(s). Risk registers and assessments.

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79	Use and maintenance of asset risk information	How does the organisation ensure that the results of risk assessments provide input into the identification of adequate resources and training and competency needs?	2	Refer AMP Sec 6.6 Life Cycle Management, Sec 6.7 Vegetation Management. Refer to Company Training Matrix and Personal Development Plans. Refer to Company Risk Registers. Refer to Health and Safety at Work and Environmental Management System. Refer to "minutes" of Health, Safety & Environmental Committee (20% of Company personnel) monthly meetings. Refer to "minutes" of Network Operations & Engineering Team monthly meetings. Refer to regular Field Crew Safety Refresher Training. During the budget process a GAP analysis is completed to ensure appropriate resources are available either internal or external. The Company Training Matrix and Individual Personal Development Plans are used to increase skills of current staff as a first option	The linkages from the risk management system to key plans is evolving. WN has recognised the need for more sophisticated growth planning and condition monitoring processes and this is part of the Asset Management Improvement Plan.	Widely used AM standards require that the output from risk assessments are considered and that adequate resource (including staff) and training is identified to match the requirements. It is a further requirement that the effects of the control measures are considered, as there may be implications in resources and training required to achieve other objectives.	Staff responsible for risk assessment and those responsible for developing and approving resource and training plan(s). There may also be input from the organisation's Safety, Health and Environment team.	The organisations risk management framework. The organisation's resourcing plan(s) and training and competency plan(s). The organisation should be able to demonstrate appropriate linkages between the content of resource plan(s) and training and competency plan(s) to the risk assessments and risk control measures that have been developed.
82	Legal and other requirements	What procedure does the organisation have to identify and provide access to its legal, regulatory, statutory and other asset management requirements, and how is requirements incorporated into the asset management system?	3	Refer AMP Sec 2.2 Basis of AMP, Sec 2.3 Key stakeholders and objectives, Sec 2.4 Link to other documents, Sec 5.13 Public Safety, Amenity Values and EDB Performance Goals, Sec 5.14 Objecive commitements. We rely on industry organisations and regulatory bodies to keep us informed of changes. Waipa Networks uses ComplyWith web enabled software to assess compliance with legislative and regulatory requirements, involving questionnaires completed by a variety of staff determined by a matrix of the registry of requirements within the ComplyWith software. This produces a six-monthly declaration of compliance that is reported to the Board.	WN monitors that it's AMP complies with the requirements of the Commerce Commission and ComplyWith is a good process to check on other areas of compliance. The external public safety audit has shown relatively few gaps in compliance. WN have introduced a Safety by Design process and are jointly reviewing high risk safety areas with another EDB.	In order for an organisation to comply with its legal, regulatory, statutory and other asset management requirements, the organisation first needs to ensure that it knows what they are (eg, PAS 55 specifies this in s 4.4.8). It is necessary to have systematic and auditable mechanisms in place to identify new and changing requirements. Widely used AM standards also require that requirements are incorporated into the asset management system (e.g. procedure(s) and process(es))	Top management. The organisations regulatory team. The organisation's legal team or advisors. The management team with overall responsibility for the asset management system. The organisation's health and safety team or advisors. The organisation's policy making team.	The organisational processes and procedures for ensuring information of this type is identified, made accessible to those requiring the information and is incorporated into asset management strategy and objectives

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
64	Information management	How has the organisation's ensured its asset management information system is relevant to its needs?	The organisation has not considered the need to determine the relevance of its management information system. At present there are major gaps between what the information system provides and the organisations needs.	The organisation understands the need to ensure its asset management information system is relevant to its needs and is determining an appropriate means by which it will achieve this. At present there are significant gaps between what the information system provides and the organisations needs.	The organisation has developed and is implementing a process to ensure its asset management information system is relevant to its needs. Gaps between what the information system provides and the organisations needs have been identified and action is being taken to close them.	The organisation's asset management information system aligns with its asset management requirements. Users can confirm that it is relevant to their needs.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
69	Risk management process(es)	How has the organisation documented process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle?	The organisation has not considered the need to document process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle.	The organisation is aware of the need to document the management of asset related risk across the asset lifecycle. The organisation has plan(s) to formally document all relevant process(es) and procedure(s) or has already commenced this activity.	The organisation is in the process of documenting the identification and assessment of asset related risk across the asset lifecycle but it is incomplete or there are inconsistencies between approaches and a lack of integration.	Identification and assessment of asset related risk across the asset lifecycle is fully documented. The organisation can demonstrate that appropriate documented mechanisms are integrated across life cycle phases and are being consistently applied.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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79	Use and maintenance of asset risk information	How does the organisation ensure that the results of risk assessments provide input into the identification of adequate resources and training and competency needs?	The organisation has not considered the need to conduct risk assessments.	The organisation is aware of the need to consider the results of risk assessments and effects of risk control measures to provide input into reviews of resources, training and competency needs. Current input is typically ad-hoc and reactive.	The organisation is in the process ensuring that outputs of risk assessment are included in developing requirements for resources and training. The implementation is incomplete and there are gaps and inconsistencies.	Outputs from risk assessments are consistently and systematically used as inputs to develop resources, training and competency requirements. Examples and evidence is available.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
82	Legal and other requirements	What procedure does the organisation have to identify and provide access to its legal, regulatory, statutory and other asset management requirements, and how is requirements incorporated into the asset management system?	The organisation has not considered the need to identify its legal, regulatory, statutory and other asset management requirements.	The organisation identifies some its legal, regulatory, statutory and other asset management requirements, but this is done in an ad-hoc manner in the absence of a procedure.	The organisation has procedure(s) to identify its legal, regulatory, statutory and other asset management requirements, but the information is not kept up to date, inadequate or inconsistently managed.	Evidence exists to demonstrate that the organisation's legal, regulatory, statutory and other asset management requirements are identified and kept up to date. Systematic mechanisms for identifying relevant legal and statutory requirements.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
88	Life Cycle Activities	How does the organisation establish implement and maintain process(es) for the implementation of its asset management plan(s) and control of activities across the creation, acquisition or enhancement of assets. This includes design, modification, procurement, construction and commissioning activities?	2.5	Refer AMP Sec 9 Fleet Management. Waipa's asset selection policy is to use only tried and proven products. The Company adopts a position of being "leading edge not bleeding edge". When new modern equivalent assets are considered, their performance and lifecycle cost are evaluated by Waipa's Engineering team including consultation with Operations before they are installed on the network. All new assets are sized appropriately for their intended use and life. Refer Design Manual and Construction Manual for construction and commissioning policies and procedures.	The Construction Manual of standard drawings and assemblies is close to complete. The Design Manual update is to follow. The appropriate use of the Powerco standards is being applied.	Life cycle activities are about the implementation of asset management plan(s) i.e. they are the "doing" phase. They need to be done effectively and well in order for asset management to have any practical meaning. As a consequence, widely used standards (eg, PAS 55 s 4.5.1) require organisations to have in place appropriate process(es) and procedure(s) for the implementation of asset management plan(s) and control of lifecycle activities. This question explores those aspects relevant to asset creation.	Asset managers, design staff, construction staff and project managers from other impacted areas of the business, e.g. Procurement	Documented process(es) and procedure(s) which are relevant to demonstrating the effective management and control of life cycle activities during asset creation, acquisition, enhancement including design, modification, procurement, construction and commissioning.
91	Life Cycle Activities	How does the organisation ensure that process(es) and/or procedure(s) for the implementation of asset management plan(s) and control of activities during maintenance (and inspection) of assets are sufficient to ensure activities are carried out under specified conditions, are consistent with asset management strategy and control cost, risk and performance?	2	Refer AMP Sec 6.6 Lifecyle Management 6.8 Surveilance. Safety and Quality audits are conducted on a sample basis to monitor performance of works. Progress against AMP and Finances is a standard report to the Board and Network Management report gives management overview of progress with programmes reported monthly and annually in the AMP including Appendix F Earth Testing and Repair Programme. Defects raised and closed out are tracked and reported.	The external public safety auditor views procedures as needing further development. The Asset Management Improvement Plan includes improvements in documentation of processes.	Having documented process(es) which ensure the asset management plan(s) are implemented in accordance with any specified conditions, in a manner consistent with the asset management policy, strategy and objectives and in such a way that cost, risk and asset system performance are appropriately controlled is critical. They are an essential part of turning intention into action (eg, as required by PAS 55 s 4.5.1).	Asset managers, operations managers, maintenance managers and project managers from other impacted areas of the business	Documented procedure for review. Documented procedure for audit of process delivery. Records of previous audits, improvement actions and documented confirmation that actions have been carried out.
95	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?	2.5	The Company monitors network performance and reports monthly on SAIDI, SAIFI, planned and unplanned outage numbers and causes of faults. Refer to AMP Sec 9 Fleet Management, Sec 5.15 Performance summary and response and Sec 6.16 Asset Management Improvement. Use of Asset Health Indicators for fleet assets provides a forward view on asset renewal requirements. Increased use of assessed condition for asset health indicators is improving accuracy of this information.	The external reviewer of the public health and safety management system commented favourably on the use of lead and lag indicators.	Widely used AM standards require that organisations establish implement and maintain procedure(s) to monitor and measure the performance and/or condition of assets and asset systems. They further set out requirements in some detail for reactive and proactive monitoring, and leading/lagging performance indicators together with the monitoring or results to provide input to corrective actions and continual improvement. There is an expectation that performance and condition monitoring will provide input to improving asset management strategy, objectives and plan(s).	A broad cross-section of the people involved in the organisation's asset-related activities from data input to decision-makers, i.e. an end-to end assessment. This should include contactors and other relevant third parties as appropriate.	Functional policy and/or strategy documents for performance or condition monitoring and measurement. The organisation's performance monitoring frameworks, balanced scorecards etc. Evidence of the reviews of any appropriate performance indicators and the action lists resulting from these reviews. Reports and trend analysis using performance and condition information. Evidence of the use of performance and condition information shaping improvements and supporting asset management strategy, objectives and plan(s).

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

99	Investigation of asset-related failures, incidents and nonconformities	How does the organisation ensure responsibility and the authority for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances is clear, unambiguous, understood and communicated?	2.5	Incidents and emergency situations are managed by the Control Room Operators who are authorised and responsible for assigning staff to respond by making safe and carry out repairs, in conjunction with the Field Services Manager and Duty Supervisors. Contracts with 3rd parties describe responsibilities and performance measures. The Network Asset Manager is responsible for investigating all network asset failures and performance of the network as per job description. The Public Safety Management System and the Health, Safety and Environmental Manual ensure Identification and Control of Significant Hazards which are included in the Company Hazard Register. Duty Supervisors and Health, Safety & Wellbeing Manager respond immediately to safety incidents.	The external review of the public health and safety system commented that incident review systems are active. Exercising the emergency management systems is planned.	Widely used AM standards require that the organisation establishes implements and maintains process(es) for the handling and investigation of failures incidents and non-conformities for assets and sets down a number of expectations. Specifically this question examines the requirement to define clearly responsibilities and authorities for these activities, and communicate these unambiguously to relevant people including external stakeholders if appropriate.	The organisation's safety and environment management team. The team with overall responsibility for the management of the assets. People who have appointed roles within the asset-related investigation procedure, from those who carry out the investigations to senior management who review the recommendations. Operational controllers responsible for managing the asset base under fault conditions and maintaining services to consumers. Contractors and other third parties as appropriate.	Process(es) and procedure(s) for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances. Documentation of assigned responsibilities and authority to employees. Job Descriptions, Audit reports. Common communication systems i.e. all Job Descriptions on Internet etc.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
88	Life Cycle Activities	How does the organisation establish implement and maintain process(es) for the implementation of its asset management plan(s) and control of activities across the creation, acquisition or enhancement of assets. This includes design, modification, procurement, construction and commissioning activities?	The organisation does not have process(es) in place to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning.	The organisation is aware of the need to have process(es) and procedure(s) in place to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning but currently do not have these in place (note: procedure(s) may exist but they are inconsistent/incomplete).	The organisation is in the process of putting in place process(es) and procedure(s) to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning. Gaps and inconsistencies are being addressed.	Effective process(es) and procedure(s) are in place to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
91	Life Cycle Activities	How does the organisation ensure that process(es) and/or procedure(s) for the implementation of asset management plan(s) and control of activities during maintenance (and inspection) of assets are sufficient to ensure activities are carried out under specified conditions, are consistent with asset management strategy and control cost, risk and performance?	The organisation does not have process(es)/procedure(s) in place to control or manage the implementation of asset management plan(s) during this life cycle phase.	The organisation is aware of the need to have process(es) and procedure(s) in place to manage and control the implementation of asset management plan(s) during this life cycle phase but currently do not have these in place and/or there is no mechanism for confirming they are effective and where needed modifying them.	The organisation is in the process of putting in place process(es) and procedure(s) to manage and control the implementation of asset management plan(s) during this life cycle phase. They include a process for confirming the process(es)/procedure(s) are effective and if necessary carrying out modifications.	The organisation has in place process(es) and procedure(s) to manage and control the implementation of asset management plan(s) during this life cycle phase. They include a process, which is itself regularly reviewed to ensure it is effective, for confirming the process(es)/ procedure(s) are effective and if necessary carrying out modifications.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
95	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?	The organisation has not considered how to monitor the performance and condition of its assets.	The organisation recognises the need for monitoring asset performance but has not developed a coherent approach. Measures are incomplete, predominantly reactive and lagging. There is no linkage to asset management objectives.	The organisation is developing coherent asset performance monitoring linked to asset management objectives. Reactive and proactive measures are in place. Use is being made of leading indicators and analysis. Gaps and inconsistencies remain.	Consistent asset performance monitoring linked to asset management objectives is in place and universally used including reactive and proactive measures. Data quality management and review process are appropriate. Evidence of leading indicators and analysis.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

99	Investigation of asset-related failures, incidents and nonconformities	How does the organisation ensure responsibility and the authority for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances is clear, unambiguous, understood and communicated?	The organisation has not considered the need to define the appropriate responsibilities and the authorities.	The organisation understands the requirements and is in the process of determining how to define them.	The organisation are in the process of defining the responsibilities and authorities with evidence. Alternatively there are some gaps or inconsistencies in the identified responsibilities/authorities.	The organisation have defined the appropriate responsibilities and authorities and evidence is available to show that these are applied across the business and kept up to date.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

Company Name	**Waipa Networks Limited**
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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	2	Waipa's AMP's asset management systems and processes developed by the Network Asset Manager, the Corporate Services team and the Network Information Specialists are subject to internal review by Executive Management. Waipa's Health, Safety & Wellbeing Manager and team audits Waipa's field crews and contractor's for work site safety and compliance with Waipa's design criteria. Paperwork audits are completed to assess quality and compliance with requirements for work management, equipment and testing records and documentation. Telarc routinely audit a selection of Waipa's works for public safety and compliance with industry best practice. Enviro-Mark audit Waipa's environmental policies and practices. ACC have audited Waipa's Workplace	An Asset Management Improvement Plan has been prepared. The outcomes of asset inspection condition monitoring have been reviewed.	This question seeks to explore what the organisation has done to comply with the standard practice AM audit requirements (eg, the associated requirements of PAS 55 s 4.6.4 and its linkages to s 4.7).	The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit teams, together with key staff responsible for asset management. For example, Asset Management Director, Engineering Director. People with responsibility for carrying out risk assessments	The organisation's asset-related audit procedure(s). The organisation's methodology(s) by which it determined the scope and frequency of the audits and the criteria by which it identified the appropriate audit personnel. Audit schedules, reports etc. Evidence of the procedure(s) by which the audit results are presented, together with any subsequent communications. The risk assessment schedule or risk registers.
109	Corrective & Preventative action	How does the organisation instigate appropriate corrective and/or preventive actions to eliminate or prevent the causes of identified poor performance and non conformance?	2.5	The Network Asset Manager is responsible for investigating all network asset failures and performance of the network as per job description. The Public Safety Management System and the Health, Safety and Environmental Manual ensure Identification and Control of Significant Hazards which are included in the Company Hazard Register. Any equipment or design hazards identified and assessed as requiring replacement to manage network risk are replaced in a planned controlled manner through the asset management plan process. The Network Asset Manager is accountable to CEO and Board. Compliance reporting against legislative and regulatory requirements are assessed in detail every six months using the ComplyWith	WN has recognised the need to put more focus on the AMP document itself. Failure investigation and improvement is evident and documentation improvements are planned. The ICAM system is used which is a good system for root cause analysis. Network related equipment faults are under the industry norms demonstrating long term maintenance and replacement processes have been active.	Having investigated asset related failures, incidents and non-conformances, and taken action to mitigate their consequences, an organisation is required to implement preventative and corrective actions to address root causes. Incident and failure investigations are only useful if appropriate actions are taken as a result to assess changes to a businesses risk profile and ensure that appropriate arrangements are in place should a recurrence of the incident happen. Widely used AM standards also require that necessary changes arising from preventive or corrective action are made to the asset management system.	The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit and incident investigation teams. Staff responsible for planning and managing corrective and preventive actions.	Analysis records, meeting notes and minutes, modification records. Asset management plan(s), investigation reports, audit reports, improvement programmes and projects. Recorded changes to asset management procedure(s) and process(es). Condition and performance reviews. Maintenance reviews

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

113	Continual Improvement	How does the organisation achieve continual improvement in the optimal combination of costs, asset related risks and the performance and condition of assets and asset systems across the whole life cycle?	2.5	Refer AMP Sec 6.5 Risk Management, Sec 6.6 Life Cycle Management, Sec 6.7 Vegetation Management. These AMP Sections set the Company's criteria of risk and performance against which optimal (the cost of) continual improvement is measured. Sec 5.15 Performance summary and response assesses performance against AMP	Improvements in risk management have been made and optimal growing planning is occurring at GXPs. Continued improvement in asset health indicators is planned as well as asset process documentation. This will enable further optimisation of cost and risk.	Widely used AM standards have requirements to establish, implement and maintain process(es)/procedure(s) for identifying, assessing, prioritising and implementing actions to achieve continual improvement. Specifically there is a requirement to demonstrate continual improvement in optimisation of cost risk and performance/condition of assets across the life cycle. This question explores an organisation's capabilities in this area—looking for systematic improvement mechanisms rather that reviews and audit (which are separately examined).	The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. Managers responsible for policy development and implementation.	Records showing systematic exploration of improvement. Evidence of new techniques being explored and implemented. Changes in procedure(s) and process(es) reflecting improved use of optimisation tools/techniques and available information. Evidence of working parties and research.
115	Continual Improvement	How does the organisation seek and acquire knowledge about new asset management related technology and practices, and evaluate their potential benefit to the organisation?	3	Company Management and Supervisors who manage and operate network assets regularly participate in EEA, Connexis and Transpower conferences, exhibitions and industry forums at which they are able to update themselves on new asset options and experiences others have had with existing network assets. The work of the EEA Asset Management Group is monitored for developments. Company Management and Supervisors regularly liaise with other EDBs and the Suppliers of assets concerning the adoption of new products and problems with existing assets. New equipment is evaluated on a cost and quality basis with life cycle performance in mind. Pilots to trial new equipment and gain experience with new technology are used in some cases before a wholesale	With additional specialist staff, an improvement programme, the implementation of the ADMS roadmap and coordination with other EDBs an appropriate technology future path will be determined.	One important aspect of continual improvement is where an organisation looks beyond its existing boundaries and knowledge base to look at what 'new things are on the market'. These new things can include equipment, process(es), tools, etc. An organisation which does this (eg, by the PAS 55 s 4.6 standards) will be able to demonstrate that it continually seeks to expand its knowledge of all things affecting its asset management approach and capabilities. The organisation will be able to demonstrate that it identifies any such opportunities to improve, evaluates them for suitability to its own organisation and implements them as appropriate. This question explores an organisation's approach to this activity.	The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. People who monitor the various items that require monitoring for 'change'. People that implement changes to the organisation's policy, strategy, etc. People within an organisation with responsibility for investigating, evaluating, recommending and implementing new tools and techniques, etc.	Research and development projects and records, benchmarking and participation knowledge exchange professional forums. Evidence of correspondence relating to knowledge acquisition. Examples of change implementation and evaluation of new tools, and techniques linked to asset management strategy and objectives.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	The organisation has not recognised the need to establish procedure(s) for the audit of its asset management system.	The organisation understands the need for audit procedure(s) and is determining the appropriate scope, frequency and methodology(s).	The organisation is establishing its audit procedure(s) but they do not yet cover all the appropriate asset-related activities.	The organisation can demonstrate that its audit procedure(s) cover all the appropriate asset-related activities and the associated reporting of audit results. Audits are to an appropriate level of detail and consistently managed.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
109	Corrective & Preventative action	How does the organisation instigate appropriate corrective and/or preventive actions to eliminate or prevent the causes of identified poor performance and non conformance?	The organisation does not recognise the need to have systematic approaches to instigating corrective or preventive actions.	The organisation recognises the need to have systematic approaches to instigating corrective or preventive actions. There is ad-hoc implementation for corrective actions to address failures of assets but not the asset management system.	The need is recognized for systematic instigation of preventive and corrective actions to address root causes of non compliance or incidents identified by investigations, compliance evaluation or audit. It is only partially or inconsistently in place.	Mechanisms are consistently in place and effective for the systematic instigation of preventive and corrective actions to address root causes of non compliance or incidents identified by investigations, compliance evaluation or audit.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

113	Continual Improvement	How does the organisation achieve continual improvement in the optimal combination of costs, asset related risks and the performance and condition of assets and asset systems across the whole life cycle?	The organisation does not consider continual improvement of these factors to be a requirement, or has not considered the issue.	A Continual Improvement ethos is recognised as beneficial, however it has just been started, and or covers partially the asset drivers.	Continuous improvement process(es) are set out and include consideration of cost risk, performance and condition for assets managed across the whole life cycle but it is not yet being systematically applied.	There is evidence to show that continuous improvement process(es) which include consideration of cost risk, performance and condition for assets managed across the whole life cycle are being systematically applied.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
115	Continual Improvement	How does the organisation seek and acquire knowledge about new asset management related technology and practices, and evaluate their potential benefit to the organisation?	The organisation makes no attempt to seek knowledge about new asset management related technology or practices.	The organisation is inward looking, however it recognises that asset management is not sector specific and other sectors have developed good practice and new ideas that could apply. Ad-hoc approach.	The organisation has initiated asset management communication within sector to share and, or identify 'new' to sector asset management practices and seeks to evaluate them.	The organisation actively engages internally and externally with other asset management practitioners, professional bodies and relevant conferences. Actively investigates and evaluates new practices and evolves its asset management activities using appropriate developments.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Schedule 17: Certification for Year-beginning Disclosures

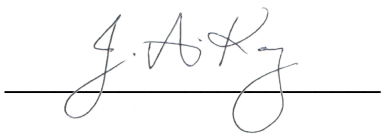
Clause 2.9.1 of section 2.9

We, Jonathan Anthony KAY and Jonathan Guy Scott CAMERON, being directors of Waipa Networks Limited certify that, having made all reasonable enquiry, to the best of our knowledge:

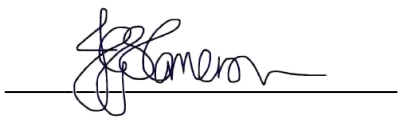
a. The following attached information of Waipa Networks Limited prepared for the purposes of clause 2.4.1, clause 2.6.1, 2.6.3, 2.6.6 and 2.7.2 of the Electricity Distribution Information Disclosure Determination 2012 in all material respects complies with that determination.

b. The prospective financial or non-financial information included in the attached information has been measured on a basis consistent with regulatory requirements or recognised industry standards.

c. The forecasts in Schedules 11a, 11b, 12a, 12b, 12c and 12d are based on objective and reasonable assumptions which both align with Waipa Networks' corporate vision and strategy and are documented in retained records.



Jonathan Anthony KAY



Jonathan Guy Scott CAMERON

31 March 2022