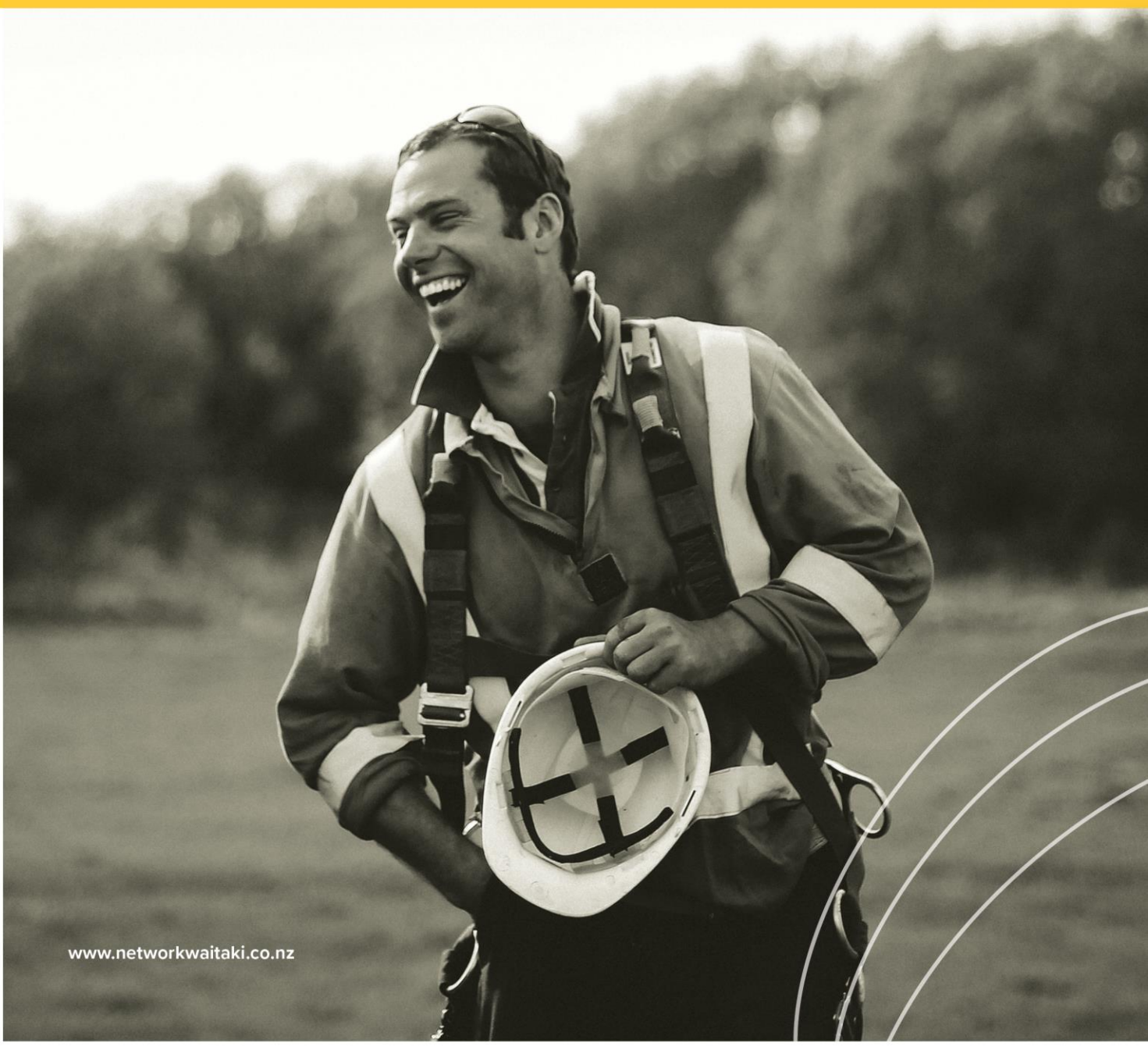
Network Waitaki
Powering North Otago

Powering North Otago.

Asset Management Plan 2019 - 2029



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Foreword.

It gives me great pleasure to introduce the 2019 publication of Network Waitaki's Asset Management Plan (AMP). The AMP aims to inform readers comprehensively on all actions pertaining to our network.

We are a consumer trust-owned, electricity distribution business and we place high value on our customer service. The management, maintenance and operation of our network is an integral part of our day-to-day operations. Recent growth in electricity demand has necessitated the planning for and investment in new and upgraded assets.

This AMP intends to provide comfort to our consumers, regulators, and stakeholders that Network Waitaki takes its responsibility of providing a safe, reliable, efficient, and cost-effective electricity network service very seriously. In this regard the AMP details the service levels that we strive to provide to our consumers.

Our focus on the health and safety of our workers and the public has seen an increase in the number of planned supply outages due to the reduced use of live line techniques.

We have been aware for several years that we are approaching the capacity limit on the 110 kV circuits that supply Oamaru. We have recently worked with Transpower to increase this limit. This, along with planned work to upgrade the GXP at Lake Waitaki and progressively upgrade our subtransmission network, will allow us to meet growth in the Waitaki Valley, Waitaki Plains and Oamaru areas until the latter part of the planning period. In association with Transpower and Alpine Energy, we are continuing to monitor growth and evaluate long-term options to ensure that timely and prudent economic decisions are made.

We value comments or questions that you might have on anything raised in this AMP. Please feel welcome to send it to service@networkwaitaki.co.nz, for the attention of Tod Trotman.

Graham Clark
Chief Executive

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01. Introduction

Welcome to our Asset Management Plan (AMP) for the planning period 1st April 2019 to 31st March 2029.

As we provide an essential service to the communities we serve, it is vital that our electricity network meets the evolving needs of our consumers. Our AMP plays a central role in determining the appropriate levels of network planning and investment required to achieve this.

This chapter introduces the AMP and is structured as follows:

Executive summary: explains our asset management approach and summarises the challenges and development ahead for us, including our capital and operational expenditure forecasts.

Purpose: explains the purpose and objectives of the AMP; the period and assets covered; the date it was approved by our Board of Directors (the Board); and the intended audience.

Key themes and initiatives: summarises the key themes and initiatives that have been outlined throughout the AMP.

Document structure: an illustration of how the AMP is structured.

1.1 Executive summary

1.1.1 Our approach to asset management

We view effective asset management as a continual cycle, with direction, planning, implementation, and review working together to improve our performance.

Our documentation such as the Strategic Plan, Asset Management Policy, Asset Management Strategy, and this AMP are all aligned with our corporate objectives. This alignment flows through to the delivery of the works programme.

We have a single shareholder, the Waitaki Power Trust (the Trust), which holds the shares of NWL on behalf of the NWL consumers. The Trust has five elected trustees and appoints directors to the Board to carry out the governance and management functions of the business.

We report monthly to the Board and quarterly to the Trust on our performance, including progress on the delivery of our works programme.

To manage the risk associated with operating an electrical network we have a robust risk management system, based on *ISO31000 - Risk management*. This has allowed us to incorporate risk management across the entire business from strategic planning through to daily activities such as fault responses. Our treatment of risk includes planning for major events and working with other local authorities through activities such as our involvement in Civil Defence and Emergency Management to align our response planning.

To keep the public safe, we operate a Public Safety Management System (PSMS) which is audited to the national standard, NZS7901:2008 *Electricity and gas industries – Safety management systems for public safety*. This PSMS is audited annually for compliance to the standard by Telarc, with any opportunities for improvement being incorporated into it.

Our Statement of Corporate Intent (SCI) is reviewed regularly along with our corporate objectives to ensure that the business drivers for operating the network are correctly aligned. These documents are key inputs into our asset management process.

Our asset management practice is to actively seek out best practice both from within our industry, and from other industries where it is appropriate. Examples of this are our use of faults data from the UK via the National Equipment Defect Reporting System (NEDeRS) database to assist in asset decision making, and staff training from within the industry e.g. Electricity Engineers Association (EEA) courses, and from other industries e.g. reliability centred maintenance training through the aviation industry.

We are currently undertaking an exercise to coordinate asset condition and operational data across several systems, which will enable greater insight into the operation and lifecycle of our assets.

One of the key activities in the early part of the planning period is the implementation of an asset criticality framework. This will inform the development of more focussed maintenance and renewal strategies and improve performance and safety outcomes for the network.

We continue to improve our awareness and implementation of Asset Management practices. Assessment of our asset management using the Commerce Commission asset management maturity assessment tool (AMMAT) shows that our asset management practice is reasonably good, but that there is still scope for improvement, with our scores being 2 or 3 out of 4 across all areas of assessment. Our growing awareness of good practice in asset management helps the continuous development of our business.

1.1.2 Managing our assets

Key features of the network are shown in the table below:

Table 1 - Key features of NWL network

Parameter	Value
Number of Poles	21,708
Length of 33 kV lines and cables	222 km
Length of 11 kV lines and cables	1,327 km
Length of LV lines and cables	343 km
Number of zone substations	18
Number of connected consumers	12,968
Coincident max demand	66 MVA

These assets are discussed in more detail in Section 5 Renewals and Maintenance.

We have traditionally managed our asset life via condition-based renewals and replacements. We are improving and strengthening these practices, for instance with the introduction of a new framework for field inspections and specialised training for our line inspectors. With the integration of our asset data systems we are working towards utilising better predictive methods for analysing lifecycle of the assets. Examples here include rolling out a remote distribution transformer monitoring system and integrating fault and asset data directly from the field into our asset management systems and GIS.

1.1.3 Developing our network

The development of our network is discussed in detail in Section 6.

The main driver for development in our network has been growth in the irrigation load, which has firmly established us as a summer peaking network. We have also seen modest growth in the industrial and domestic sectors. Most irrigation growth has occurred at our rural zone substations. In some cases, this has had the effect of reducing spare capacity, and the ability to provide back up to neighbouring substations. Projects are underway to investigate and remediate this, and to optimise the spare capacity around the network.

We are forecasting continued growth across the network, as shown below.

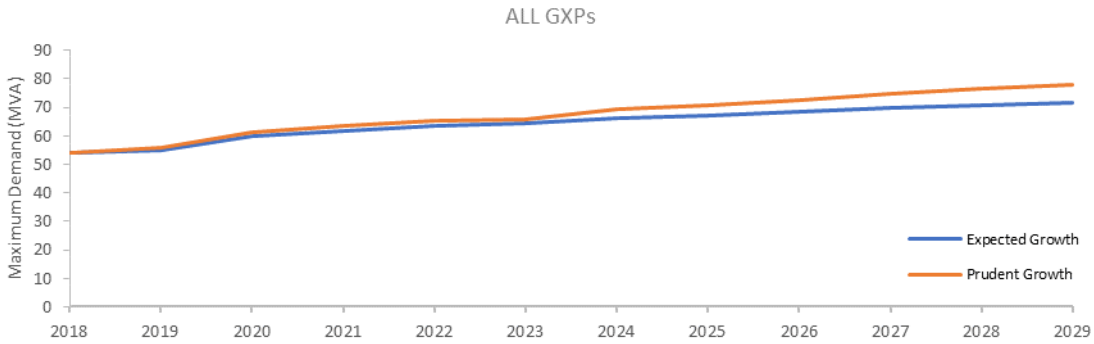


Figure 1- Load growth of all GXPs (excluding Black Point GXP)

There is a capacity constraint on the Transpower 110 kV transmission lines that supply Oamaru GXP. This threatens to restrict the available capacity to connect new load in the lower Waitaki, as well as affecting other areas in South Canterbury. We are working with Transpower, Alpine Energy Ltd, and other stakeholders to address this situation. This is detailed further in Sections 6.3.4 and 6.4.1.

At the network level, we are dealing with this constraint, by continuing to develop our 66 kV subtransmission network. This will enable further migration of load from our Oamaru GXP to an upgraded Waitaki GXP, effectively bypassing Transpower's constrained 110 kV transmission system for a portion of our load. More details of these developments are included in Section 6.

Potential effects from emerging technologies, such as electric vehicles, solar distributed generation, and batteries have been analysed and included in our load forecasting. We acknowledge that there is high uncertainty in both the size and the timing of the effect that these technologies will have on our network.

We plan to increase the monitoring and data gathering on our low voltage networks and to continue working to gain access to customer smart meter data from retailers. Access to the retailers' data would save us significant financial outlay and provide us visibility of the performance of our LV network. If the data were real-time, it would provide the added benefit of allowing us to respond to and analyse fault outages more quickly.

1.1.4 Our summary of forecast expenditure

The summary of our forecast expenditure for the planning period is shown in Table 2 below.

These estimates are considered to be fairly accurate for the first 5 years of the planning period, and less accurate beyond that point. This is primarily due to many of our investment, maintenance and renewal decisions being very dependent on outcomes of inspections in the first 5 years, consumer growth, the impact of emerging technologies such as solar generation and electric vehicles, and other issues that are currently out of our control, including issues with the Transpower constraints in North Otago and South Canterbury.

Table 2 - Summary of forecast expenditure

Forecast Expenditure ($)										
Capital Expenditure	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
Consumer connection	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
System growth	3,320,000	3,455,000	2,680,000	5,730,000	3,180,000	2,110,000	2,960,000	4,160,000	3,960,000	760,000
Asset replacement and renewal	3,460,000	3,080,000	2,500,000	2,330,000	3,170,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000
Asset relocations	0	0	0	0	0	0	0	0	0	0
Reliability, safety, and environment: Quality of supply	1,132,000	735,000	659,000	339,000	329,000	229,000	189,000	159,000	159,000	159,000
Reliability, safety, and environment: Legislative and regulatory	480,000	480,000	290,000	290,000	10,000	10,000	10,000	10,000	10,000	10,000
Other reliability, safety, and environment	0	0	0	0	0	0	0	0	0	0
Subtotal Capital Expenditure	**9,642,000**	**9,000,000**	**7,379,000**	**9,939,000**	**7,939,000**	**5,839,000**	**6,649,000**	**7,819,000**	**7,619,000**	**4,419,000**
Operational Expenditure										
Service interruptions & emergencies	494,000	494,000	494,000	494,000	494,000	494,000	494,000	494,000	494,000	494,000
Vegetation management	599,000	599,000	599,000	599,000	599,000	599,000	599,000	599,000	599,000	599,000
Routine & corrective maintenance & inspection	1,131,000	928,000	928,000	928,000	928,000	908,000	908,000	908,000	908,000	908,000
Asset replacement & renewal	590,000	490,000	490,000	490,000	490,000	490,000	490,000	490,000	490,000	490,000
Subtotal Operational Expenditure:	**2,814,000**	**2,511,000**	**2,511,000**	**2,511,000**	**2,511,000**	**2,491,000**	**2,491,000**	**2,491,000**	**2,491,000**	**2,491,000**
Total Expenditure	12,456,000	11,511,000	9,890,000	12,450,000	10,450,000	8,330,000	9,140,000	10,310,000	10,110,000	6,910,000

1.2 Purpose

The purpose of this AMP is to align the management of our assets with our corporate objectives and our mission of "owning and operating a safe, reliable, and efficient distribution system that meets the evolving needs of our consumers, while supporting the economic growth and wellbeing of the community we serve."

This AMP is an integral part of our business planning process alongside other key corporate documents, including our Statement of Corporate Intent, annual business plan and budget, Network Development Plan, monthly board reports, and our emergency preparedness documents.

The objectives of this AMP are to:

- link the asset management processes to consumer and stakeholder preferences for prices, supply reliability, and public safety
- ensure that all asset lifecycle activities, plans and associated costs are systematically planned with a long-term view towards minimising lifecycle costs, which promotes productive efficiency
- ensure that physical, commercial, and regulatory risks are correctly managed throughout the life of the asset.

1.2.1 Approval date

The 2019-2029 AMP was approved by the Network Waitaki Ltd.'s (NWL) Board of Directors on 25th March 2019. See Appendix B for a copy of the signed Certificate of Approval.

1.2.2 Scope

The scope of this AMP includes all areas of planning that relate to NWL's electrical distribution services as an Electricity Distribution Business (EDB). This does not include business streams outside the core EDB business, such as electrical contracting, metering services, and the fibre optic network.

1.2.3 Intended audience

The AMP is published on our website (www.networkwaitaki.co.nz) and is aimed at the following readership:

- The Commerce Commission
- Our trustees, directors, and management
- Our staff
- Our consumers
- Our other stakeholders
- Interested members of the public
- Other Electricity Distribution Businesses (EDBs)

1.3 Key themes

The key themes for the planning period within the Waitaki area are:

- The importance of safety on and around the network, both as a safe workplace for our staff and as a safe utility for the public.
- Continued growth is expected in demand in the rural areas based on further irrigation development in the region.
- The impact of the constraint on the Transpower 110 kV supply to Oamaru GXP.
- Resilience to natural events is becoming a more important issue for our communities.
- The impact on system operation and asset management as a result of the change to our live line working policies.
- In the urban areas, it is expected that load changes will be due to population growth, commercial/industrial growth and the gradual uptake of new technologies (such as electric vehicles).

1.4 Document structure

Figure 2 below illustrates the structure of this AMP.

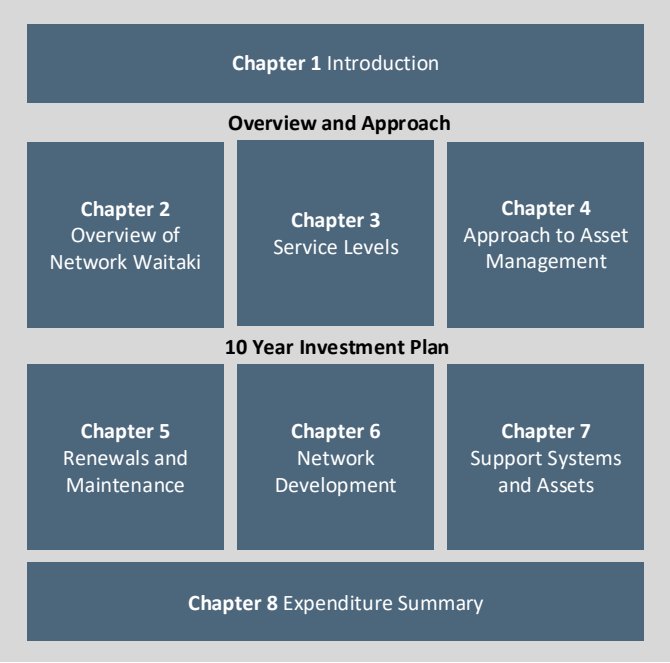


Figure 2 - Structure of Network Waitaki Ltd 2019-2029 AMP

02. Overview

This chapter describes who we are and what we want to achieve and is structured as follows:

Our company: outlines our corporate objectives, organisational and governance structures.

Operating environment: an overview on the issues that have an impact on us and our approach to asset management, such as geography, vegetation management, and changes in demand.

Stakeholders: this section describes who our stakeholders are, their interests and expectations, and how these interests and expectations are accounted for in our asset management practices.

Our consumers: an overview of our consumers including total number of connections; our major consumers and their impact on network operations and our asset management objectives; and the load characteristics of our network.

Our network: an overview of the network including coverage areas; the extent it is overhead and underground; and our substation arrangements.

Our assets: a population summary of our assets by category.

2. Overview of Network Waitaki

2.1 Our company

Network Waitaki (NWL, or the Company) has a single shareholder, the Waitaki Power Trust (the Trust). The shares of NWL are held on behalf of the NWL consumers by the Trust, who appoint directors to the Board to carry out the governance and management functions of the business. The Trust has five trustees. Every three years, three trustees are elected by electricity consumers connected to the network. The *trust deed* holds all trustees collectively accountable to the New Zealand judiciary for compliance with the deed.

We operate primarily as an Electrical Distribution Business (EDB), although other business opportunities within the utilities and related sectors may be investigated. We also, where appropriate, support the growth and well-being of the wider community through our network investment decisions, scholarships and sponsorship.

2.1.1 Mission statement and corporate objectives

Our mission statement and corporate objectives require us to manage our assets efficiently and effectively to facilitate the delivery of a safe and reliable supply of electricity to our consumers. To achieve this, we have aligned our asset management practices and objectives with our corporate objectives and mission.

Our mission statement is:

> *To be a locally-owned and operated electricity distribution company that provides the benefits of local consumer trust ownership by:*
>
> - *owning and operating a safe, reliable, and efficient distribution system that meets the evolving needs of its consumers*
> - *supporting the economic growth and wellbeing of the community it serves.*

Our corporate objectives cover eight areas:

> *Health and safety*
> - To ensure our activities cause no harm to staff, contractors, the public and property.
> - To operate health and safety systems that meet all of our regulatory requirements.
>
> *Shareholders*
> - To pursue policies which will secure the Company's financial position as a consumer trust-owned business for present and future consumers.
>
> *Consumers*
> - To provide consumers with the delivery of a safe, efficient, and reliable electricity distribution system.

Efficient use of resources

- To promote the efficient use of energy as required under the Energy Companies Act 1992 clause 36 (2).
- To efficiently and effectively utilise the resources of the Company.

Public and social responsibility

- To be a good corporate citizen by being a law-abiding company.
- To support activities that provide economic growth in the area serviced by the network.

Employer

- To be an equal opportunity employer.
- To recruit and retain competent, motivated, committed staff.
- To provide training opportunities that will enable individual staff members to attain their fullest potential in the service of the Company.

Environmental

- To ensure compliance with the Resource Management Act.
- To operate in a way that minimises the impact on the environment.

Compliance

- To continue with our comprehensive compliance programmes currently in place and to comply with all obligations under relevant legislation and regulators.

Together these eight areas form the basis for establishing our asset management practices and processes.

2.1.2 Corporate documents

The Company maintains a number of internal and external documents as part of its annual business planning process. The main ones are the:

- Statement of Corporate Intent (SCI), which is agreed annually between the Board and the Trust, and sets out the objectives, goals, and related performance targets for NWL for the following three years.
- Regulatory disclosure documents, including those associated with information disclosure, financial accounts, and the Commerce Commission's price-quality threshold regime.
- Network Development Plans which detail the demand growth forecast for different growth scenarios for the next 10 years, and the planned response of the network to meet that demand.
- Annual business plan and budget which is approved by the Board for the next financial year.
- Monthly board reports, which update the Board on the progress against the annual budget, along with other issues that they need to approve or be made aware of.
- Suite of emergency preparedness documents that detail the plans to maintain and restore supply following emergency events.

2.1.3 Organisation structure

The Trustees appoint the Board to govern the company who in turn appoint the Chief Executive Officer (CEO). Ultimate accountability for the network assets lies with the Board, who approve this AMP. The Board are also accountable to the Trustees for meeting the requirements set out in the Statement of Corporate Intent (SCI), which includes specific asset management objectives and service targets.

The Board have an involvement in approving projects and budgets needed to support the AMP. The AMP and Network Development Plan signal the need for future investments so that the Board can assess the long-term issues such as funding requirements. The Board ensures that members of the public have access to the AMP and other disclosure documents on the Company's website[1].

The management team report outage statistics, network performance, and work programme progress to the Board on a monthly basis. Quarterly reports comparing year to date performance against the SCI are provided to the Trust. Annual reports are prepared by both NWL and the Trust.

Most of the annual works programme is undertaken by our integrated contracting business unit, which has a staff of approximately 35 people located in Oamaru.

2.1.4 Asset management governance

NWL has a relatively small staffing establishment intended to resource a narrow business model i.e. operational management of a lines business.

Asset management responsibilities are allocated between the senior staff as follows:

Chief Executive Officer

The Chief Executive Officer is accountable to the Board to ensure that the strategic objectives of the Board and the Trust are delivered.

Finance Manager

The Finance Manager is responsible for the preparation of annual budgets with input from all areas of the business as well as providing reports that enable actual costs to be monitored against budgeted costs.

Engineering Manager

The Engineering Manager has responsibility for the day to day operation of the network and the implementation of the annual capital and maintenance work programmes.

[1] https://www.networkwaitaki.co.nz/company/regulatory-disclosures/

Planning Manager

The Planning Manager is responsible for network planning, including development of load models and working with key stakeholders such as Transpower and major consumers to ensure that our future needs are understood and met.

Asset Manager

The Asset Manager is responsible for development of the asset management processes and systems, and the development of standards and policies.

Regulatory and Network Support Manager

The Regulatory and Network Support Manager is responsible for the preparation of disclosures, as well as for consumer engagement, and providing administrative support to the operations and planning/asset teams.

Contracting Manager

The Contracting Manager is responsible for the provision of field services in order to complete the annual works plan in those areas of service provided by our in-house contract team. They are also responsible for managing any work outside our network, for other network companies or private customers, provided the NWL works programme is given the focus that it requires.

2.1.4.1 Expenditure Approvals

Operational and capital budgets are prepared annually and approved by the Board. For larger projects, investments in new areas, and projects committing the company to expenditure over several years the approval process includes a formal Sanction for Expenditure (SFE). This provides the Board with technical detail and presents the business case for the proposal. Following the completion of a major project, the Board will review any associated SFE to confirm delivery on the benefits stated.

All roles within the company also have approved delegated financial authorities. Any expenditure beyond these limits requires specific approval from a manager or the CEO or the Board, depending on the absolute amount of the expenditure.

Work is generally prioritised in the following order:

- Emergency works
- Safety related works
- Planned consumer works
- Planned maintenance works
- Planned capital works

2.1.4.2 Asset management capability

Our organisational and governance arrangements are structured to ensure that we have the necessary capability to implement this AMP. We ensure that our AMP work programme can be achieved by tracking our progress with monthly formal reporting on the physical and financial progress of the work programme against our plans and budgets. This reporting also includes operational metrics such as SAIDI and SAIFI.

We also regularly review and forecast our future revenue streams to ensure there is sufficient funding to develop and maintain the network. This involves annual price reviews, calculation of the discounts returned to consumers, and setting capital connection levies.

To ensure the maximum efficiency of our work force, the skill set of our field staff is focussed on the core line construction and maintenance roles, including live line work, cable jointing and line construction. Specialist experience such as communications and power technicians and electrical fitters have been successfully contracted in from outside suppliers for several years. This approach is successful due to strong relationships with our preferred service providers, many of whom are local to the Waitaki area. This avoids unnecessary overheads associated with specialised training and support of these trades.

2.2 Operating environment

The operating environment of the Waitaki region is a mixture of coastal plains and alpine areas.

The climate is traditionally dry and cold in winter, and dry and hot in summer. The area is known to suffer from drought conditions.

Extreme weather events can include wind and snow storms, and floods. We expect to experience at least one significant weather event every year. The impact of these events is typically restricted to the inland area of the network, but can occasionally affect the whole region, and in extreme events can affect neighbouring regions as well.

The coastal conditions are comparatively benign, although coastal erosion is starting to impact in some areas of the region, with local road networks being affected. We are monitoring these situations with respect to our assets in the specific affected areas.

The major urban population is centred on Oamaru, a coastal town of approximately 13,900 people located on the east coast of the South Island. The population of the wider Waitaki region is approximately 22,300. Statistics New Zealand forecasts modest population growth of up to 5% for the planning period of this AMP.

There are several small townships in the region, most which are located on the two state highways that run North to South (SH1) and East to West (SH83) through the region.

The rural economy of the region is based on a mixture of beef and sheep farming, crops, and dairy. Irrigation is used widely throughout the region, via schemes that include border dyke systems, direct pumping from a local water source, or reticulated systems to the farm gate. Irrigation is a major source of the growth on our network. The Ministry for Business, Innovation,

and Employment records that the contribution to the regional economy from the agriculture sector ranges from approximately 12% to 22% GDP up to 2015 (more recent figures are not available).[2]

There is also a significant manufacturing sector in the region, contributing approximately 12% to the regional economy in 2015.[3]

Despite the typically dry summer conditions, vegetation growth is robust throughout most of our network, and management of this is an ongoing concern.

2.2.1 Live line policy

The Health and Safety at Work Act 2015 came into force in April 2016. Key components of the act and how it is interpreted by WorkSafe New Zealand triggered Network Waitaki to review how operational risks were considered in the planning of live line work. Live line work is where special techniques and insulated equipment are used to carry out physical work on overhead electrical networks without disconnecting the source of electricity. The alternative to this is isolating the worksite from the source of electricity and electrically connecting equipment being worked on to earth (known as "isolated and earthed"). The conclusion of that review was that the practice of live line work at that time did not meet the requirements of the Health and Safety at Work Act 2015.

Our policy requires that the default position for planning any work on the network is that it should be carried out with the network isolated and earthed. Live line work can only then be considered if a formal risk assessment shows that the selected, approved live line method "minimises risk to employees, the public, and public property". This means that the safest option between live line or de-energised work is utilised.

Furthermore, execution of any live line work that is justified based on a risk assessment must be approved by both the Network Operations Team Leader and the Contracting Manager prior to being scheduled.

NWL Contracting can field up to three live line crews for High Voltage (HV) work, and prior to the policy change 45-50% of our planned HV maintenance and construction work was carried out safely using live line techniques. Since the new policy has come into effect, the amount of work carried out using live line techniques has dropped significantly.

[2] Source: MBIE Regional Economic Activity Web Tool. http://webrear.mbie.govt.nz/summary/new-zealand, Feb 2018
[3] Source: MBIE Regional Economic Activity Web Tool http://webrear.mbie.govt.nz/summary/new-zealand, Feb 2018

In order to track the impact on our network we have recorded whether a planned outage could have been carried out live prior to the policy change. An analysis of the impact of reducing live line work on our SAIDI and SAIFI outage statistics over the last year is shown in Figure 3 and Figure 4 below. (see section 3 for more information on these service targets).

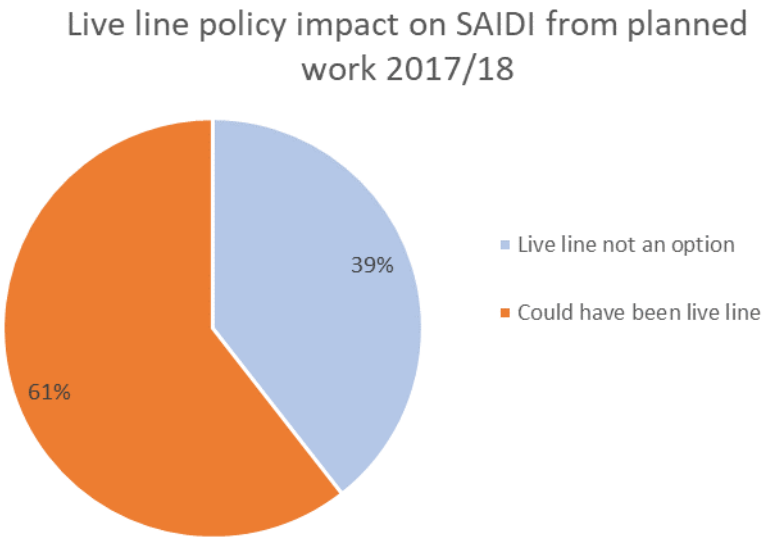


Figure 3 – Impact of live line policy changes on SAIDI

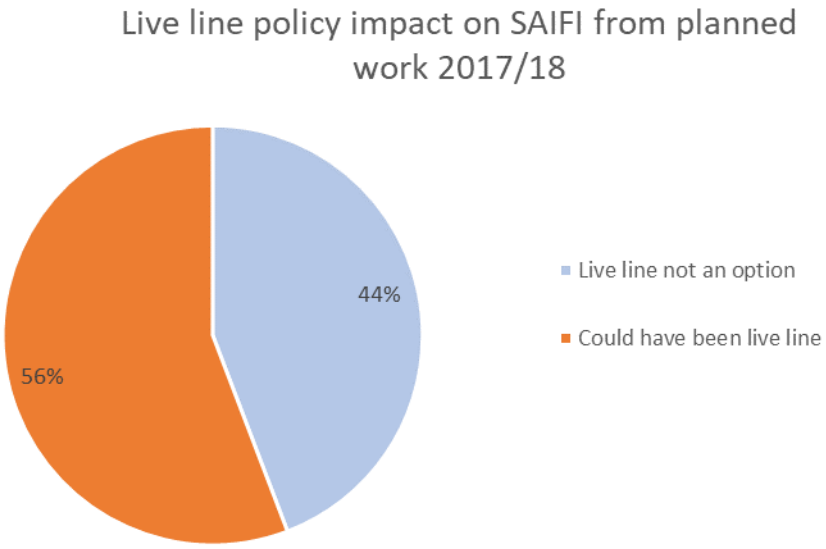


Figure 4 - Impact of live line policy changes on SAIFI

2.3 Stakeholders

2.3.1 Stakeholders and their interests

Our stakeholders are the people or organisations that can affect, be affected by, or perceive themselves to be affected by our decisions or activities. Stakeholder requirements are an important driver for our performance and we place considerable focus on identifying and meeting stakeholder expectations. Our stakeholders are described in Table 3 below, along with their requirements, how those requirements are identified and how they are incorporated into our asset management practices.

Table 3 Network Waitaki stakeholders

Stakeholder	Requirements	Identification of requirements	Requirements incorporated into asset management practices
Consumers	Safety; reliability; value for money; effective communication particularly during emergencies and faults; emergency and lifeline preparedness.	Bi-annual consumer surveys; face to face interviews with major consumers; feedback; public safety performance measures.	Maintaining audited Public Safety Management System and other safety initiatives; price/quality trade off; network development plans; investment planning; asset lifecycle management.
Waitaki Power Trust	Fair and reasonable rate of return on equity; incentives to invest and innovate; good governance; risk management; business sustainability; good reputation with the community; Good asset management	Trustee meetings; performance measures.	Network development planning; investment planning; asset lifecycle management; organisation and governance structures; integration of risk management into all business processes; quarterly and annual reporting

Stakeholder	Requirements	Identification of requirements	Requirements incorporated into asset management practices
Public, and landowners	Safety; emergency and lifeline preparedness; protection of property and amenity values; effective communication regarding access and maintenance	Meetings; feedback; consultations.	Safety initiatives; emergency preparedness planning; service levels.
Councils	Alignment with district and regional requirements; statutory compliance.	Meetings; consultations on regional and district plans.	Network development planning for system and load growth.
Electricity generators and retailers	Safety, reliability, effective communication; statutory and regulatory compliance; fair contractual arrangements; transparent; effective delivery of business to business services.	Industry forums, conferences, and seminars; regular consultation, statutory and regulatory requirements; contractual arrangements.	Network development planning; service levels
Regulators and Governmental Agencies	Statutory and regulatory compliance; ensure consumers receive a reliable supply of electricity accounting for price/quality trade off; compliance with health and safety requirements.	Statutory and regulatory requirements; consultations; industry forums, conferences, and seminars.	Network development planning; service levels; risk management; governance arrangements; inclusion of safety by design principles.

Stakeholder	Requirements	Identification of requirements	Requirements incorporated into asset management practices
Transpower (as Grid and System Operator)	Security of supply; new grid investment and planning provisions; effective and timely communication; statutory and regulatory requirements; sustainable earnings from connected and interconnected assets	Operational standards and procedures; regular meetings;	Network development planning; investment planning; asset lifecycle management; risk management
Alpine Energy Ltd	Coordinated investigation into shared transmission constraints	Meetings to discuss collaboration opportunities	Decisions will be incorporated in future Network Development Plan
Staff and other workers	Safe and enjoyable work environment; job satisfaction; assurance of work continuity; visibility of forward workload requirements; work/life balance; career development opportunities; fair remuneration; effective support	Staff feedback; regular staff briefings and communications; staff input into decisions affecting work environment and methods	Safety initiatives and reporting; integration of risk management into all business processes; forward planning of work;
Board of Directors	Governance; risk management; business direction and sustainability; Performance of Chief Executive; statutory and regulatory compliance.	Regular board meetings and directives; performance measures.	Integration of risk management into all business processes; regular reporting.

2.3.2 Managing conflicting interests

Any conflicts in stakeholder requirements are normally resolved by prioritising on a risk and obligation basis. All stakeholders want to minimise the risk of property damage or injury to the public, consumers, staff, or other workers and so safety concerns are given the highest priority.

Other issues that are considered are:

- Compliance issues, including compliance with technical requirements, such as power quality, as well as business compliance.
- obligations to maintain supply to existing consumers at the service levels set out in the SCI.
- The ongoing viability of the company are given next priority, in order for our management of the network to be sustainable.
- The reliability of the electricity supply

2.4 Our consumers

2.4.1 Load profiles

A summary of the load served by our network for the year 2017/18 and the five years previous is shown in the table below:

Table 4 - Summary of consumer profile 2014-2019

Year	Number of Connected Customers	Coincident Maximum Demand (MVA)	Percentage of ICPs in Urban Areas	Energy Delivered (GWh)
2013-2014	12310	51	50	245
2014-2015	12431	57	50	237
2015-2016	12581	54	54	291
2016-2017	12710	52	54	242
2017-2018	12954	65	54	265
2018-2019	12968	66	54	251

As shown in Figure 5 the energy delivered to our consumers over the last 5 years is variable and does not necessarily match the growth in maximum demand or increase in connected customers. This is primarily due to climatic conditions, where a mild winter will reduce energy demand for heating, and a dry summer will increase energy demand in the irrigation sector.

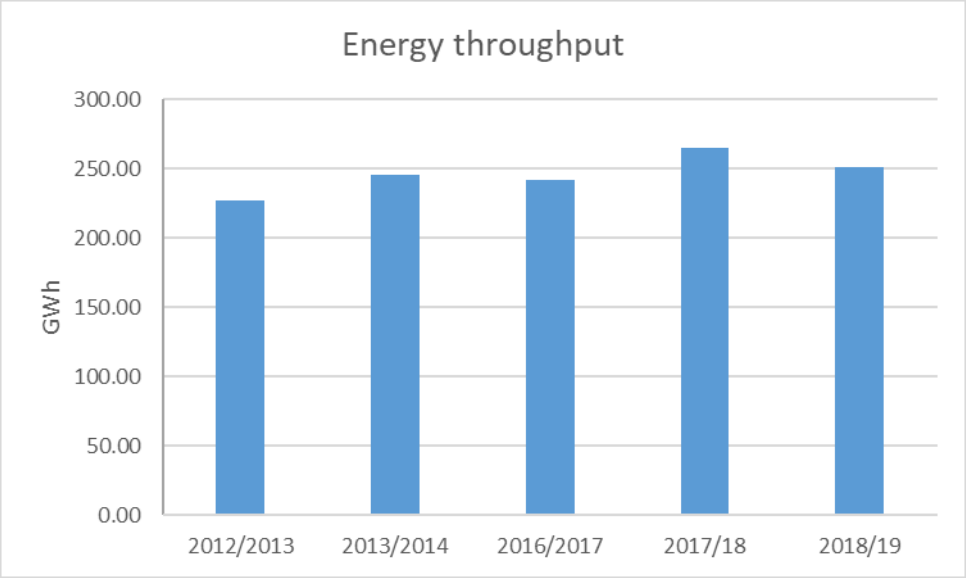


Figure 5 – Energy per annum delivered by the NWL network

2.4.2 Major consumers

NWL has two consumers who could be considered as large by national standards. These are shown in Table 5:

Table 5 - Large consumers on NWL network

Consumer	Supply Arrangement
North Otago Irrigation Company (NOIC)	Supplied as the sole consumer from the dedicated Black Point GXP with *N* level security and no 11 kV interconnection to NWL's network.
Alliance Pukeuri Works	Supplied from the Pukeuri Substation via dedicated dual 11 kV connections to their own internal 11 kV network. Pukeuri is an *N-1* level security substation with multiple 11 kV substation interconnections.

In addition, there are a number of consumers that are small by national standards but are nonetheless considered to be important to the local economy and community. We endeavour to engage with these consumers whenever we are planning work or any changes to the network that may lead to business disruption or health and safety concerns.

The introduction of a new GIS system in 2017 has enabled better visibility of the impact of network operations on consumers, which aids in this consultation process. This system has led to the development of more accurate notifications to consumers for planned and unplanned outages, the coordination of works, and identification of contact points for consultation.

2.5 Overview of our network

We are predominantly a rural network supplying the North Otago, Hakataramea, and Ahuriri regions as shown in Figure 6 below.

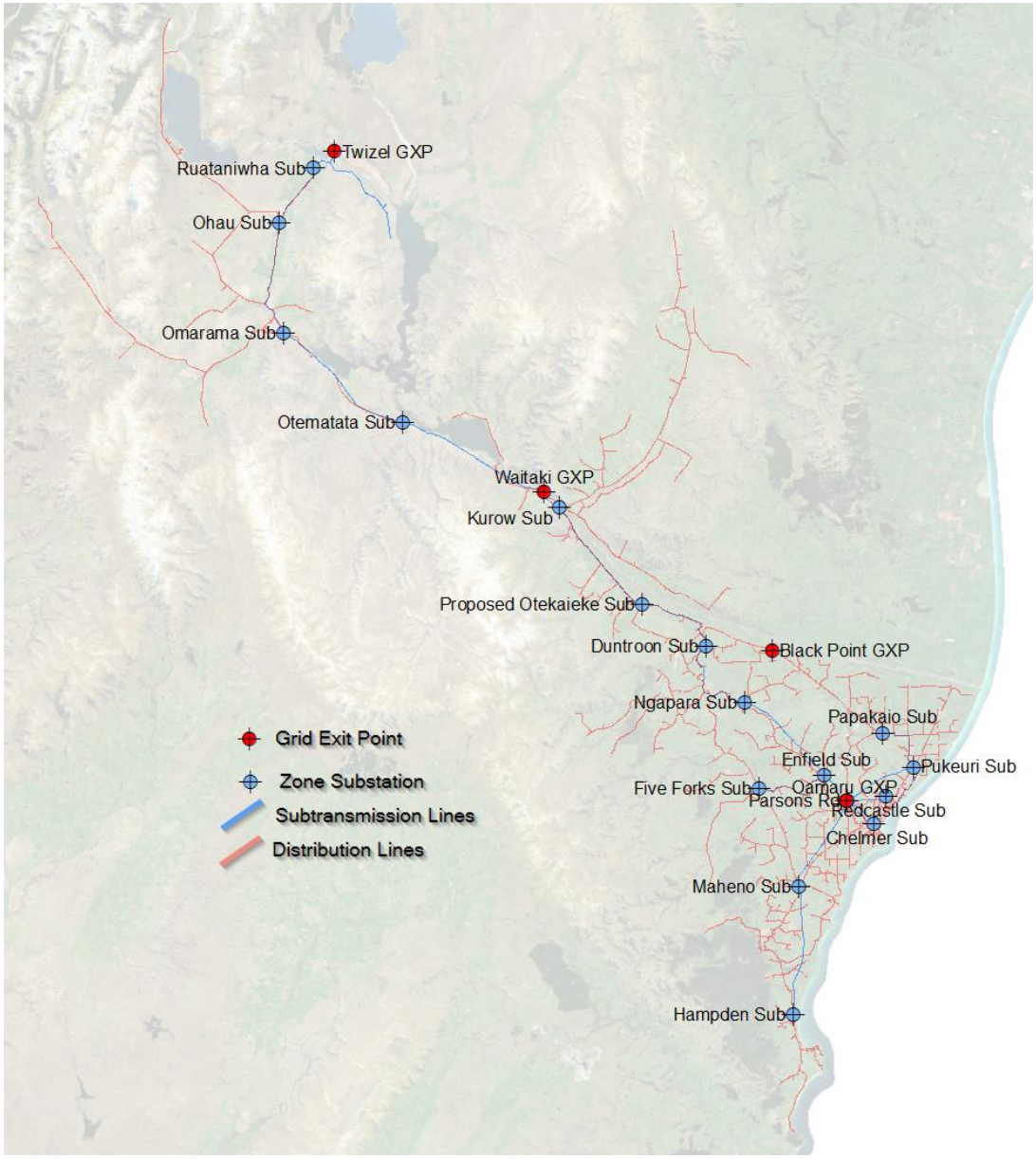


Figure 6 - Map of NWL area of supply and network extent

Bulk supply of electricity is taken from Transpower's national grid at our 4 grid exit points (GXPs). This energy is then transported via our subtransmission network at 33,000 volts (33 kV) to our zone substations. Power transformers at the zone substations convert the 33 kV supply to a lower distribution voltage of 11,000 volts (11 kV) which is supplied to some consumers directly (generally large commercial and industrial customers) but is more commonly stepped down via distribution transformers to our low voltage system (400 volt, three phase/230 volt single phase) which supplies most of our consumers.

The characteristics of our grid exit points (GXPs) are listed in the table below:

Table 6 - Characteristics of NWL grid exit points as at 31 March 2019

Supply point	Voltage	Capacity	Max demand 2018/19 (Non Coincident)	Zone Substations supplied
Oamaru GXP	110/33 kV	45 MVA	38 MVA	10
Black Point GXP	110/11 kV	25 MVA	13.5 MVA	0
Waitaki GXP	11/33 kV	24 MVA	11.3 MVA	5
Twizel GXP	220/33 kV	20 MVA	3.8 MVA	3

A 33 kV sub-transmission network connects the GXPs to our zone substations. The 33 kV sub-transmission network is predominantly overhead construction, apart from a few short cable sections.

2.6 Our assets

Key features of the network are shown in Table 7 below:

Table 7 - Key features of NWL network

Parameter	Value
Number of Poles	21,708
Length of 33 kV lines and cables	222 km
Length of 11 kV lines and cables	1327 km
Length of LV lines and cables	343 km
Number of zone substations	18
Number of connected consumers	12,968
Coincident max demand	66 MVA

These assets are discussed in more detail in Section 5 Renewals and Maintenance.

Powering North Otago.

03. Service levels

The service levels outlined in this AMP reflect our mission of owning and operating a safe, reliable, and efficient distribution system.

This chapter is structured as follows:

Stakeholder engagement: provides an overview of how we interact with our stakeholders, identify their requirements, and how those requirements are incorporated into our asset management processes.

Health and safety measures and targets: describes our safety objectives, methods, measures, and performance against targets.

Reliability measures and targets: describes our reliability objectives, methods, measures, and performance against targets.

Economic efficiency measures and targets: describes our network performance and efficiency objectives, methods, measures, and performance against targets.

3. Service Levels

3.1 Stakeholder engagement

As illustrated in Section 2.3 we have many stakeholders with varying requirements. We identify these requirements through consumer surveys, face to face interviews with major consumers, and participation in industry forums and conferences. We also participate in consultations on statutory and regulatory changes and Regional and District Plans.

Stakeholder requirements are incorporated into our asset management planning processes through our Public Safety Management System, service level measures and targets, our Network Development Plan and asset fleet management processes.

3.1.1 Consumer surveys

We undertake regular representative surveys to enable a better understanding of our consumers' energy priorities. The most recent survey was in February 2017, where 400 mass market consumers were interviewed by telephone. The survey respondents were selected randomly from our full consumer database. 70% of the respondents were urban and 30% were rural, which corresponds with our overall urban to rural mix.

At the same time, we conducted face to face interviews with 12 of our major consumers, picked at random from a sample of our top 25 users (by volume of electricity used). This survey had representative respondents from large industrial, commercial, and farming (mostly irrigation and dairy farming operations) users.

The key findings from this survey were:

- The service attributes most highly valued by consumers are continuity of supply and network maintenance.
- The vast majority of respondents who had experienced unexpected outages indicated that supply had been restored within an acceptable timeframe.
- The vast majority of respondents who had experienced planned outages indicated that supply had been restored within the notice time.
- The vast majority of respondents are satisfied with reliability of supply.
- The majority of respondents regarded cost as being the main barrier to installation of distributed generation.
- A number of respondents expressed an unwillingness to install smart meters.

We have used these key findings to inform our asset management practices, investment plans and service level measures and targets.

3.1.2 Website

Our company website (www.networkwaitaki.co.nz) was rebuilt in 2017. One of the key objectives was to make the site more user-friendly and offer interactive features to help consumers.

New features on the website include a map that shows our planned outages, which is updated daily. Users also have the ability to apply online for a number of services, including new connections.

Website traffic records show that the most visited page on the new website is the outage page at approximately 2,500 visits a month, followed by views relating to information about the company, careers and connection applications.

Data about consumer visits to the company website is analysed to inform our customer relations work as we believe it provides a sense of the type of information that is important to consumers.

3.2 Service level: health and safety

We are committed to ensuring that our network remains safe at all times and seek to actively manage risks to the public, public property, and our staff. To facilitate this, we are focused on continuing to foster a positive safety environment for staff and the public. Policies, procedures, and staff training are developed, reviewed, and updated in an ongoing process of continuous improvement.

We operate an audited Public Safety Management System (PSMS) where known and likely hazards and risks to the public are documented, along with the controls used to resolve them (eliminate the risk, or minimisation of the risk or likelihood of it occurring). This system is audited annually against the standard NZS7901:2008 *Electricity & Gas Industries Safety Management Systems for Public Safety* by Telarc, an external auditor. The outcomes of the audit process are analysed by our staff to make improvements to the PSMS and how we use it.

3.2.1 Health and safety objectives

Our overall objective is that staff, workers, the public, and their property are safe and free from harm due to the operation of our business. We will not compromise the health or safety of our staff, workers, the public or their property.

In summary, our safety objectives are:

- That safety is a top priority in all aspects of our business.
- Staff, workers, and the public are not harmed due to the operation of our business.
- The promotion of a positive health and safety culture amongst all of our staff and workers.
- Any identified health and safety hazard is assessed for risk, prioritised and mitigated as soon as possible.

3.2.2 Methods

To achieve our objectives, we have undertaken the following initiatives:

- We engage with the public through newspaper and radio safety advertisements to raise public awareness of the hazards associated with working or playing in the proximity of electricity reticulation assets.
- We take part in public events such as agricultural shows to demonstrate electrical safety issues to the public, and to provide opportunities for feedback
- All known and likely hazards and risks to the public are documented by staff in our Public Safety Management System as they are discovered, along with the controls put in place to mitigate them
- The instigation of reporting and monitoring of near miss incidents. Staff are encouraged to report near miss incidents with the purpose of identifying cause, mitigating risk, and learning. To facilitate this, we have adopted the Incident Cause Analysis Method (ICAM) methodology for incident investigation.
- The adoption of the Vault safety management system for recording and analysing workplace safety and training data.
- Involvement in the EEA safety climate project, “Orange Umbrella”.
- Wide ranging staff involvement on our health and safety committee.
- Involvement in community safety initiatives such as Safer Waitaki.
- Introduction of vehicle training for staff in 4WD and 2WD vehicles.
- We regularly review our safety policies, procedures, and staff training so that they are continuously improved.
- Improvements in the type of personal protective equipment (PPE) used by staff to improve comfort in the field, such as using climbing helmets for construction crews rather than ordinary hard hats.
- Providing incentives to staff to encourage them to submit ideas that improve the safety of network operations.
- Utilising objective measures to support decision making, such as Portascan and Thor hammer pole tests.
- Where appropriate we use technology to reduce the risk to our field staff, for instance using pole mounted GoPro cameras to reduce the amount of pole climbing that inspection crews have to carry out.
- Installing GPS tracking systems with “man-down” functionality in all vehicles.
- Coordinating with neighbouring EDBs to align safety procedures where possible.

3.2.3 Measures and targets

Monitoring our safety performance is a focus of our business. We track a number of safety metrics and indicators, including the following:

- Monitoring of staff safety behaviours for compliance with targets, such as:
  - number of safety observances or site audits (leading indicators).
  - lost time injuries, near misses, plant damage or environmental incidents (lagging indicators).
- Monitoring indicators of organisational safety behaviours, such as:
  - the number of times staff have worked to the stage where they need to stand down (leading indicators).
  - the amount of sick leave and ACC hours taken across the whole company (lagging indicators).
- Monitoring the number of incidents and accidents on our network involving the public.
- Annual accreditation to NZS7901:2008 for our Public Safety Management System – using Telarc as independent auditors.
- Monitoring mitigation of specific risks e.g. the removal of red tag poles from the network.

Our targets for safety performance are:

- Zero injuries per annum to staff.
- Zero injuries to the public.
- A downward trend in the number of reported adverse public interactions.
- A downward trend in the number of deliberate or accidental unsafe acts by the public.
- To work with consumers to ensure that no privately owned HV service lines are disconnected because of unsafe condition.
- At least 36 safety audits on work sites by staff per year.

3.2.4 Performance

Historically measurement of safety performance has focussed on lost time injuries and incidents reported for our workers.

We also measure and monitor public incidents and accidents on our network, as shown in Table 8 below.

Table 8 - Public incidents and accidents

Summary of electrical accidents and incidents involving the public						
Activities	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Rural/Farming activities	19	19	11	19	16	15
Construction work	13	8	2	7	7	8
Trades	5	1	3	0	0	0
Leisure & sports	0	2	0	0	0	0
Consumer premises issues (Tree cutting/house fires, etc.)	1	7	5	11	11	4
Vandalism	1	0	2	1	1	1
Motor vehicles	13	19	20	19	19	16
Total	**52**	**56**	**43**	**57**	**54**	**44**

As can be seen from the historical figures, the number of incidents involving the public has been reasonably static since 2013/14. The bulk of the incidents in recent years have been due to unintended contact with our buried cables or overhead lines, typically operators of equipment such as diggers, farm machinery or irrigators.

These are lagging indicators, and while they are of some use, we acknowledge that they are not as effective as leading indicators at improving safety outcomes.

The key method of improving the performance is educating rural workers, trades workers, contractors, and emergency services staff to be aware of the hazards that our network present in the environment, and to manage the risk accordingly.

Actions currently taken to address this issue include:

- Using print advertising in local newspapers and radio advertising on local stations to raise public awareness around the hazards of electricity.
- Engaging directly with contractors to discuss the hazards and processes of working around electricity network equipment, at public events such as the A & P show, as well as holding targeted education sessions.
- Streamlining permitting processes with the introduction of online applications for high load and close approach consents for contractors such as tree trimmers, agricultural workers, and house movers, to encourage voluntary use of the safety systems available.

Assuring that our public safety management system conforms to the New Zealand standard NZS 7901:2008 is an annual exercise carried out in conjunction with Telarc. This accreditation was continued in 2019 with a satisfactory audit resulting in no “unattained” issues, and the verification of our NZS 7901 compliance. Any items raised as “partially attained” or “opportunities for improvement” are corrected as soon as possible.

Over the coming year we will be adjusting our PSMS to align to the latest version of the standard, NZS 7901:2014.

We have also trained staff in the role of internal auditors; these auditors carry out several internal audits annually. The audits assist in identifying opportunities to improve our processes and help identify potential issues in a timely fashion.

With the introduction of the Vault safety management system, recording of our safety performance against targets is simplified. A Health and Safety report is tabled and discussed at each monthly Board meeting and includes performance figures against our goals. Figure 7 below is an example of this reporting. A key feature is the clarity of information on safety performance indicators.

Safety Performance Table: January FYTD 2018/19

	First Aid Injuries	Medical Injuries	Discomfort, Pain, Injury	Lost Time Injuries	Totals
Month	1	0	0	0	1
Year	3	0	4	1	8
Last Year: Total					14

	Month	FYTD	Targets Month	Targets FYTD	Achieved: Yes/No Month	Achieved: Yes/No FYTD
Work Observations	45	279	> 15	> 135	✓	✓
Engineer Site Audits	9	53	> 3	> 27	✓	✓
Director Field Visits	0	3	4 Per Year			✓

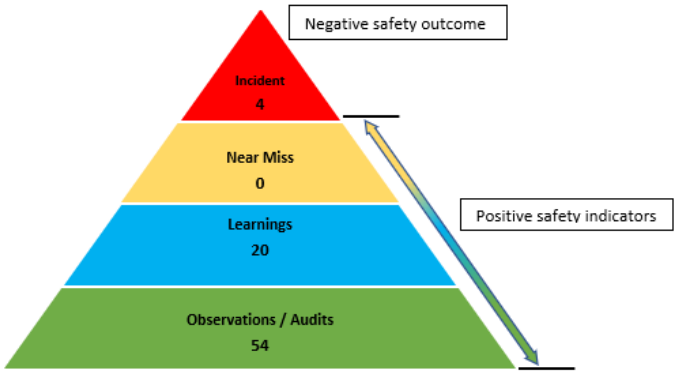


Figure 7 - Executive summary of safety performance

We have achieved our target of reducing unauthorised access to our network – there was no unauthorised access to our network equipment or substations in the last year. We believe this shows that our site security and public awareness programs are successful.

No HV service lines needed to be disconnected because of unsafe conditions in the last year, which meets our safety target for this metric. This indicates that the safety audit program that we operate for these lines is successful.

The target for work site audits by our engineering staff was met. These audits give an opportunity for the staff that are designing and specifying work to verify first-hand the level of safe work practices that are applied in the field. This reflects the high level of staff engagement in maintaining a safe work environment.

There has been a single lost time incident for the 12 months to March 2019.

We recognise that the use of LTI's as a safety metric is a lagging indicator, and we are seeking to add other leading indicators that will help achieve our outcome of maintaining a safe work environment.

3.3 Service level: reliability

Reliability of our network is of high importance to us and to our consumers. Our consumer surveys have revealed that the service attributes most highly valued by consumers are "*keeping the power on"* and *"getting the power back on if it goes off*".

3.3.1 Objectives

An important part of our corporate mission and objectives is to *"operate a reliable and efficient distribution network".* Results from our surveys tell us that most of our consumers have expressed a preference for similar levels of reliability to what they currently experience. Hence our objective is to retain the same levels of reliability over the term of this AMP as we currently provide and minimise outages to as short a time as possible. Due to the recent trend upwards in SAIDI and SAIFI resulting from reduced use of live line procedures (See Section 2.2.1) we will be working to limit the effect of planned outages on our consumers. This includes use of our GIS and work management systems to coordinate work within an area to minimise the impact of power outages.

3.3.2 Methods

We will meet our reliability objectives by:

- deploying automated and remotely controlled devices, such as reclosers, sectionalisers, and tie-switches to limit the number of consumers affected by faults
- building ties between neighbouring spurs to form open rings as load growth makes this economically viable. This strategy enables adjacent feeders to provide back-up capacity during planned or unplanned outages
- leveraging subtransmission developments that are driven by load growth to increase the number of zone substations with supplies available from alternative GXPs
- optimising the location of isolation devices to minimise the number of consumers affected by particular outages
- monitoring, analysing, and benchmarking service level performance and reacting quickly when adverse trends appear
- examining network performance after major events such as snow storms to gain insight in to Asset Management changes that may improve performance. Even though these events are normalised out of the SAIDI and SAIFI statistics we realise that they do have an impact on consumers and aim to improve our resilience against them.

3.3.3 Measures and targets

The two indicators we use to monitor the reliability of our network are the industry performance measures of System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI).

SAIDI is the accumulated total time that the average consumer connected to the network will be without supply in any measurement year as a result of faults and planned outages on our network. The units are in minutes.

SAIFI is the total number of supply interruptions that the average consumer connected to the network will experience in a measurement year as a result of faults and planned outages on the network. The units are outages per consumer per year. It should be noted that, while an individual consumer can only experience a whole number of outages, the target is set as a real number to allow for the effect of averaging.

In our view SAIDI and SAIFI effectively measure the extent to which we are able to achieve our objectives of supplying a safe, reliable, and efficient electricity supply to our consumers. SAIDI and SAIFI are also used by the Commerce Commission for setting a quality threshold which it uses to determine whether the EDBs that it regulates are performing to an acceptable standard. As a consumer-owned EDB we are exempt from this default price-quality path regulation, however we believe that it makes good sense to subscribe to the same methodology used by non-exempt EDBs. This also allows for functional benchmarking against other EDBs throughout New Zealand.

In line with the approach taken by the Commission, our SAIDI and SAIFI targets are normalised. Normalisation is designed to exclude the impact of events (such as an extreme weather event or an interruption due to an outage on the Transpower network) that are outside of our reasonable control. We believe that setting targets using normalised measures will provide a better indication of the success of our asset management strategies by limiting the extent to which events outside our control impact on our measured performance.

Our reliability measures for SAIDI and SAIFI are target bands. We believe that this approach serves as a more useful measure for performance than a single fixed value. The targets as published in our Statement of Corporate Intent are shown in Table 9 below.

Table 9 - SAIDI and SAIFI target bands.

Network Non-Financial Performance Measures			
	31 March 2019	*31 March 2020*	*31 March 2021*
System Average Interruption Duration Index (SAIDI)	150 to 250	150 to 250	150 to 250
System Average Interruption Frequency Index (SAIFI)	1.0 to 2.0	1.0 to 2.0	1.0 to 2.0

The use of live line techniques was previously one of the key strategies used to meet our network reliability targets. Since the change in work practice the SAIDI and SAIFI measures for the network have increased, as work that would have not required an outage in the past now results in lost customer minutes.

Our SAIDI results are affected by the length of time it takes us to restore power from an unplanned outage. While keeping safety paramount, we are committed to restoring power to our consumers as soon as possible should an unplanned outage occur. Our targets for restoration times are shown in Table 10 below.

Table 10 - Restoration time targets

Consumer type	Maximum time to restore power	Maximum number of power interruptions
Urban	6 hours	4 events per annum
Rural	10 hours	10 events per annum
Remote Rural	12 hours	20 events per annum

3.3.4 Performance

Our historical SAIDI and SAIFI performance data is shown below in the figures below. The performance levels shown exclude the impact of Transpower outages, and have been presented for both actual and normalised results

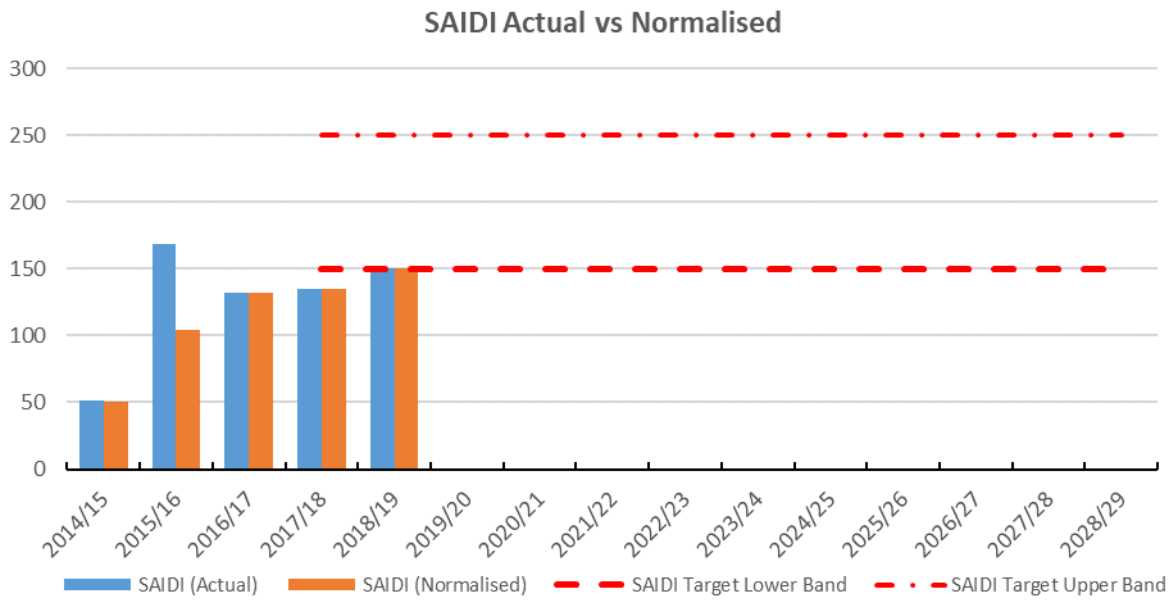


Figure 8 Historical SAIDI performance compared to target

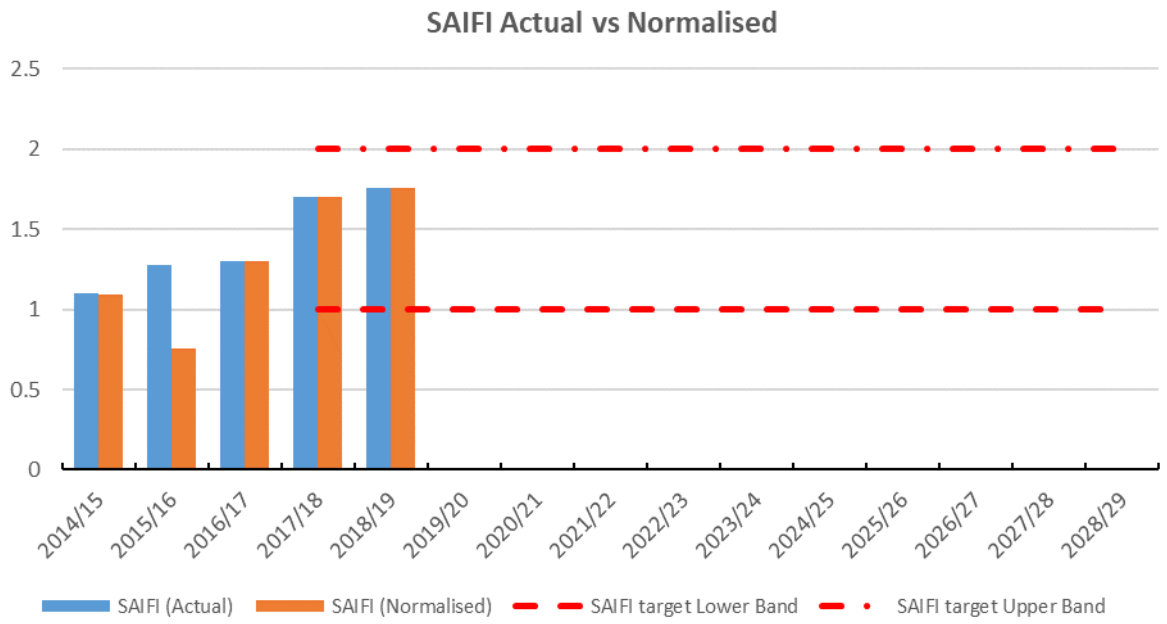


Figure 9 Historical SAIFI performance compared to target

As can be seen from the SAIDI graph in Figure 8 the performance of the network for outage duration is at the bottom of our target band. We have undertaken a lot of work to increase reliability and resilience, and data shows that we have improved the performance of the network.

The performance for the outage frequency metric is within our target band. The increase in recent years is mainly due to the requirement for planned outages to carry out work that would have once been live line. We expect that this was a step change to a new normal level, rather than the start of an upward trend in SAIFI.

Changes made to the systems that we use to record SAIDI and SAIFI metrics will allow us to monitor the ongoing SAIDI and SAIFI and tune planned outage work to make sure that the impact to individual consumers is managed.

3.4 Service level: economic efficiency

As well as delivering supply reliably, there is a need to ensure consumers are supplied in an economically efficient and cost-effective manner. We benchmark several measures to understand whether our asset investment strategies are delivering efficient outcomes for the benefit of our electricity consumers in the region.

3.4.1 Objectives

We have three economic efficiency objectives. These are to:

- minimise energy losses on our network
- optimise the utilisation of our assets
- manage operating costs to minimise the overall supply costs to our consumers.

3.4.2 Methods

To ensure that our economic efficiency targets are achieved we:

- consider the impact of losses when evaluating options for network upgrades and renewals
- optimise loading between our GXPs to improve the efficiency of energy transmission to consumers
- actively manage capacity and asset utilisation, and balance equipment loadings where an under or over use becomes apparent
- continually work to improve our works delivery model and processes
- investigate new technology options for improved performance.

3.4.3 Measures and performance

The economic efficiency measures we employ are:

- Loss ratio
- Distribution transformer utilisation
- Operational expenditure per connection point.

3.4.3.1 Loss ratio-measure and target

Loss ratio is a measure of the amount of energy that is lost on our network between the delivery point at Transpower Grid Exit Points to the connected consumers' metering points.

We consider loss ratio to be a valid performance measurement indicator as the minimisation of losses benefits all parties in the energy supply chain, including consumers.

Energy losses on the network can be reduced through good design, asset selection and operation of the network.

Our standing target of 6% is consistent with the long run average past performance and industry best practice.

3.4.3.2 Loss ratio performance

The graph below in Figure 10 illustrates our historic performance for loss ratio and future targets.

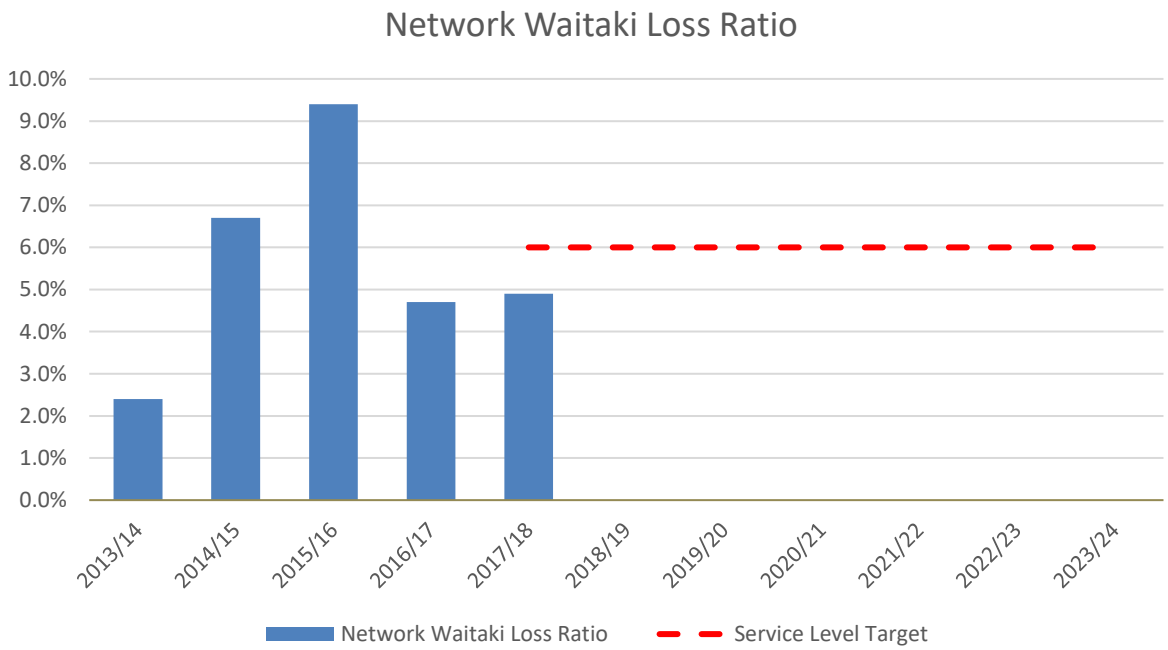


Figure 10 Historical performance of loss ratio compared to our future targets

The 2017/18 calculated loss ratio of 4.9% is lower (better) than our target

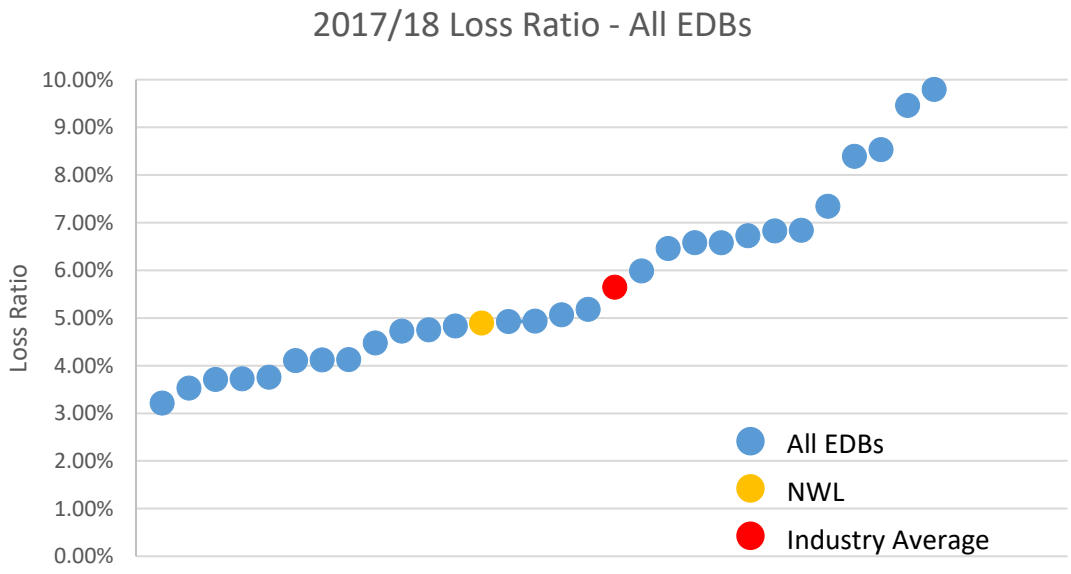


Figure 11 – 2017/18 Loss Ratio compared to all EDBs

Our loss ratio is lower (better) than the industry average and is considered satisfactory and appropriate for our network.

3.4.3.3 Distribution transformer utilisation–measure and target

This is an indicator of the efficient use of network equipment. Distribution transformer utilisation (DTU) is calculated on the coincident maximum demand from our GXP's versus the installed capacity of all distribution transformers on our network.

Tracking this measure ties into our asset management objective of ensuring all asset lifecycle activities are systematically planned with a long-term view towards minimising lifecycle costs. If higher transformer utilisation can be achieved, then the number of our transformers is effectively optimised for the requirements of our network.

We believe that our standing target of 27% for transformer capacity utilisation reflects the predominately rural nature of most of our network, where the opportunities for connection of multiple ICPs to a single transformer are limited to the distance between consumers.

3.4.3.4 Distribution transformer utilisation-performance

Referring to Figure 12 below, there is a strong correlation between System Maximum Demand and DTU which indicates that this has a significant influence on year to year variation between 25% and 32%.

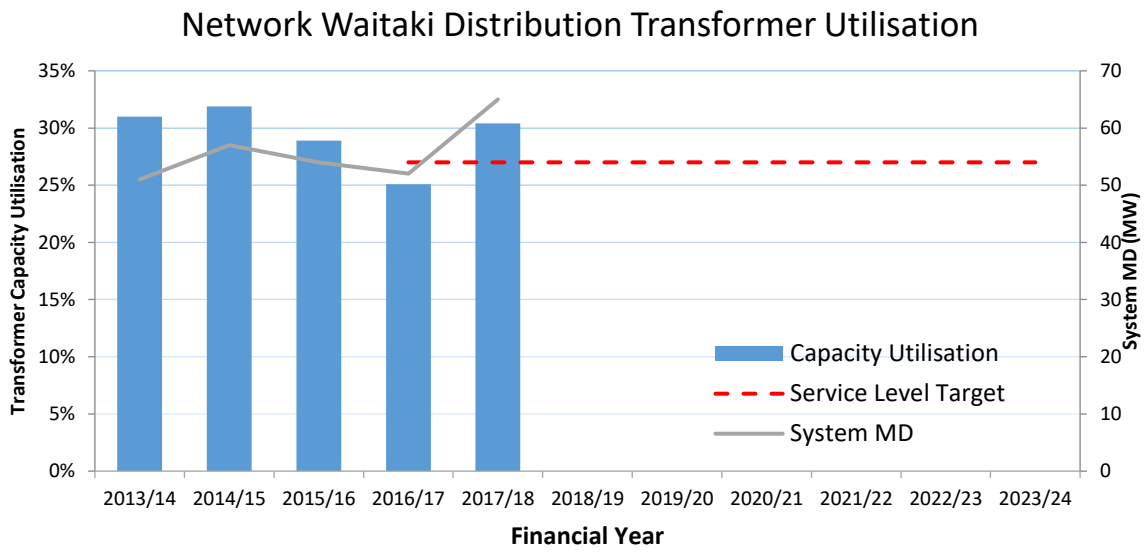


Figure 12 Historical performance of distribution transformer capacity utilisation. 2017/18 data includes figures for Black Point irrigation scheme.

A further test of our performance against this metric is to compare our distribution transformer utilisation against that of other EDBs. We would expect to be consistent with EDBs that have a similar network makeup to ours, with a mixture of urban and rural consumers. This comparison (based on figures disclosed by the Commerce Commission in 2018) is shown in Figure 13 below.

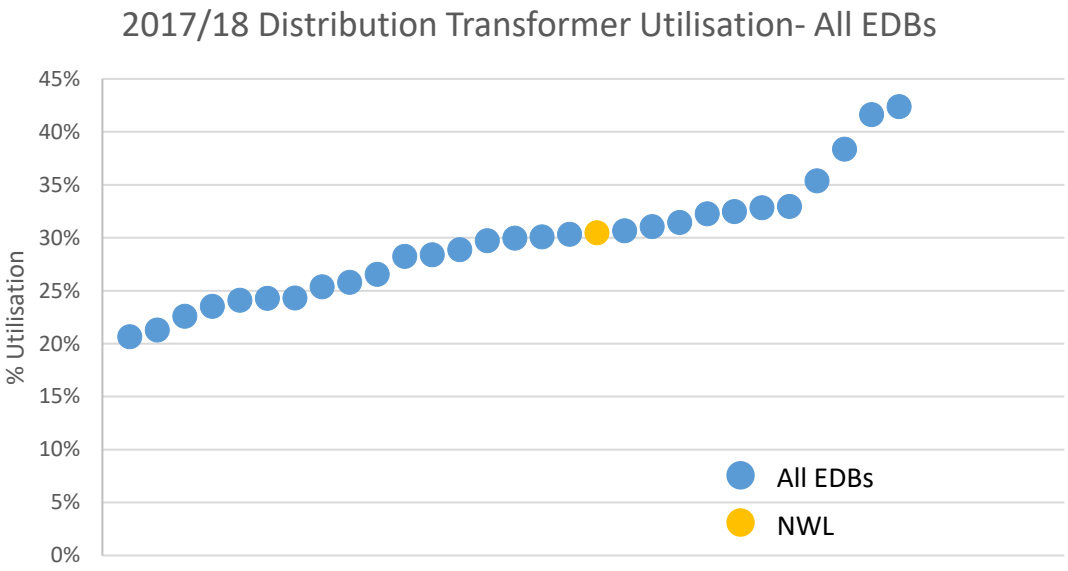


Figure 13 - 2017/18 Distribution transformer capacity utilisation compared to All EDBs

At the high end of the graph are the distributors with mainly urban load and at the low end are those with a high proportion of rural. At 30.4% utilisation we sit close to the median for the 2017/18 period which puts our performance in the same band as EDBs with a similar load type and distribution. We consider our distribution transformer utilisation to be satisfactory and appropriate for our network.

3.4.3.5 Operational expenditure per connection point – measure and targets

This measure provides an understanding as to whether operating expenditures are appropriate given the operating parameters of our company. The target levels are based on our forecast operational expenditure budgets and include an allowance for inflation.

Tracking this measure links our asset management processes to consumer and stakeholder preferences for supply reliability. Adequate levels of operational expenditure per connection point are required to ensure sufficient maintenance is performed to maintain overall system reliability.

Our service level target (Figure 14) is based on known operational expenditure in 2018/19 and is adjusted for 2% inflation.

3.4.3.6 Operational expenditure per connection point - performance

The graph shown in Figure 14 below illustrates the historical performance of our operational expenditure per connection point, and our future target.

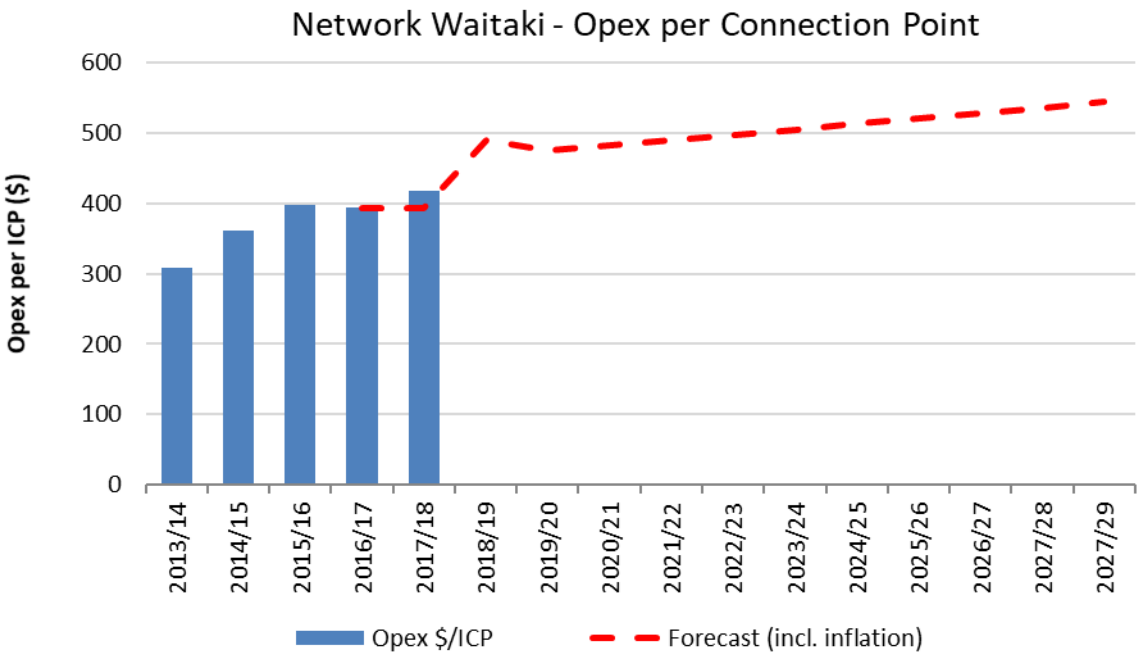


Figure 14 Historical performance of our operational expenditure per connection point compared to our future targets.

Figure 15 shows a comparison between our 2017/18 OPEX per connection point and that of all other EDBs in New Zealand.

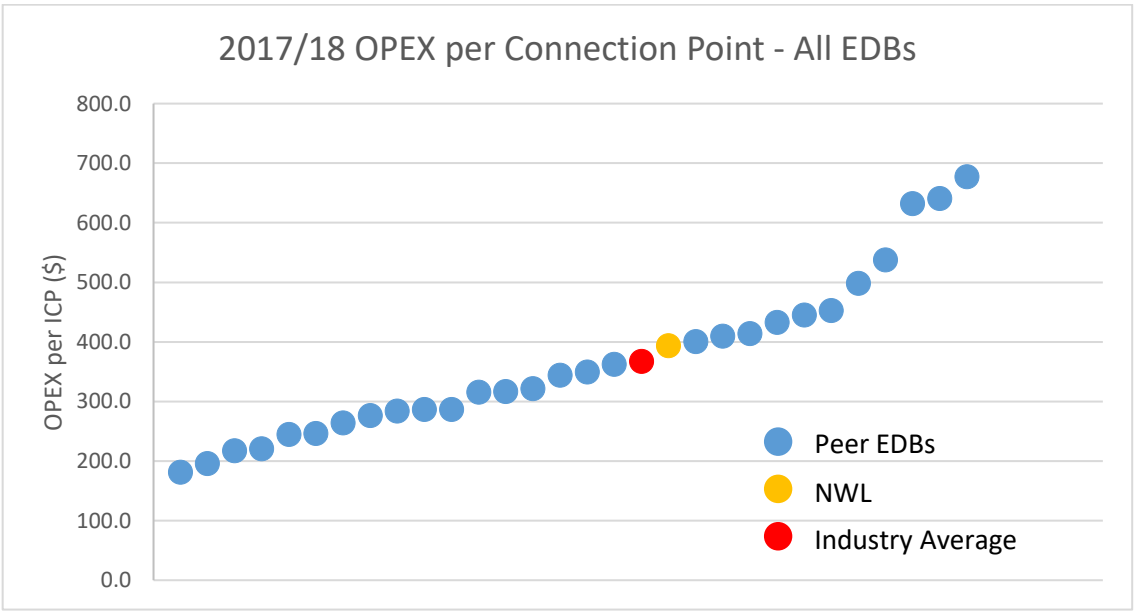


Figure 15 NWL operational expenditure per connection point performance compared to all EDBs

We believe that we have the balance between operational costs and network reliability correct, as shown by our OPEX per ICP being in keeping with the rest of the industry. Analysis of the base data for the graph in Figure 15 shows that EDBs with similar network conditions are grouped around our position.

3.4.3.7 Operational expenditure per metre of circuit length –measure

This measure provides another view of whether operating expenditures are appropriate for our network. We will be developing specific target levels for this measure, but it currently serves to provide another means of normalising our operating costs against all other EDB's in New Zealand.

Tracking this measure will link our asset management processes to consumer and stakeholder preferences for supply reliability. Adequate levels of operational expenditure per metre of circuit length in the network are required to ensure sufficient maintenance is performed to maintain overall system reliability.

3.4.3.8 Operational expenditure per metre of circuit length -performance

Referring to Figure 16 below, our operational costs per metre of circuit length are significantly lower than most EDBs in New Zealand.

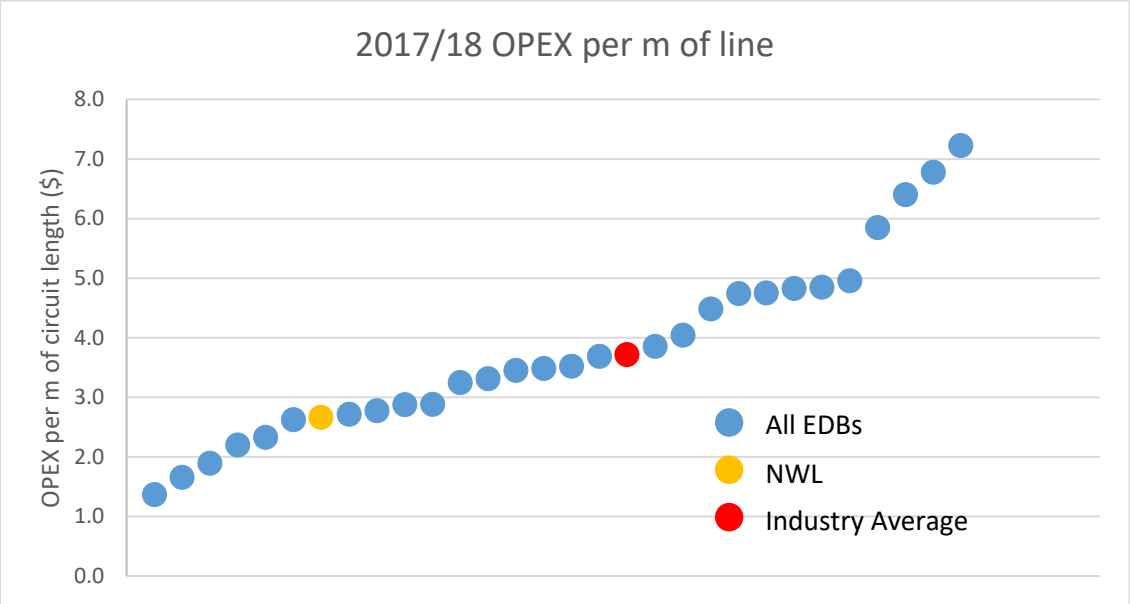


Figure 16 – Operational expenditure per metre of circuit length performance compared to all EDBs

Looking at the combination of operational expenses per length of circuit and per ICP shows that we are successfully managing the operational costs associated with operating an electricity network. We believe that this indicates that small, locally owned EDBs can deliver excellent service for the same (or lower) costs than larger companies.

Powering North Otago.

04. Approach to Asset Management

This chapter outlines the approach that we take to managing our Network assets. It provides an outline of the key parts of the planning and the delivery areas of this discipline. This chapter is structured as follows:

Asset management process: provides an overview of how we view Asset Management as a process and provides detail of how key elements fit the process.

Asset lifecycle management: describes how we approach the different aspects of the lifecycle of our assets, including initial investment, ongoing maintenance, and refurbishment, and how we make decisions on asset investment.

Risk management framework: describes how we apply Risk Management to our business, especially around the treatment of assets.

Public Safety Management System, high impact low probability events and emergency response policies and contingency plans: these sections outline processes that we use to manage keeping our network safe for the public, and how we manage our preparedness for major events.

Asset management maturity: this section reflects on how mature we believe our asset management processes are, specifically using the Commerce Commission's AMMAT system for analysis.

Improvement initiatives/continuous improvement: this section outlines the ways in which we are working to improve our asset management capability.

4. Approach to Asset Management

4.1 Asset Management process

The process that we apply to planning our Asset Management is illustrated in Figure 17 below.

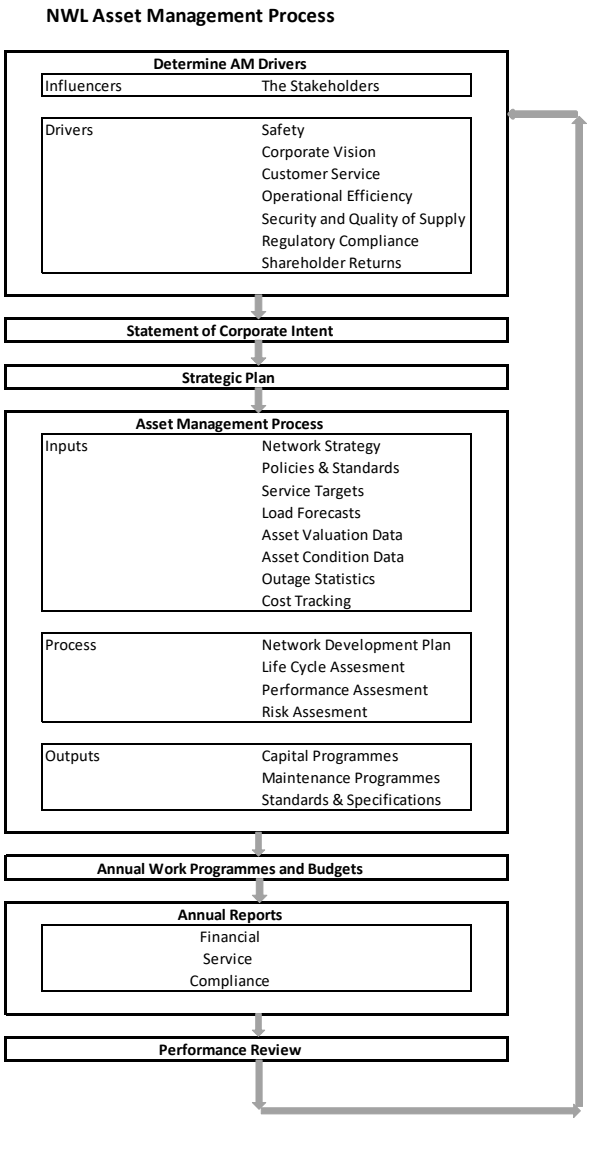


Figure 17 NWL asset management process

The planning process should be viewed as a continuous cycle rather than a hierarchy of documents. Details of some of the key components of this process are described below.

4.1.1 Asset Management Policy

The purpose of our Asset Management Policy is to ensure that our asset management activities occur within a structured and systematic framework. This framework provides a focus on delivering a safe, reliable, secure, resilient, and cost effective supply of electricity that meets the performance expectations of our consumers, while complying with all relevant New Zealand laws, regulations, and codes of practice.

4.1.2 Asset Management Strategy

Our Asset Management strategy is to ensure that our asset management practices continue to deliver agreed service levels as set out in this AMP at minimum long term cost.

Our Asset Management strategy aligns with our Asset Management Policy and corporate objectives and encompasses the components listed below.

4.1.2.1 Asset configuration

The following strategies are applied to our consideration of asset configuration:

- We will take a long-term view of asset requirements, noting that consumers ultimately benefit from well planned investments.
- We will construct all future subtransmission lines at either 66 kV or 33 kV, in line with our Network Development Plan. Lines may be operated at 33 kV in the short-term prior to a strategic decision to convert to 66 kV.
- When building new substations, we will purchase sufficient land to enable dual transformer 66 kV (where appropriate) substations to be built.
- We will consider using portable or semi-portable generators to help meet security of supply standards during planned and unplanned outages. To enable this, when installing new, or upgrading existing distribution boxes, consideration will be given to installing generator connection plugs to enable quick and easy connection of portable generators.

4.1.2.2 Resourcing

The key strategies applied to resourcing for our company are:

- We will identify the required skill sets needed for effective asset management and have a well-developed recruitment and training plan in place.
- We will ensure that our contracting business has a well-developed recruitment/training plan.
- We will continue to engage suitable contractors to maintain our communications and SCADA networks, and other specialist systems.
- We will continue to maintain our engineering skill set through the hiring of qualified engineers and supporting the growth of trained engineers by providing scholarships for local students taking engineering qualifications.
- We will continue to engage suitable consultants for specialist work including civil design, protection, and regulatory advice.

4.1.2.3 Materials

We recognise that decisions made around material selection for construction projects can have long term implications on capital and operational expenditure. We apply the following principles to purchasing decisions:

- We will use only materials and equipment approved by our internal policies and standards, or by specific design where necessary.
- In assessing offers to supply materials or equipment, we shall consider the total life cycle costs of the offer.

4.1.2.4 Delivery of works programme

Where practical our engineering staff commence design for projects in the financial year prior to the works programme. Budgets are developed to provide funds to do this prework where possible. This smooths out the planning process between our designers, project managers and contractors.

This also provides opportunities to pre-order long lead-time material items so that they can arrive earlier in the financial year.

Progress against the works programme is monitored by the Network Operations Team Leader and the Contracting Manager and their teams throughout the year, with careful attention paid to the resourcing and prioritisation of work.

Where we forecast a project may not be completed before the end of the financial year in which it was issued, that work will be reassessed and may be either:

- reissued with the same priority the following year
- given a higher priority
- removed from the work programme.

This last situation is uncommon, and usually only occurs when the job analysis indicates that events have overtaken the original job, e.g. the repaint of a distribution transformer is made irrelevant by replacement of the transformer because of load growth.

4.1.2.5 Performance reporting for asset management

We believe that the asset management of our network should be implemented in an open and transparent manner. The key formal reporting mechanisms that we employ are shown in Table 11.

Table 11 - Key asset management reporting mechanisms

Reporting line	Reporting mechanisms and content
The Company to consumers and stakeholders	The company website includes the AMP, Company Annual Report, and other disclosure documents. Company annual report includes Chairman and Chief Executive's statements and audited accounts. Annual information disclosure.
The Board to the Trust	Quarterly presentation includes financial and operational performance.
Chief Executive to the Board	Chief Executive's statement in company annual report includes narrative of year's highlights. Monthly board report includes progress on significant Capital projects and major outages. Email updates between meetings on significant developments.
Engineering Manager to Chief Executive and the Board	Annual report on budget and major projects Monthly report includes year to date performance and progress against budget. Individual reports on major projects. Daily updates on areas of concern
Contracting Manager to Engineering Manager	Monthly meetings on progress to budget

4.1.3 The Asset Management Plan

This Asset Management Plan (AMP) provides a summary of the information contained in our internal planning documents, to enable stakeholders to assess our asset management practices. Our AMP is also the main document for communicating our asset management practices and planning processes to our stakeholders.

In particular, the objectives of this AMP are to:

- link the asset management processes to consumer and stakeholder preferences for prices, supply reliability, and public safety
- ensure that all asset lifecycle activities, plans and associated costs are systematically planned with a long-term view towards minimising lifecycle costs, which promotes productive efficiency
- ensure that physical, commercial, and regulatory risks are correctly managed throughout the life of the asset.

The AMP is written in conjunction with the production of budgets for Board approval. This provides certainty to the stakeholders on the plans contained within the AMP.

4.2 Asset lifecycle management

Investment in the life cycle of assets in operation on our network falls into four categories:

- Planned routine and preventative maintenance
- Reactive maintenance
- Planned renewal or refurbishment

4.2.1 Planned routine and preventative maintenance

We currently operate a time-based inspection and preventative maintenance programme, where all assets are either maintained at regular intervals or inspected at regular intervals to identify defects such as wear and tear. The frequency of inspections is tailored to focus the highest scrutiny on our most critical assets, such as subtransmission systems. We are moving towards using more condition-based maintenance planning, and the integration of data from the use of mobile devices in the field, and through integration of performance data in new software packages will help with this initiative.

This sort of work may include cleaning and maintenance of a circuit breaker, or the retightening of hardware on a particular section of line. The purpose of planned routine or preventative maintenance is to ensure that an asset can continue to provide its original function through to its design life.

Non-critical defects that are found during inspections or operation of the network are included in our GIS. This provides excellent visibility of our progress in rectifying defects, and allows for the better coordination of work, which is especially important to minimise the effect of planned outages. Data input in the field is directly entered into databases for analysis, where it would previously have been captured on paper for later transcription into our systems.

4.2.2 Reactive maintenance

Unplanned fault-based maintenance not only includes responding to faults but also to incipient fault situations, and critical safety situations. Examples of critical safety situations include such things as disconnecting power to a property which is on fire or isolating a section of line for a car versus pole event.

NWL operates a 24-hour fault service that provides prompt and effective response to faults and emergency situations.

Our faults are presently managed in our works management system. Follow-up analysis of network asset performance occurs in a separate database. We are developing the ability to relate the faults data to asset performance directly through the use of our GIS, which will strengthen our ability to draw conclusions on network performance from our captured faults data.

4.2.3 Planned replacement and renewal

Planned replacement or renewal activities are undertaken to ensure network safety and reliability. This strategy uses network safety, asset criticality, serviceability, performance, economic viability, and the environmental consequences of failure to justify this expenditure. The key drivers for the replacement and renewal programme are age and condition of the assets. This is determined by the outcomes of the routine inspections and preventative maintenance programme.

Renewal generally involves the repair or replacement of components of an asset to maintain the capacity of the asset through to its design life. In certain circumstances, we may choose to refurbish an asset according to the manufacturer's recommendations, or good industry practice. These refurbishment intervals are usually quite long (in the order of 10-25 years) or based on operational conditions (e.g. clearance of a certain number of high current faults).

We may need to replace an asset rather than renewing it. The primary driver for replacing assets versus renewing them is economic, where the discounted cost of on-going repairs exceeds the replacement cost, or the cost to refurbish or enhance the asset to meet the service criteria (e.g. safety, capacity) is not economic. The other major drivers for replacement, which may override taking the most economic course of action are where:

- the risk and consequences of failure of an asset warrant replacement
- removal of risk where an asset is unique in the fleet and may not have spares
- the performance of the asset is likely to be poor following repairs.

4.2.4 Development options

When a security or capacity constraint is forecast on our network, the options below are considered.

1. **Accept the constraint**

   This option is not usually implemented for long periods of time and may be used where longer-term solutions cannot meet required time frames or where the costs of other options significantly outweigh the benefits. The risks of operating in this mode must be quantified and assessed as acceptable.

2. **Optimise the network**

   This option could involve altering the configuration of 11 kV feeders to shift load from a heavily loaded to a lightly loaded feeder or it could involve installing a voltage regulator on a feeder to avoid a conductor upgrade.

   Consequences such as increasing system losses or a reduction in security of supply should be included in the cost-benefit analysis.

3. **Control customer load**

   This option involves NWL acting to reduce customer load while a constraint is present.

   If new load is likely to exceed a constraint limit NWL may choose to impose conditions that allow NWL to control that load during constraint periods. If the network is upgraded to remove the constraint these conditions may be removed.

   Loads that may be controlled include load traditionally available for interruption such as water heaters and load that is specified as controllable in our Security of Supply Standard (e.g. Irrigation load)

4. **Non-traditional solutions**

   This option may be used to augment parts of our network or in some cases replace them. A remote power system could be used to replace a traditional power line if the lifecycle costs of this are less than the costs of building or maintaining the line or solar and/or batteries could be installed to avoid upgrade of existing assets by reducing peak loading. There is scope in this option for innovative solutions to be developed.

5. **Modify or re-rate existing assets**

   This option could involve a design review to increase conductor maximum temperatures or using dynamic rating on a line or cable to increase capacity. Cooling fans could be added to a transformer to increase capacity.

6. **Install new assets**

   This involves either building new network or upgrading existing assets.

Customer load increases are often signalled to us at short notice which may require that options 1 to 3 are used in the short term, followed by a long-term response following detailed analysis of all appropriate options.

For low cost projects, we use deterministic rules from our design and Security of Supply standards which may result in evaluating only a subset of these options.

All options selected for detailed study are evaluated for cost and benefit (including costs of energy losses and value of lost load where appropriate) and considered for alignment with:

- Our strategic plan (which includes health and safety, environment and sustainability requirements),
- Statutory requirements (e.g. voltage, power quality limits)
- NWL Security of Supply Standard.
- Forecast network capacity requirements
- Customer reliability requirements

Options are scored across these categories and ranked according to their scores. The option (or options) with the best score are submitted for expenditure approval.

4.2.5 Expenditure approvals

Following on from this initial prioritisation process, a sanction for expenditure (SFE) is prepared for all high priority, high cost projects. The SFE will be presented to the board for approval.

The SFE details:

- the issue that the project is designed to address
- the options that have been considered
- recommendations for solutions
- the rationale for the selected option or options
- financial analysis of the options, including a risk based assessment of the cost of lost load, if applicable
- Any other benefits that will accrue from this project in terms of security, quality, consumer/community perception etc.

Our Board requires all requests for major capital funding to be supported by a SFE.

4.3 Risk management framework

Our business faces a wide range of risks. Some of those risks relate specifically to our network assets and the physical environment in which they are located, whilst other risks include more generic risks that all businesses face. Risk management is a fundamental part of good management practice and corporate governance, and effective stewardship of our assets.

Our approach to risk management strengthens our asset management decision making and practices. We apply risk management in all our business activities, including policy development,

business planning and change management. We adopt a systematic risk management process that is based on *AS/NZS ISO 31000:2009 – Risk management – Principles and guidelines*.

Figure 18 below illustrates the systematic application of risk management according to the standard:

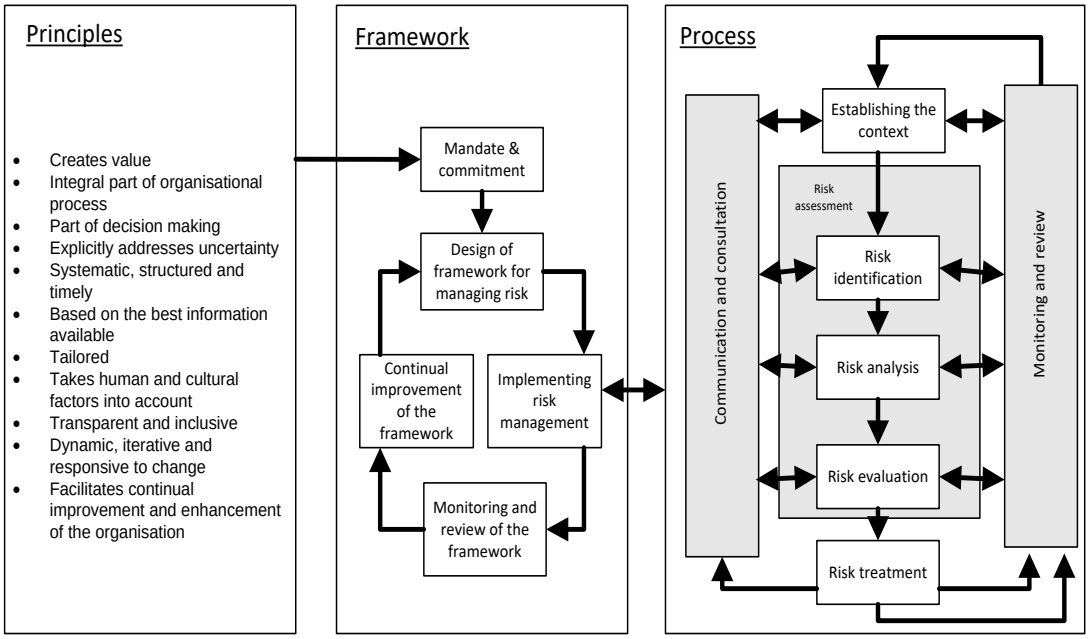


Figure 18 - From ISO31000:2009 relationships between the risk management principles, framework, and process

Our risk management system consists of the following components:

- Specific risk management policy
- NWL risk management framework
- Risk management process
- Risk management plans
- Risk registers
- Risk reporting.

4.3.1 Risk Management Policy

Our Risk Management Policy was rewritten in the past year and focussed on the development and maintenance of a risk management system to:

- Promote continuous improvement
- Actively encourage the early and accurate reporting of risks, as health and safety and business continuity is dependent on effective risk management.
- Set risk management objectives and performance criteria for all work areas and review these annually or more often as required.
- Develop systems and procedures to eliminate or minimise risk and monitor those controls.
- Investigate all reported risks to ensure controls are identified and, where appropriate, plans are formulated to take corrective action.
- Review existing risks and take all reasonably practicable steps to control those risks with controls including elimination or minimisation.
- Ensure that all workers are made aware of the risks they may be exposed to and are adequately trained to manage those risks to an acceptable level.
- Encourage consultation, coordination and participation with workers, including contracted workers and other Persons Controlling Business Units (PCBU) in all matters relating to risk as far as reasonably practicable

4.3.2 Risk management framework

Our Network Risk Management Framework document defines the approach we take to manage risk within our business. It ensures that risk management is integrated into all aspects of our business including governance, strategic planning, operational planning, and reporting.

4.3.3 Risk management process

Our risk management process ensures our risks are identified, understood, and managed consistently across all levels of our business. We assess our known risks in accordance with our likelihood and consequence criteria, to determine which risks need treatment and the priority for treatment.

Our risk management process involves the following steps:

1. **Establishing the context** in which we operate in. This involves understanding our business objectives and values, defining the internal and external environment which we operate in, and setting the scope and risk criteria for the remaining risk management process. We consider many factors including accessibility of our assets by the public, asset age, and location.
2. **Risk identification** is the process of identifying, recognising and describing our risks and the effect those risks have on the ability to achieve our objectives. Our risks are identified through operational processes including hazard identification recording in our Hazard Register by employees in the field, team and project meetings, our Health and Safety management process which includes recording and tracking workplace safety and training data into our safety management system, and our public safety processes.

3. **Risk analysis.** We use both qualitative and quantitative methods during the risk analysis stage. All our identified risks are analysed in terms of likelihood and consequence.
4. **Risk evaluation.** All of our identified risks are evaluated against our likelihood and consequence risk score. This assists us in our decision making to ascertain which risks need treatment and the priority for treatment implementation.
5. **Risk treatment.** We treat a risk depending on the risk score it has been allocated in the analysis and evaluation stage. Risk treatment involves selecting one or more options for modifying risks, and these can include the following:
    - Avoiding the risk by not commencing or continuing the activity.
    - Removing the risk source.
    - Changing the likelihood.
    - Changing the consequences.
    - Sharing the risk with another party or parties (e.g. contracts and insurance).
    - Retaining the risk by informed decision.
6. **Post treatment risk evaluation.** The risks are reassessed after the application of the treatment to verify that the post treatment level of risk is known and accepted by the company.
7. **Ongoing review of risks.** It is important that once a risk is recorded in the system it is regularly reviewed, as the likelihood and consequence can change. We use the Vault health and safety software package to record and manage risks, including scheduling reviews, and reporting on outstanding risks.

4.3.4 Risk management plans

We currently employ job safety analysis (JSA) to apply a disciplined risk management approach to planning around the health and safety elements of a particular job. We are leveraging off this work to develop complete risk management plans for major projects, covering health and safety, financial, environmental, and operating risks for a project. These plans will be developed and approved by the key stakeholders involved in the work in question, such as engineers, managers, and contractors.

4.3.5 Risk registers

Information from the risk management process is recorded, reported, and monitored using our risk registers. There are multiple risk registers in service covering:

- Public Safety Management System
- Health and Safety risks
- Business risks
- Asset risks
- Individual project risks
- Physical risks for specific sites

We are in the process of consolidating the various risks into the online Vault risk management system. This will ensure that all risks can be tracked and managed in one system.

4.3.6 Risk reporting and monitoring

The monitoring of risks is generally carried out at the level of the risk register. The integration of all the registers into Vault has allowed consolidated and consistent management of the different registers. This includes such features as sending emails to staff who have been assigned to manage the risk, and tracking the progress of corrective actions, as well as providing reports summarising the risk items recorded. We have confidence that the monitoring and reporting processes in this area are robust and complete, with monthly reporting on risks in this area going to the board.

Other risks, such as project level performance and commercial risks are monitored by the staff managing the project itself and are normally reported to management on an exception basis if the risk becomes a real threat.

4.3.7 Health and Safety Critical Risks

We maintain a special awareness and focus on critical risks associated with operating an electricity network. These risks have been identified and assessed in collaboration with other EDB's through our involvement in industry safety groups. They represent the greatest risks to our staff, and include:

- Driving
- Confined space work
- Crane, elevated platform vehicle and excavator operation
- Working alone
- Working in remote areas
- Operation of switchgear
- Working at height
- Electrocution and arc-flash

The treatment of these risks includes special focus on training and the development of standard work practices, as well as regular monitoring of the risk profile and our performance in these areas.

4.4 Public Safety Management System (PSMS)

As an infrastructure company, we strive to manage our assets in a way that residual risk is reduced to as low as reasonably practical. Our accredited PSMS manages all known hazards and risks to the public or their property, caused by the operation of our business. It records the actions to be taken (or that have been taken) to resolve those risks. Our risks are identified through operational processes such as documentation by field staff, and team and project meetings. This information is also reported to the Board monthly and in annual reports.

Our PSMS is an accredited system to NZS7901 and is audited annually by an external auditor (Telarc). In February 2019, we received confirmation that our PSMS would again achieve accreditation to NZS7901:2008. Future audits will be against NZS 7901:2014.

4.5 High impact, low probability events (HILP)

We are subject to the risk of a number of potential high impact, low probability (HILP) events, which could give rise to a major unplanned service outage for an extended period of time. A key example of an HILP event is a rupture of the South Island's alpine fault.

Our exposure to such events is reviewed every few years to maintain currency of the planning, or whenever it is identified that there is a new or changed HILP risk. An example of this would be an assessment of Tsunami risks to our business that was carried out after the Fukushima earthquake in Japan.

HILP events can have a widespread impact, but it will often be prohibitively expensive to prepare our network to avoid any impact, if this could be done at all. Accordingly, we have a responsibility to plan and manage for HILP events as best we can within practical limits. Within this context, our policy is to ensure:

- a safe environment for staff, contractors, and the wider community
- the timely restoration of power supply as far as practicable
- effective communication
- efficient provision and recovery of information tools for critical business activities.

Our critical business activities relate primarily to keeping our staff safe, protecting the public from harm from our assets, power security and reliability, consumer service, and quality of supply.

Events that could interrupt our critical business functions include natural disasters such as a large earthquake on the alpine fault, a tsunami, major storm events (snow, wind, and floods), a failure at one of the dams on the Waitaki River, major critical asset failure; communications failure; and long term loss of supply from Transpower.

4.6 Emergency response policies and contingency plans

As a lifeline utility provider, we have a responsibility to plan and prepare for HILP events. We have a suite of risk management and response documents and policies in place to ensure that power supply is restored in the minimum time.

4.6.1 Lifeline utility and engineering lifeline groups

The Civil Defence and Emergency Management (CDEM) Act 2002 stipulates the responsibilities and roles of key organisations that provide an essential service within New Zealand. Our core business as an EDB is an essential service and under the CDEM Act we have been classified as a *Lifeline Utility*. As such, we must:

- Ensure that we are able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency;
- Have a plan for functioning during and after an emergency;
- Participate in CDEM strategic planning; and
- Provide technical advice on CDEM when required.

4.6.2 Civil Defence plan

Under the CDEM Act 2002, Regional Councils are required to establish CDEM Groups. As a lifeline utility, we are required to establish planning and operational relationships with our local CDEM Group, which is the Otago Civil Defence Emergency Management Group (Otago CDEM Group). As a member of the steering committee for this group we participate in the development of their plans and provide technical advice as requested.

We have a company Emergency Preparedness Plan in place which details how we will respond to a Civil Defence Emergency. In addition, we have developed emergency response plans for dealing with widespread abnormal situations created by either equipment failure, natural causes, or certain man-made scenarios such as fire or bomb threat.

4.6.3 Information system security breaches or losses

Our information technology and telecommunications (ITT) systems are an important part of our business and operational systems. Our ITT department manage the threat from external sources via industry standard approaches, including antivirus software, restricted administrator access, offsite backup systems and firewall technology.

We are involved with the CSSIE (Control Systems Security Information Exchange) group, which is supported by the National Cyber Security Council (NCSC).

Our ITT infrastructure has been designed to be robust and includes a standby generator and UPS support for our server room.

All data is backed up to an offsite facility daily to provide protection in case of local site damage.

4.7 Asset management maturity

We have applied the Commerce Commission's Asset Management Maturity Assessment Tool (AMMAT) to review the maturity of our asset management practices. This assessment tool is a series of questions based around the principles of PAS 55. The outcomes are also useful to identify gaps in our asset management systems. We are not currently seeking PAS 55[4] or ISO55000[5] accreditation, but we will be looking at incorporating the principles of those standards into our asset management systems and process as we move forward.

4.7.1 Summary of AMMAT assessment

The latest assessment of our asset management practices against the AMMAT is attached in the Appendices. Our asset management practices scores were generally 2 out of 4. These scores are lower than in previous AMMATs, but this reflects our growing awareness of good practice in asset management rather than a degradation of performance.

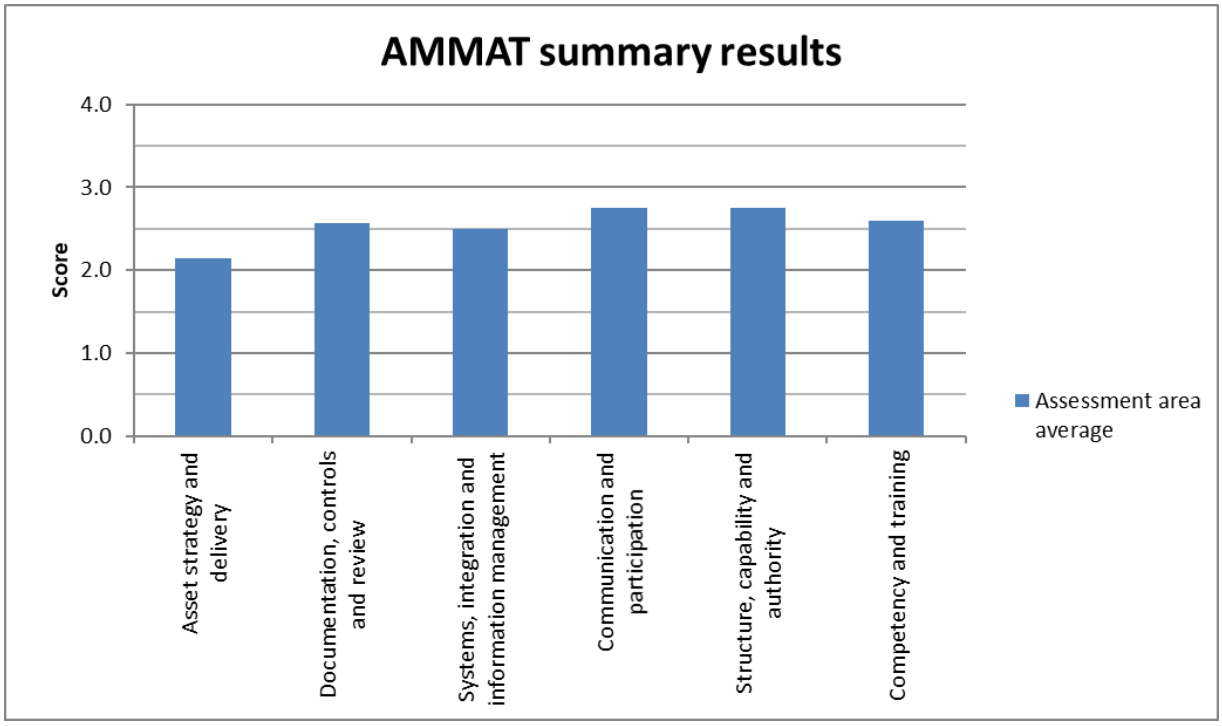


Figure 19 - AMMAT results summary

Generally speaking our systems and processes are functional but are often not particularly efficient. We are still very reliant on paper forms being manually entered by personnel. Integration and coordination of data across multiple systems can also require considerable human intervention, as can analysis of that data to generate useful information. We are actively involved in improving the efficiency and effectiveness of our systems through the introduction of field-based data capture systems, and the integration of data between software systems such as our GIS and our work management system.

[4] PAS 55 – Publicly Available Specification 55 – Asset Management
[5] ISO 55000 – International Standard for Asset management. Overview, principles, and terminology

From this original AMMAT assessment point we have been working towards identifying and improving our processes where we think we can, in ways that align with the scale of our business.

4.8 Improvement initiatives / continuous improvement

One of the key improvement initiatives that we are involved with is the development of our asset data information systems.

The goal is to ensure a tightly integrated system across the following areas:

- Works planning
- Maintenance scheduling
- Condition monitoring and analysis
- Financial management
- Timesheet integration for plant and staff
- Defects recording and location
- Management of controlled documents such as standards and policies
- Fleet management of plant
- Asset registers, operational, financial, and regulatory
- Stores and procurement
- SCADA Data

This will allow us to record and maintain our assets, and to track the work involving them.

The component systems are already operational or under development, and work is now progressing on implementing a data store to allow data from the separate specialist components to be integrated and analysed.

05. Renewals and maintenance

This chapter describes how we renew and maintain our network. It covers how we plan this work, our general approach to inspection and monitoring as well as more specific information about our different groups of assets and how they are maintained. This chapter is structured as follows:

Approach to renewals and maintenance: gives an overview of how we determine what work needs to be carried out on our assets.

Approach to data issues: this section an overview of how we deal with asset data that is incomplete, and how we are dealing with data gaps.

Asset categories: Outlines assets by function and criticality, which guides how we apply maintenance and renewal regimes.

Asset quantity summary: This is a summary showing the breakdown of our asset base by various categories.

Asset category details: in these sections, we detail the maintenance and renewal approach for each of the different categories of our assets. We show the asset population data, population risks, any specific inspection and maintenance practices, or renewal programmes, and a summary of forecast renewal and maintenance expenditure. Forecasts are nominal and have been adjusted for the effects of inflation.

Renewals and Maintenance Summary: A graphical summary of the forecast expenditure on renewals and maintenance for the planning period.

5. Renewals and maintenance

5.1 Approach to renewals and maintenance

Assets are regularly inspected to identify any defects – inspection intervals are determined according to the type and criticality of the asset. Information to trigger renewals or maintenance can come from the results of these regular inspections, analysis of fault reports, from observations of our staff or from wider industry advice of an issue with a particular asset type.

The results of the routine inspections and outcomes from defect reports are used to trigger specific maintenance or renewal activities. All defects are entered into a defect database. Major defects which have a potential risk of causing serious harm to members of the public, employees, or property; or which could have a large impact on the reliability of the network are treated with high priority and must be resolved within three months.

Our objective is generally to detect pending failures in our critical assets and replace them before significant supply disruption or damage to the asset occurs. The impact of the failure of less critical assets, such as service fuses, may be minor compared to the expenditure and operational impact, provided there is no health and safety risk associated with the failure. In such cases we balance the possibility of a localised outage to deal with a problem if and when it arises against the cost and disruption of regular planned outages to inspect minor items.

NWL field staff carry out the inspection of all overhead lines and poles, distribution assets, and the general inspection of zone substations. Specialist contractors are used to undertake assessments such as dissolved gas analysis (DGA) and partial discharge (PD) analysis of key assets such as substation transformers, ground mount switch gear, and cable terminations.

5.1.1 Maintenance planning

To justify expenditure, maintenance proposals are assessed for each asset based on:

- safety
- impact of the possible defect on normal operation
- criticality of the particular asset
- serviceability and performance of the asset
- economic consequences of failure
- environmental consequences of failure.

Maintenance falls into two main categories:

- Corrective maintenance, where the work is to remove the cause of a problem on an asset, e.g. a component that is broken or out of tolerance.
- Preventive maintenance, where the work is to remove the cause of a potential problem on the asset, e.g. replacing dirty oil, tightening bolts before a failure occurs.

5.1.2 Renewals planning

Planned renewals are undertaken to ensure network safety and reliability. The methods for justification of a planned renewal programme are the same as for maintenance, listed above.

The difference between renewal and maintenance actions are often around the scale of the work to be carried out on an asset. Common drivers in the renewal programme are age and general condition of a group of assets, such as a particular section of overhead line.

Renewal may also be carried out to ensure that an asset or system will continue to meet its performance requirements, such as capacity or speed of operation.

Economic analysis is also completed to decide whether an asset is renewed or replaced.

5.1 Standard Life expectancy

Our company has applied standard life expectancy figures across all categories of assets for many years. The values for these life figures are developed from industry published figures and are used primarily for accounting purposes such as setting depreciation rates. In practice we are seeing that the useful (and safe) life of our assets is generally higher than the standard life, and can be highly dependent on location, treatment, and loading. For this reason, we avoid using age as a proxy for condition and base asset decisions on observed or tested data.

5.2 Treatment of unknown age data

Where age data is missing from our records and there is evidence supporting a likely particular period of installation then we will linearly divide the assets across that period. Otherwise, we will take a conservative approach and divide the assets across the earliest likely period. Lack of age data is offset by condition assessment, which serves as a better predictor of remaining asset life than the date of manufacture.

5.3 Asset criticality

A focus of the early part of the planning period is the analysis of the criticality of assets in the network. While the criticality of parts of the network is well understood from an operational point of view, this is a macro level of knowledge. Best practice in our industry is developing around extending formal criticality analysis down to the individual asset level in some instances. Much recent work has been carried out by the EEA and other EDBs around the Health and Criticality methodology developed by OFGEM in the United Kingdom.

The review of asset criticality will be coordinated with work on network resilience planning.

5.4 Use of constant dollar values

Capital and operational expenditure values are expressed in real dollar terms. We have not included an adjustment for inflation in order to allow for better comparison of expenditure between years.

5.5 Asset categories

The different asset classes that we use for the planning of maintenance and renewals and the frequency of inspections are summarised in the following table.

Table 12 - Overview of inspection regimes by asset class

Asset class	Inspection regime	Frequency
Poles (Section 5.8)	Sub transmission -ground patrols Sub transmission -climbing patrols Sub transmission -vegetation patrols Distribution – ground patrols Distribution - vegetation patrols (the number of line patrols has been nearly doubled during the 2018/19 financial year to provide extra information for review of the line patrol program)	Yearly 3 Yearly Yearly 5 Yearly 5 Yearly
Subtransmission (including pole mounted switchgear) (Section 0)	Ground patrols Climbing patrols Vegetation patrols	Yearly 3 Yearly Yearly
Zone Substation Buildings, Grounds, Fittings (Section 5.10)	General inspection	Quarterly
Zone Substation Transformers (Section 5.10)	Dissolved gas analysis (DGA) Tap changer overhaul Oil processing	Yearly Based on loading and operation Based on loading, operation and oil test results
Zone Substation Switchboards (Section 5.10)	Partial discharge testing Trip testing on older equipment (>25 years old)	Yearly Yearly

Asset class	Inspection regime	Frequency
Distribution Network (Section 5.11)	Ground patrols Vegetation patrols	5 Yearly 5 Yearly
Distribution Switchgear (Section 5.12)	Ground mount: partial discharge testing Pole mount: ground patrols	3 Yearly 5 Yearly
Distribution Transformers (Section 5.13)	Ground patrols MDI readings Earth testing	5 Yearly Yearly 5 Yearly
LV Network (Section 5.14)	Ground patrols Vegetation patrols	5 Yearly 5 Yearly
LV Switchgear (Section 5.15)	Ground patrols	5 Yearly
Other System Fixed Assets Voltage Regulators	Ground patrols	5 Yearly
SCADA/Communications	Inspection and testing	Yearly
Ripple Control Transmitters (Section 5.16)	Manufacturer's inspection	2 Yearly
Other Systems	Manufacturer's recommendations	As required

5.6 Asset quantity summary

Table 13 - Summary of network assets by category

Asset category	Unit	Amount
Concrete poles / steel structure	No.	8926
Wood/other poles	No.	12783
Subtransmission OH up to 66 kV conductor	km	217
Subtransmission UG up to 66 kV (XLPE)	km	4.1
110 kV CB (Outdoor)	No.	1
33 kV Switch (Pole Mounted)	No.	93
33 kV CB (Indoor)	No.	11
33 kV CB (Outdoor)	No.	39
11 kV CB (ground mounted)	No.	81
11 kV CB (pole mounted)	No.	3
Zone Substation Transformers	No.	23
Distribution OH Open Wire Conductor	km	1255
Distribution UG XLPE or PVC	km	63
Distribution UG PILC	km	8.1
11 kV CB (pole mounted) - reclosers and sectionalisers	No.	58
11 kV Fuses (pole mounted)	No.	3452
11 kV Air Break Switches (pole mounted)	No.	440
11 kV RMU (individual switches)	No.	192
Pole Mounted Transformer	No.	2367
Ground Mounted Transformer	No.	535
Voltage regulators (sets)	No.	14
LV OH Conductor	km	231
LV UG Cable	km	112
LV Switchgear (Distribution Boxes)	No.	292

5.7 GXP equipment

We are connected to the Transpower network at four Grid Exit Points (GXPs). The characteristics of these are listed in Table 14 below.

Table 14 - Characteristics of NWL grid exit points

Supply point	Voltage	Capacity	Zone Substations supplied
Oamaru GXP	110/33 kV	45 MVA	10
Black Point GXP	110/11 kV	25 MVA	0
Waitaki GXP	11/33 kV	24 MVA	5
Twizel GXP	220/33 kV	20 MVA	3

The GXPs are Transpower assets; We own a small amount of switchgear at Black Point GXP and a single power transformer at Waitaki GXP. These assets are maintained in conjunction with Transpower outages as per our zone substation equipment summarised in section 5.9.

5.8 Poles

5.8.1 Quantity and life expectancy of our poles

Table 15 - Pole population by material

Pole Material	Number in Service
Wood	12783
Concrete	8926

The wood pole group includes hardwood and softwood poles and assumes that the 113 poles on our network classed as “Other” are wood. This is a conservative assumption and we will reclassify these poles based on the returns from the next line inspection.

The concrete pole group contains 5 poles that have been classed as steel or iron. Existence of these and condition will be confirmed during the next line patrol.

The nominal life expectancy we apply to our poles is shown in the table below:

Table 16 - Life expectancy of distribution assets

Asset Description	Standard life expectancy (years)
Concrete Pole	60
Wooden Pole	45
Cross Arm	20

5.8.2 Management approach

We manage our poles with the aim of keeping them safe for the public and our staff, and minimising outages. This is based on regular condition assessment of poles in service.

Pole renewals are mostly initiated from defects found during line inspections, or as a result of faults.

Line patrols are systematic assessments are carried out by line mechanics with extra training, using specialised pole testing equipment. In early 2018 we completed a review of our pole inspection processes. The review found that our processes were generally up to a level equivalent to others in the industry, at the same time highlighting areas where we could improve to meet industry best practice across Australasia.

These changes include:

- carrying out extra line patrols in 2018/19 to supply condition information for better analysis
- adopting software tools to calculate loading on poles during inspections
- inspector training and support to improve consistency of inspections
- integration with test tool outputs
- Software tools to systematically manage patrols
- Software tools to analyse inspection data.

5.8.3 Age profiles

Of the 21709 poles on our network, 9525 are of unknown age. Data collection using the new field collection platform will provide estimated ages as part of the inspection process, supported by condition data for each pole. This should close this age information gap within 5 years.

Any probable installation dates that are developed during this exercise will also be verified against the details of nearby assets using our GIS systems. In this way, we expect to improve our confidence in the age profile of our network poles.

5.8.3.1 Wooden poles

The age profile of our wooden poles is shown in the graph below. The unknown hardwood poles have been evenly distributed between 1950 and 1989 at a rate of 100 poles per year and the

unknown softwoods between 1990 and 2011 at a rate of 25 per year. We believe that this is a conservative approach and may refine this in the future.

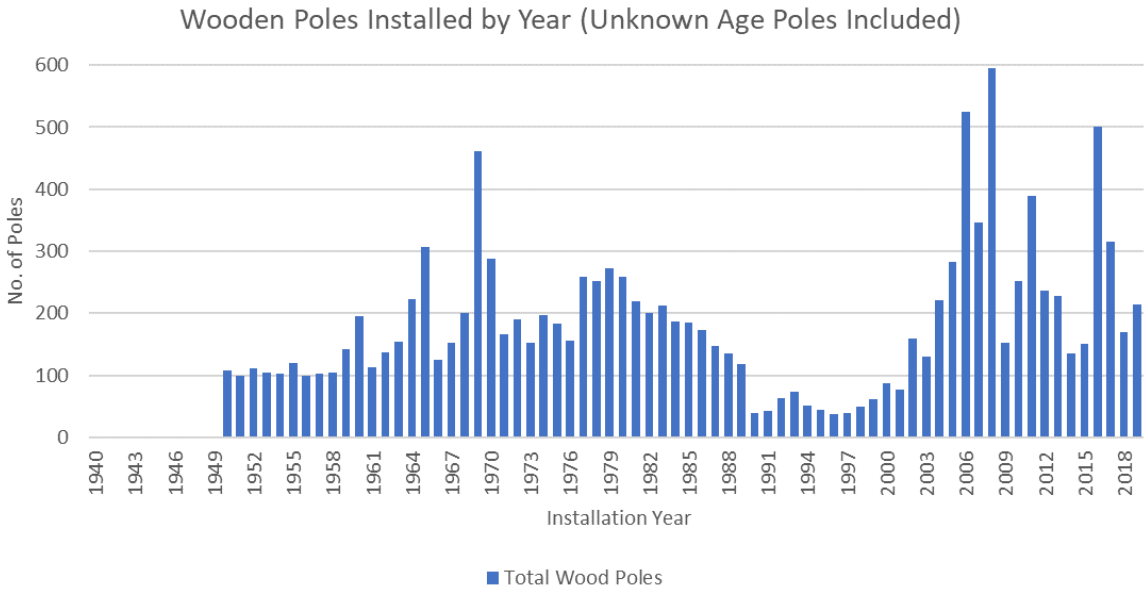


Figure 20- Age profile of NWL wooden poles

At the start of this planning period we have 4155 poles over 45 years of age (<1973). These will all be fully inspected and tested using the updated inspection process in the first three years of the planning period.

5.8.3.2 Concrete poles

The age profile of our concrete poles is shown in the graph below. The unknown concrete poles have been evenly distributed between 1950 and 1989 at a rate of 129 poles per year. We believe that this is a conservative approach and may refine this in the future.

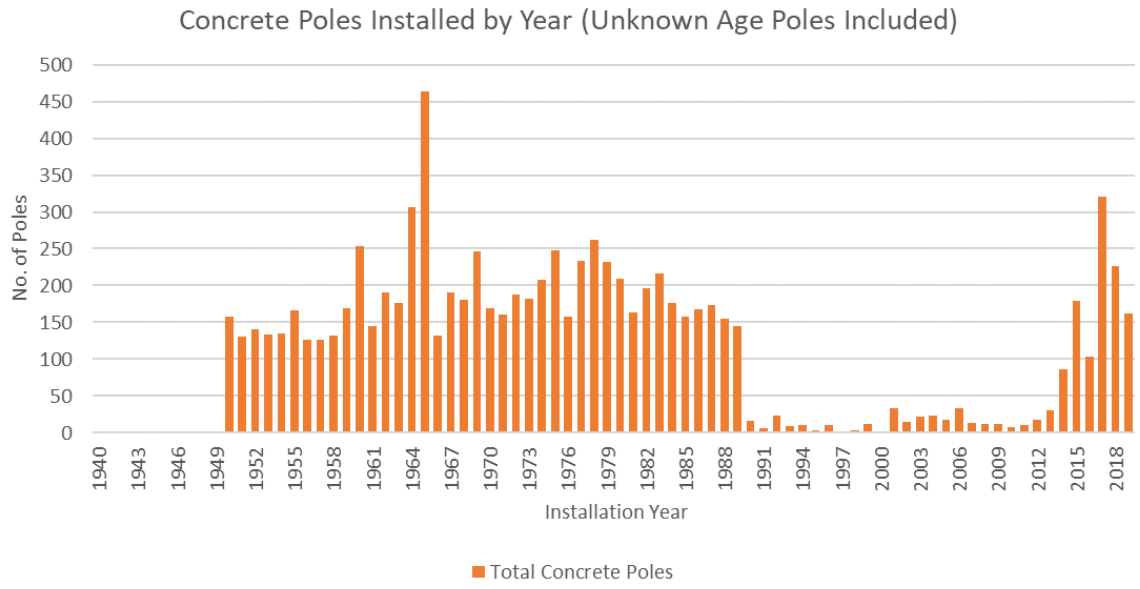


Figure 21 - Age profile of NWL concrete poles

At the start of this planning period we have 1420 poles over 60 years of age (<1959). These will all be inspected in the first three years of the planning period.

5.8.4 Asset risk

Major risks to our poles include:

- vehicle impact – many of our poles are in road reserve
- extreme weather events such as high winds or heavy snow
- external equipment – pivot irrigators moving into, spraying, or being blown into lines
- degradation of structural strength due to age related issues such as rot or rust.

5.8.5 Inspection and maintenance practices

Poles are not replaced based on age, but on assessed condition. Our 33 kV poles are inspected each year and 11 kV poles every five years.

As part of this inspection we test each wooden pole with our acoustic non-destructive tester (Thor hammer) which assesses pole condition above and below ground. Each pole is subject to an initial below ground inspection (excavation) to assess any problems that may need further investigation.

Poles are assessed for remaining life. If remaining life is less than five years, they are scheduled for replacement. If required, inspectors can further assess wooden pole conditions using our Portascan timber density scanner.

Research and development in wooden pole test equipment is very strong at present and in collaboration with other EDBs we actively seeking new and improved methods to test our wooden poles. This has included trialling equipment in our network, as well as visiting other EDBs to review their use of tools and techniques.

When a part of the network is particularly affected by a major event (e.g. a snow storm) we may instigate a special line patrol post event.

NWL has elected to accelerate (double) the rate of our inspections on our distribution and LV poles for the next two years. The early availability of the inspection data coupled with our upgraded asset management systems will put us in a position to make sound decisions regarding our poles.

Results from an initial inspection of 3000 network poles indicate that the number of poles that will need replacing within the first few years of the planning period is in the order of 600 poles per annum. We will continue to analyse the returns from the inspections to generate more accurate forecasts for future pole replacements. Improvements in data capture and analysis will allow the development of better forecast models for the latter end of the planning period.

5.8.6 Renewal programme

Forecast expenditure for the planning period is:

- Pole replacements resulting from accelerated line patrols (Years 1 and 2).
- Continuation of line patrols at normal rate (Year 3 onwards)
- Pole replacements to remove existing defects (Year 1).
- Analysis of removed poles to assess the performance of the inspection program.

5.8.7 Expenditure forecast

Table 17 - Expenditure forecast for our poles

Poles Forecast	2019/20 ($)	2020/21 ($)	2021/22 ($)	2022/23 ($)	2023/24 ($)	2024/25 ($)	2025/26 ($)	2026/27 ($)	2027/28 ($)	2028/29 ($)
Operational Expenditure										
Routine and Corrective	0	0	0	0	0	0	0	0	0	0
Replacement & Renewal	0	0	0	0	0	0	0	0	0	0
Capital Expenditure										
Quality of Supply	0	0	0	0	0	0	0	0	0	0
Legislative and Regulatory	0	0	0	0	0	0	0	0	0	0
Replacement & Renewal	1,700,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000

5.9 Subtransmission network

5.9.1 Quantity and life expectancy of subtransmission lines

Our subtransmission network connects our grid exit points to our zone substations. This system currently operates at 33 kV, with future plans to operate some sections at 66 kV. These supplies are arranged as shown in Figure 22

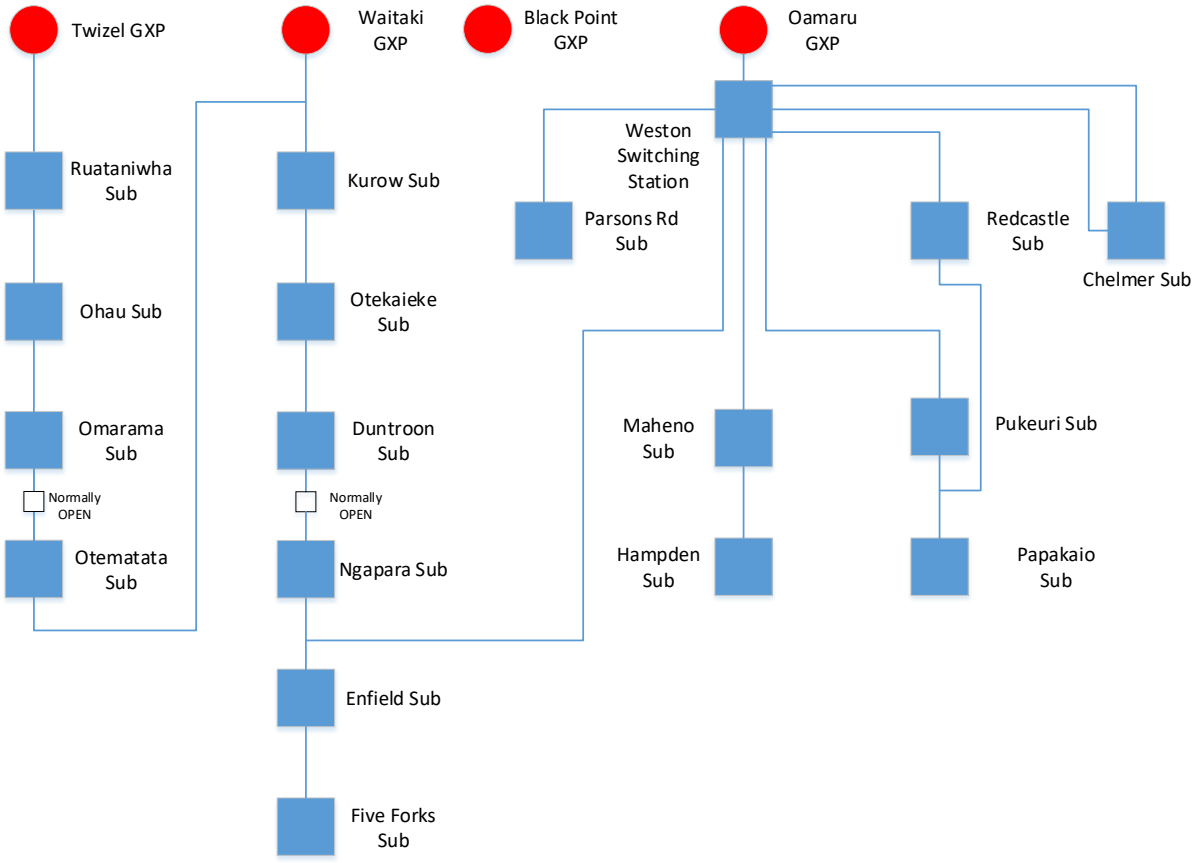


Figure 22- Subtransmission system configuration

There is 222 km of subtransmission network, including 4.1 km of 33 kV cables.

The life expectancy we apply to our subtransmission assets is shown in Table 18 below.

Table 18 - Life expectancy of subtransmission assets

Asset Description	Standard life expectancy (years)
Overhead conductor	55
XLPE cables installed <1985	45
XLPE cables installed >1985	55
PILC cables	70
Air Break Switches	35

5.9.2 Management approach

Our subtransmission assets are critical assets. A component failure at this level can affect many consumers and have a significant impact on system reliability. Hence these assets are subject to annual inspections rather than five-yearly inspections for lower voltage distribution assets.

Climbing inspections are undertaken at three yearly intervals. We have trialled using pole mounted cameras for pole top inspection with some success and are also monitoring the ongoing use of inspection drones in our industry.

5.9.3 Age profiles

33 kV Subtransmission circuits:

The 33 kV sub-transmission network is predominantly overhead construction, apart from some short lengths of cable, generally between the feeder CB's and line terminations, and on the Redcastle to Pukeuri feeder. The age profile of these assets is shown in Figure 23 and Figure 24 below.

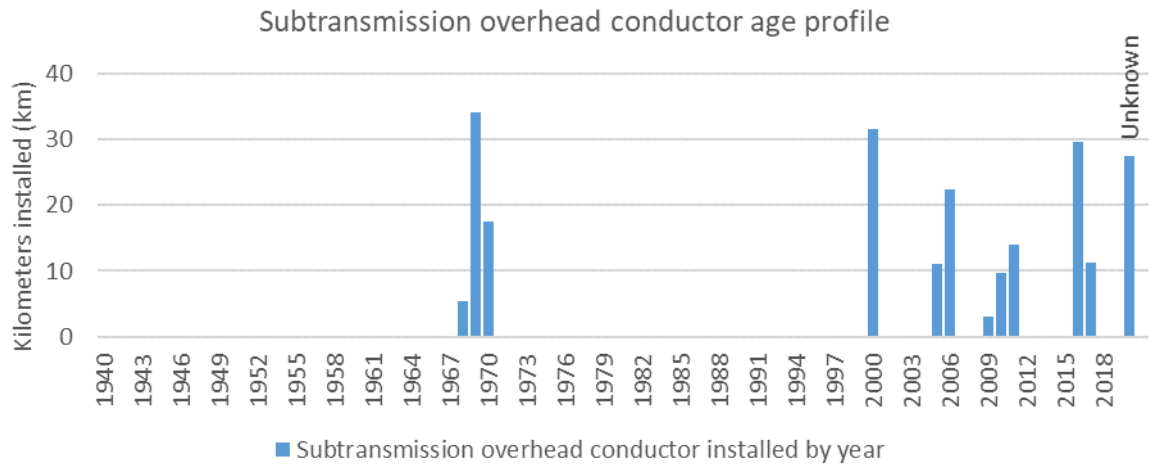


Figure 23 - Age profile of subtransmission overhead conductor

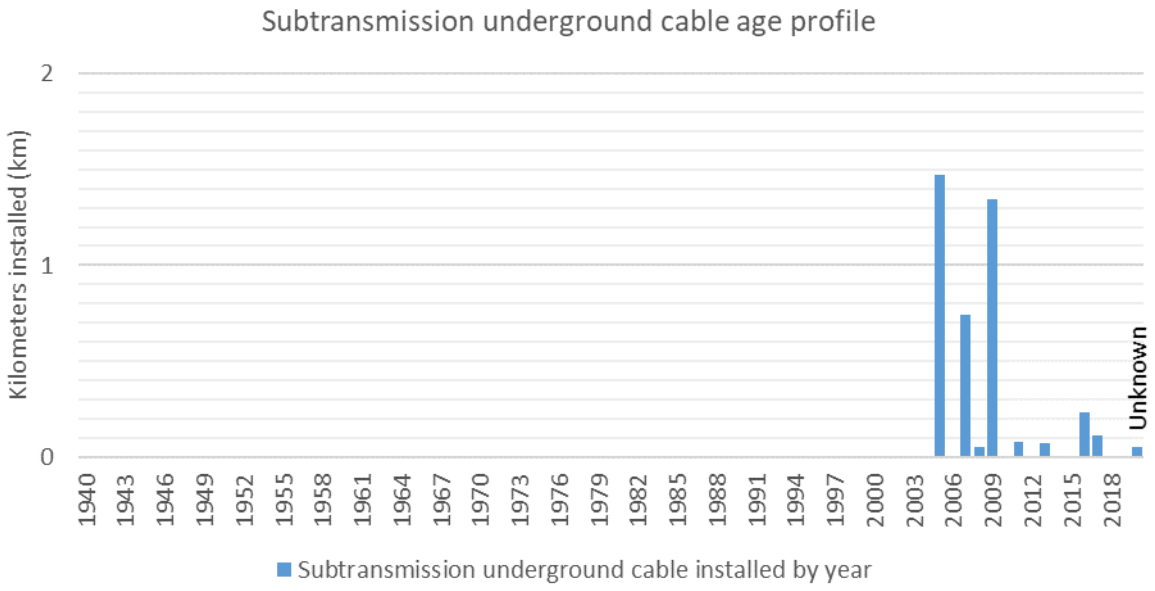


Figure 24 - Age profile of subtransmission underground cables

5.9.4 Asset risk

We prioritise maintenance of our subtransmission and zone substation assets above our other asset categories, as a failure of these assets can result in a major impact on our consumers.

Due to the high frequency of inspections and the high priority of defect correction, the subtransmission population is considered to be at low risk of failure.

Major risks to the subtransmission network include:

- vehicle impact – much of the network is built on road reserve
- extreme weather events such as high winds or heavy snow
- external equipment – pivot irrigators moving into, spraying, or being blown into lines
- degradation of structural strength due to age related issues such as corrosion.

5.9.5 Inspection and maintenance practices

A pole by pole visual inspection from ground level is made of all 33 kV lines each year. Pole top inspections are performed on a three-year cycle. This is either via remote camera (GoPro camera) or by accessing the pole from a ladder or bucket truck and includes an assessment of the pole setting in the ground.

If the cause of a 33 kV line fault is not identified during the fault restoration process, we will patrol the affected line segment as soon as possible after the fault.

Vegetation growth is carefully managed around our subtransmission lines. We attempt to clear corridors of trees during the installation of new lines, but regrowth is common during the lifecycle of the lines. Any vegetation is managed in accordance with the Electricity (Hazards from Trees) Regulations 2003.

5.9.6 Renewal programme

Forecast expenditure for the planning period is:

- Ongoing subtransmission line repairs resulting from line patrols
- Line retightening projects in the year following installation for major projects.
- Testing conductor samples for strength and condition.
- Rebuilds of critical lines built in the 1960's. Timing and scope is dependent on the condition assessment of lines using the updated pole assessment techniques.

5.9.7 Expenditure forecast

Table 19 - Forecast of maintenance and renewal expenditure for subtransmission assets

Subtransmission Forecast	2019/20 ($)	2020/21 ($)	2021/22 ($)	2022/23 ($)	2023/24 ($)	2024/25 ($)	2025/26 ($)	2026/27 ($)	2027/28 ($)	2028/29 ($)
Operational Expenditure										
Routine and Corrective	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Replacement & Renewal	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Capital Expenditure										
Quality of Supply	130,000	40,000	40,000	46,000	50,000	40,000	0	0	0	0
Legislative and Regulatory	0	0	0	0	0	0	0	0	0	0
Replacement & Renewal	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000

5.10 Zone substations

5.10.1 Quantity and life expectancy of zone substations

Our Zone Substations are summarised in the following table.

Table 20 - Summary of NWL zone substations

Zone Substation	GXP Supply	Capacity (MVA)	Security	Date of Construction	Age of Power Transformer	Age of main Switchgear
Ohau	Twizel	3	N	2006	1959	1997
Omarama	Twizel	3	N	1984	1960 & 1963	1985
Ruataniwha	Twizel	2	N	2015	1971	None
Otematata	Waitaki	3	N	1973	1961	2017
Kurow	Waitaki	12.5	N-1	1991	1966 & 1979	2015
Otekaieke	Waitaki	7	N	2018	2005	2018
Duntroon	Waitaki	7	N	2010	2010	1969
Ngapara	Oamaru	7	N	1970	2005	1972
Papakaio	Oamaru	7	N	2006	2012	2006
Enfield	Oamaru	7	N	2006	2005	2006
Five Forks	Oamaru	7	N	2017	2005	2016
Parsons Road	Oamaru	10	N	1970	1966	2018
Pukeuri	Oamaru	12.5	N-1	1971	1966 & 1966	2017
Chelmer Street	Oamaru	28	N-1	1967	2009	2009
Redcastle	Oamaru	15	N-1	1967	2014	2008
Maheno	Oamaru	5	N	1967	1965	1968
Hampden	Oamaru	7	N	2010	2012	1968

The life expectancy we apply to our zone substation assets is shown in Table 21 below:

Table 21 - Life expectancy of zone substation assets

Asset Description	Standard life expectancy (years)
Site Development/buildings	70
Transformers	45
Indoor switchgear	45
Outdoor switchgear	40
Protection relays	40
DC Supplies/Batteries/Inverters	20

5.10.2 Management approach

Our zone substation assets are critical assets as a component failure can have a significant impact on system reliability with a large number of consumers affected. These assets are visually inspected every 3 months.

We carry out annual inspections of substation equipment using partial discharge and thermal assessments.

Where possible We prefer to use vacuum switchgear with air insulated busbars, rather than the lower cost option of Sulphur Hexafluoride (SF_6) gas insulated switchgear. This decision was based on environmental considerations and future maintenance and compliance costs associated with SF_6 gas.

All of our substation equipment is purchased with a focus on providing consistency between sites and maintaining an efficient level of maintenance.

5.10.3 Age profiles

5.10.3.1 110 kV switchgear

We own one 110 kV air break switch and one 110 kV switch bay at the Black Point GXP. This GXP is dedicated to the supply of one consumer, NOIC. This equipment was purchased and installed in 2006.

5.10.3.2 Zone substation transformers

The age profile shown in the following graph is based on the date of manufacture of the transformers.

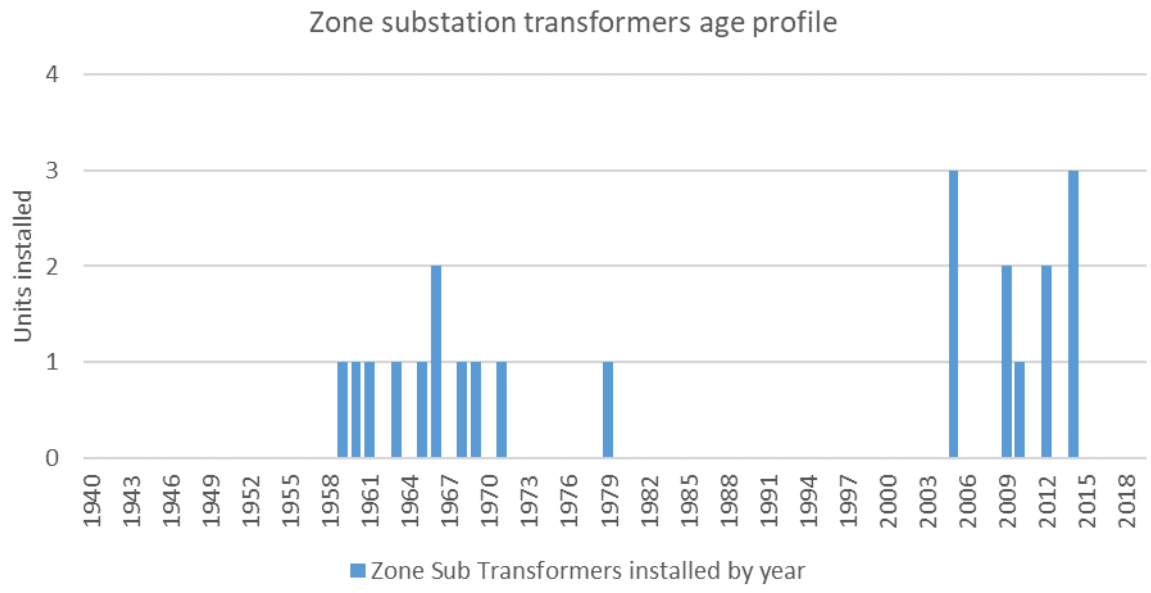


Figure 25 - Zone transformers age profile

5.10.3.3 33 kV and 11 kV switchgear

We own and operate a 33 kV indoor switchboard at the Parsons/Weston zone substation, supplied by Oamaru GXP. This 33 kV board is air insulated with vacuum CBs.

The majority of 11 kV circuit breakers are of the bulk oil type with the oldest listed as being installed in 1968. The newest CB's are those associated with the 11 kV switchboards in the Otematata and Pukeuri substations installed in 2017.

While the average age of the population is 20 years, 37% (23) are over 35 years old and some will reach the end of their 45-year standard life before the end of the planning period covered by this AMP. Regular testing and inspections have shown that this equipment is in good condition and much of it is operating well below rated values for fault levels. We therefore expect that the majority of these CBs will be capable of operating safely and reliably beyond their life expectancy of 45 years.

A program is underway to replace older oil filled switchgear, especially at locations that are subject to higher fault levels. This has seen the Pukeuri switchboard replaced in 2017/18, and in the planning period for this AMP we will replace several oil filled switchboards with modern switchboards with vacuum circuit breakers.

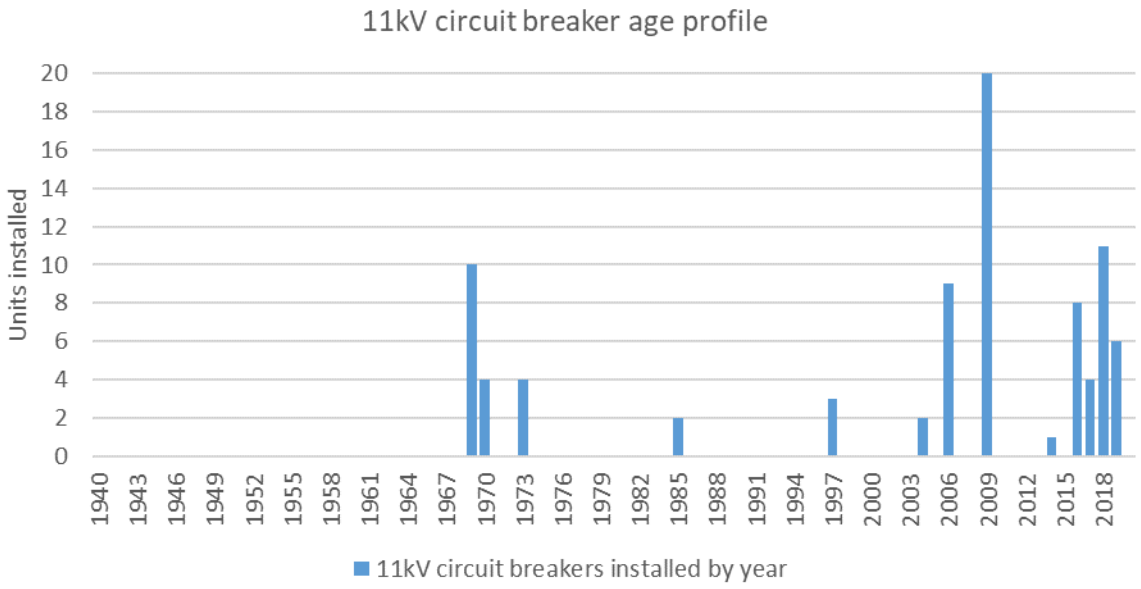


Figure 26 - 11 kV Indoor circuit breaker age profile

The 33 kV CBs at zone substations are a combination of vacuum, vacuum/oil, and oil type units. The majority of these CBs are less than 20 years old and are all working well within their load and fault ratings.

33 kV reclosers and sectionalisers installed in the Waitaki – Twizel 33 kV sub-transmission line at each connected zone substation provide automatic sectionalising of the line in the event of a fault. All 33 kV and 11 kV CBs are connected to the SCADA system and can be switched remotely.

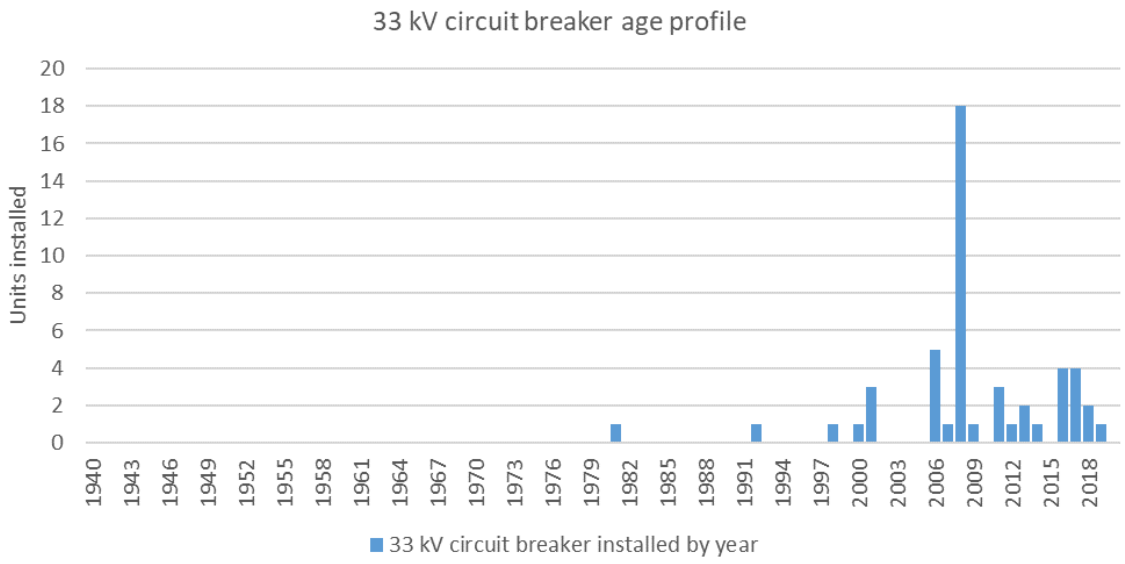


Figure 27 - 33 kV circuit breaker age profile

5.10.4 Asset risk

The criticality of our zone substations is high, so inspections and maintenance on these assets is a high priority and is given equal priority with subtransmission work.

Due to the high frequency of inspections and the high priority of defect correction, the zone substations are considered to be at low risk of failure.

The major risks to our substations include:

- animals
- human intruders – theft or vandalism
- external objects being blown into open air switchyards.

As part of our ongoing substation inspections we review security and signage at these sites to bring them up to current good practice.

In the next two years we will be carrying out detailed inspections of control and power wiring at our zone substations to verify against as built drawings and rectify any deviations.

5.10.5 Inspection and maintenance practices

5.10.5.1 Substation structures and buildings

Substation structures, such as transformer and switchgear foundations and buildings have been subject to a special assessment in the 2018/19 financial year. This assessment is aimed at identifying issues that may threaten the operation of substations and prevent rapid recovery after a major natural disaster. A work plan is being developed to address critical issues over the first two years of the planning period.

5.10.5.2 Zone substation transformers

Inspections on zone substation transformers centre on annual dissolved gas analysis (DGA) sampling. This provides a non-invasive test which is effective at indicating the health of the transformer.

The need for maintenance on zone substation transformers is determined by trend monitoring of DGA results.

On load tap changers (OLTC) on our zone substation transformers are overhauled based on DGA results, service life, or any particular issues found regarding specific models of OLTC. During this work the transformer may also be given an overhaul – the extent of this servicing is decided based on a detailed condition assessment of the transformer in question and an economic analysis of renewal vs. replacement.

In the first three years of the planning period we will be carrying out testing and inspections on all of our power transformers to provide a clear snapshot of condition and remaining life.

5.10.5.3 Indoor substation switchboards

Partial discharge testing is employed on an annual basis to determine the need for CB maintenance. The frequency of testing is increased as deterioration is detected.

Bulk oil CB's also receive an oil change and contact dressing following a number of major fault trips, depending on the levels of the faults. This is unplanned reactive maintenance.

The age and design of some of our switchboards means that assessment of equipment safety and operational parameters. This evaluation for future replacement.

5.10.6 Renewal programme

Forecast expenditure for the planning period is:

- Two power transformer tap changer overhauls per year
- Replacement of 11 kV switchboards at Maheno (year 1)
- Replacement of 11 kV switchboards at Duntroon (year 2, subject to detailed evaluation)
- Replacement of 11 kV switchboards at Omarama (year 3)
- Replacement of 11 kV switchboards at Hampden (year 5, subject to detailed evaluation)
- Replace 110 V Battery Banks & Charger (Year 1)
- Install arc flash protection (5 Substations, Years 1-2,5-7)
- Replacement of obsolete protection relays (Years 1 and 3)
- Replacement of at least two power transformers, dependent on condition assessments and development of the 66kV system – conversion of existing 33 kV substations will release 33 kV transformers which can then replace older units in service.

5.10.7 Expenditure forecast

Table 22 - Zone substation and equipment forecast expenditure

Zone Substations Forecast	2019/20 ($)	2020/21 ($)	2021/22 ($)	2022/23 ($)	2023/24 ($)	2024/25 ($)	2025/26 ($)	2026/27 ($)	2027/28 ($)	2028/29 ($)
Operational Expenditure										
Routine and Corrective	331,000	331,000	331,000	331,000	331,000	331,000	331,000	331,000	331,000	331,000
Replacement & Renewal	85,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000
Capital Expenditure										
Quality of Supply	90,000	0	90,000	60,000	60,000	0	0	0	0	0
Legislative and Regulatory	200,000	200,000	0	0	0	0	0	0	0	0
Replacement & Renewal	530,000	910,000	160,000	10,000	960,000	10,000	10,000	10,000	10,000	10,000

5.11 Distribution network

5.11.1 Quantity and life expectancy of distribution network

There are fifty-seven 11 kV distribution feeder lines emanating from the seventeen 33/11 kV zone substations. As most zone substations are radially connected to their GXP, supply restoration is therefore dependent on 11 kV interconnection between substations. To further assist in quicker supply restoration, we have embarked on a programme of installing automated open points on 11 kV interconnection between substations. The only zone substations that require *N-1* security are Chelmer St, Redcastle and Pukeuri, which supply approximately half of our total consumer base.

Our distribution network operates at 11 kV, and connects zone substations to distribution substations which supply the majority of our consumers at 400/230 V.

There are 1255 km of overhead lines and 72 km of 11 kV cables on our distribution network.

The life expectancy we apply to our distribution assets is shown in Table 23 below:

Table 23 - Life expectancy of distribution assets

Asset description	Standard life expectancy (years)
Overhead conductor	55
XLPE cables installed <1985	45
XLPE cables installed >1985	55
PILC cables	70
Air Break Switches	35

Where 11 kV feeders interconnect, they are normally configured as open points, providing the ability to reconfigure the network to support load in the event of an outage. NWL's loadings are such that security provisions are generally focused on switching to restore supply quickly rather than targeting nil interruptions.

5.11.2 Management approach

We maintain our distribution network with the aim of keeping it safe for the public, and minimising outages. Our approach is predominately driven from defects found during regular inspection cycles, or generated from other work such as consumer connections, or attendance at faults. When a part of the network is particularly affected by a major event (e.g. a snow storm) we will instigate a special line patrol post event.

This approach, backed by a fairly well interconnected distribution network means that outage figures are kept below our targets without over investment on the distribution network.

In addition to regular inspections we monitor any ongoing issues with particular equipment, both in our network and based on the experience of other networks. This information is usually provided via industry alerts from the EEA, or via the NEDERs equipment incident database from the UK, provided in New Zealand by the EEA.

5.11.3 Age profiles

Approximately 25% of the population has survived past 45 years (the wooden pole ODV Standard Life). Maintenance does not appear to significantly extend the life of a line but sustains the line in service until the end of its economic life. The normal driver to upgrade NWL's distribution lines tends to be voltage constraints on conductors due to load growth, which for more critical main line situations tends to happen well before 45 years.

The age profile of these assets is shown in the following two charts:

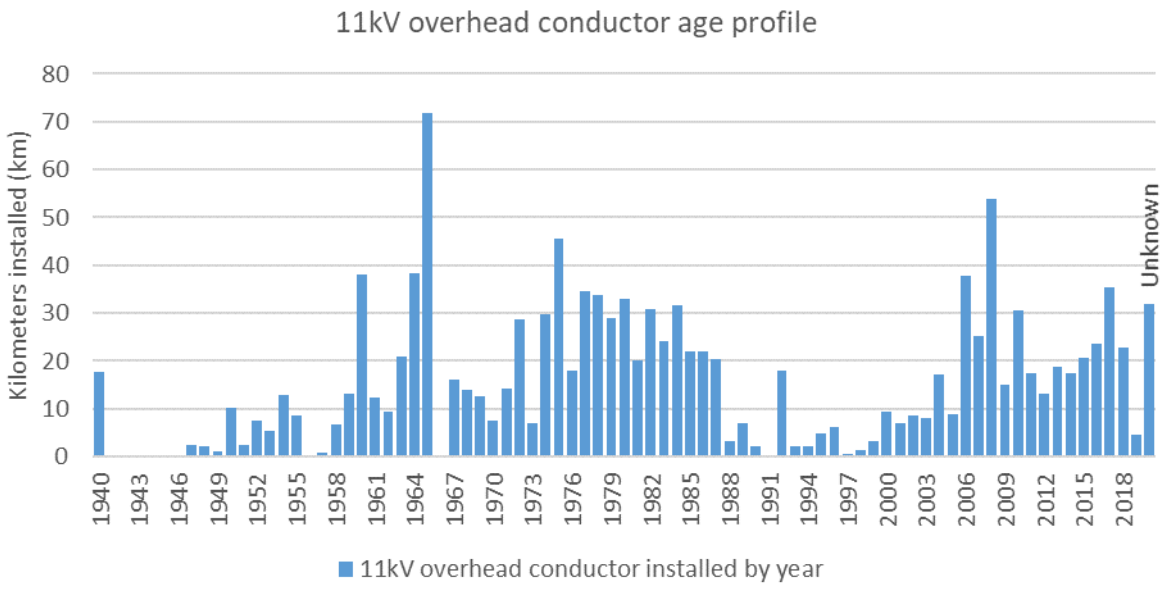


Figure 28 - Age profile of 11 kV overhead lines

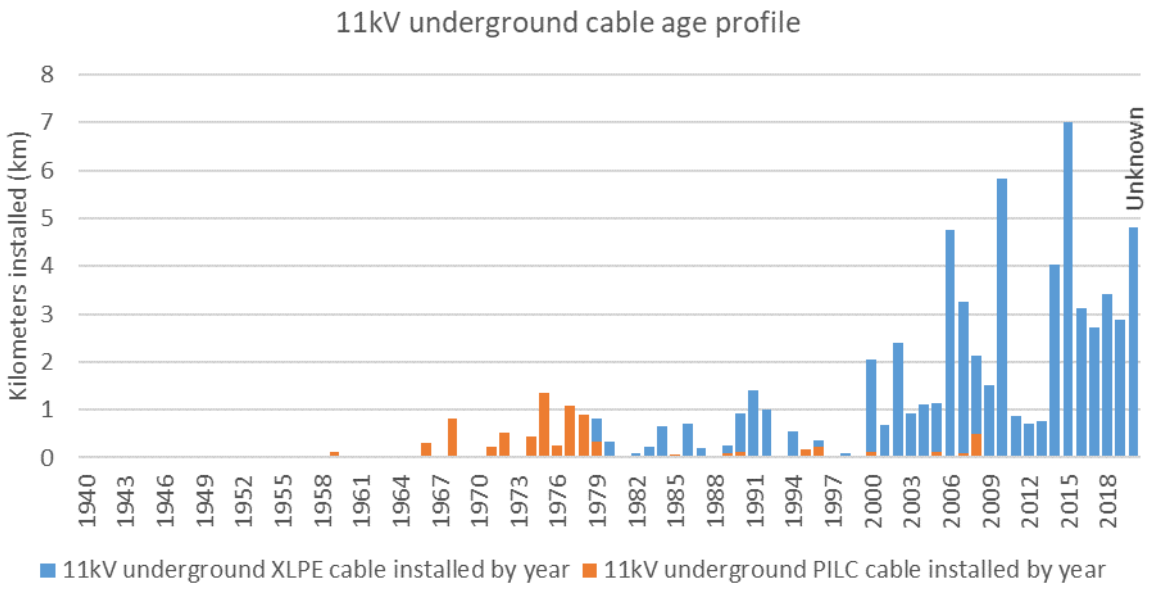


Figure 29 - Age profile of distribution cables

5.11.4 Asset risk

The overhead distribution network is subject to a number of risks, mainly due to the extensive nature of the network. These risks include:

- vehicle impact – much of the network is built in road reserve
- weather events such as high winds or heavy snow
- external equipment – pivot irrigators moving into, spraying, or being blown into lines
- degradation of structural strength due to age related issues such as corrosion.

5.11.5 Inspection and maintenance practices

All of our 11 kV distribution lines are inspected on a 5-yearly cycle. Any poles which are considered to be suspect are either scheduled for replacement or subjected to a more detailed inspection and testing.

The policy of patrolling after faults when no cause has been identified is also applied to 11 kV lines. Climbing patrols are only undertaken for pole top defects identified by ground patrols.

Vegetation management is a significant ongoing part of the maintenance of our distribution lines. We are in the process of implementing field capture of vegetation information direct to our internal systems, which will streamline analysis and processing of this work stream.

5.11.6 Renewal programme

Forecast expenditure for the planning period is:

- General renewals resulting from inspections and defects.

- Replace one rural two-pole structure per year.
- General urban upgrades.
- Condition based renewal of 11 kV fuses and lightning arrestors.
- Line rebuilds due to condition.
- Targeted conductor testing, especially older copper conductor
- Replacement of strategic conductors that are considered unsafe for live line work, such as 7/16” copper.

5.11.7 Expenditure forecast

Table 24 - Expenditure forecast for distribution network

Distribution Network Forecast	2019/20 ($)	2020/21 ($)	2021/22 ($)	2022/23 ($)	2023/24 ($)	2024/25 ($)	2025/26 ($)	2026/27 ($)	2027/28 ($)	2028/29 ($)
Operational Expenditure										
Routine and Corrective	449,000	294,000	294,000	294,000	294,000	274,000	274,000	274,000	274,000	274,000
Replacement & Renewal	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
Capital Expenditure										
Quality of Supply	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Legislative and Regulatory	0	0	0	0	0	0	0	0	0	0
Replacement & Renewal	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000

5.12 Distribution switchgear

5.12.1 Quantity and life expectancy of distribution switchgear

We use 11 kV reclosers and sectionalisers extensively in rural areas to automatically clear transient faults, and to minimise the areas affected by fault outages. Most of these devices are linked to the SCADA system and can be remotely monitored and operated. We have 57 of these units in service.

11 kV oil filled ground mount switchgear (individual fused switches and ring main units) have been installed from 1990, as part of the major urban undergrounding programmes that commenced then, and the more recent network reinforcement programs. There are 38 RMUs or fused switches in service, with most located outside, although a few are inside buildings.

Distribution spur lines and individual 11 kV service lines are often connected to the main feeder via drop out type fuses, or manually operated air break switches. These provide a control point for disconnecting the spur during a fault or planned outage, and the fuses provide a level of discrimination for faults on the fringes of our network. Other such switches are used as manual sectionalising points during fault response or to minimise outages during planned work.

Life expectancy for this class of asset are shown in the table below:

Table 25 - Life expectancy for distribution switchgear

Asset description	Standard life expectancy (years)
Air break switch (ABS)	35
Ring Main Unit (RMU)	40
Fused Oil switch	40
Drop out fuse	35

5.12.2 Management approach

We manage distribution switchgear based on its criticality in the network. A sectionaliser or recloser has a bigger impact on our ability to reduce SAIDI and SAIFI figures than an ABS on a spur line, so work is prioritised based on this.

We will often manage distribution switchgear based on the design or age of the equipment, as common failure points become obvious in a particular design.

5.12.3 Age profiles

The age profiles of 11 kV distribution switchgear are shown in the following figures:

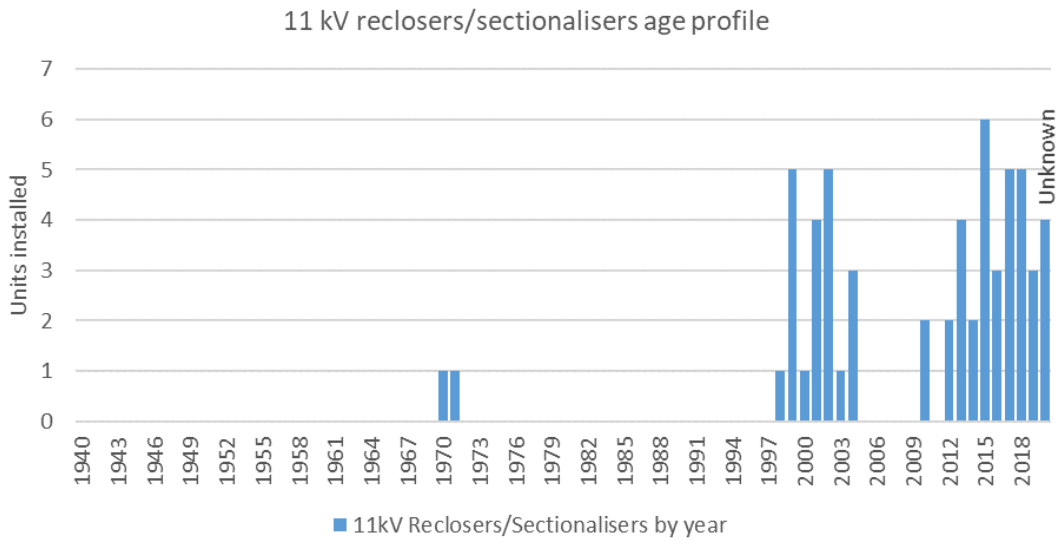


Figure 30 - Age profile of distribution sectionalisers and reclosers

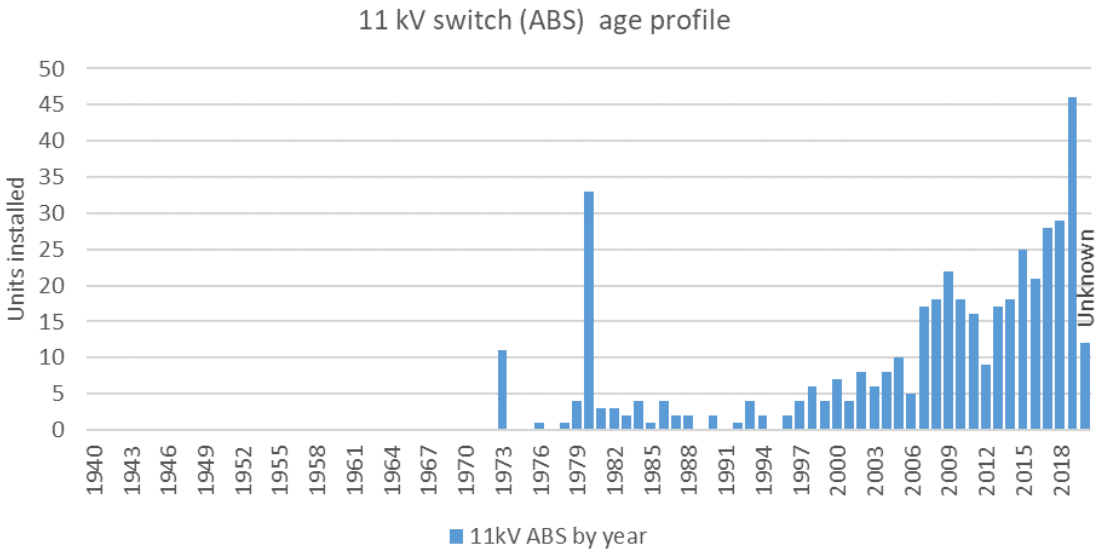


Figure 31 - Age Profile of Pole Mounted ABS

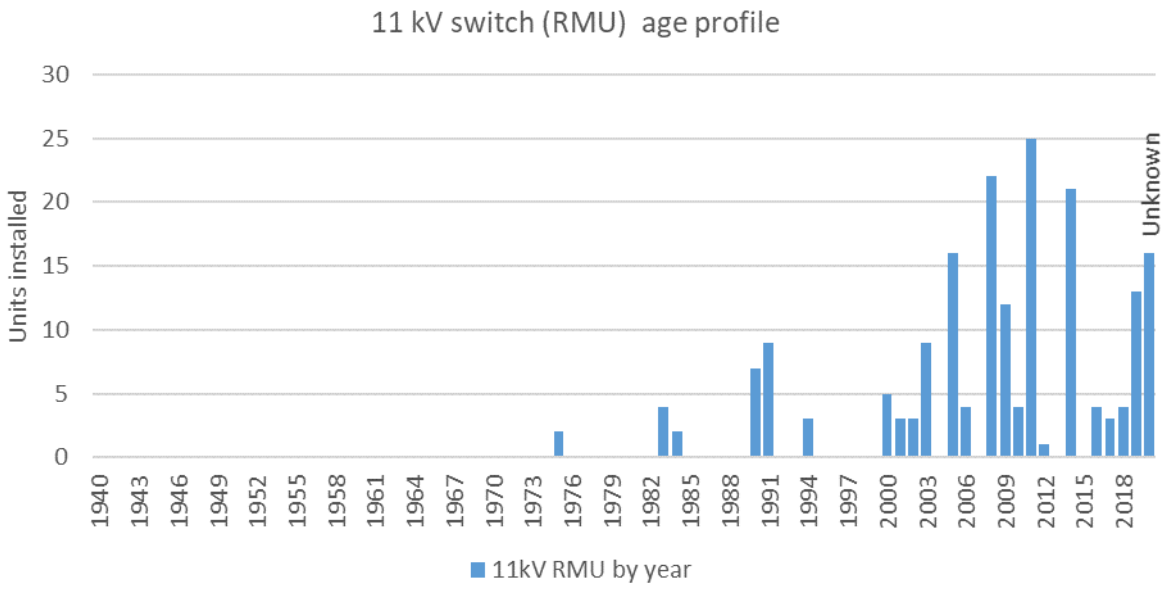


Figure 32 - Age profile of ground mounted distribution switchgear

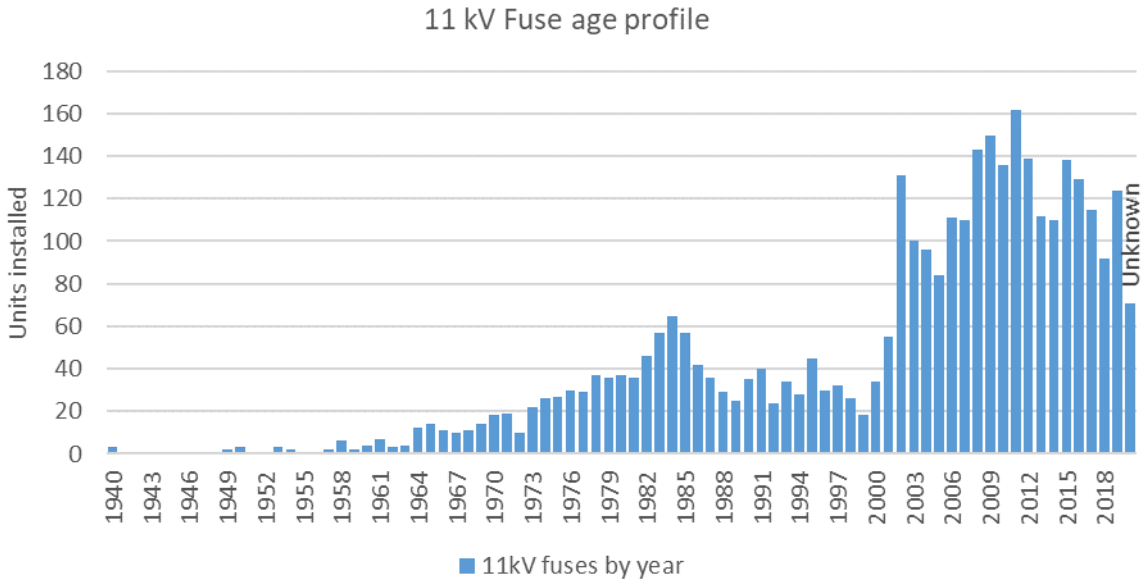


Figure 33 - Age profile of 11 kV fuses

5.12.4 Asset risk

Major risks for the asset class include:

Pole mounted ABSs, reclosers, sectionalisers

- Lightning – although surge arresters are widely used, a direct strike may be destructive
- Animal contacts, such as possums and birds.
- Failure of porcelain insulators during operation

Ground mounted switchgear

- Vehicle incidents, as many are located in the road reserve
- Failure due to dirty insulating oil
- Failure of cable terminations on the unit
- Failure of mechanism during switching

The operational risk associated with the failure of distribution switchgear is dependent on the location and use. In service failure of a sectionaliser or recloser on a major feeder could either lead to the loss of more consumers than necessary during a fault (because upstream protection must clear the fault) or prevent a planned alternate feed being used to restore lost load during an outage. By comparison with this, an ABS or fuse on a spur line has low operational risk.

Safety related risks are generally lower for pole mounted equipment but can be more important for ground mounted equipment, where operators are standing in close proximity during switching.

Recent operational experience in New Zealand and overseas has shown that older oil filled switchgear can fail during operation in a way that is dangerous to the operator. Following this we have stopped manual operation of these units and instead use a remote actuator. In practice, these operational restrictions are increasing switching complexity and outage times on the network.

The majority of the ring main units currently in service on our network are Andelect/ABB SD types. These units are no longer manufactured and in some cases are not supported by the manufacturer. We plan to replace three of these units per year with modern vacuum switch ring main units with remote SCADA operation. These will be installed in locations selected to enhance our resilience to faults. This will support future “smart grid” features, such as ring feeders with automatic fault isolation and detection. Removal of the oil filled switchgear will provide an ongoing stock of spares for the remaining units in service.

5.12.5 Inspection and maintenance practices

Pole mount switchgear is inspected at the same intervals as the distribution lines on a five-year cycle.

In addition to regularly scheduled inspections we will carry out special inspections if necessary. One such inspection regime was triggered in the 2018/19 financial year with a number of insulator failures of a particular type of 11 kV Air Break Switch (ABS). Investigations have shown that several other EDBs have also seen the same failure modes on this equipment in their networks.

We have worked with the manufacturer of the switchgear to identify failure modes and indicators for the particular problem but have not yet been able to isolate the problem to a particular batch of product. At this stage it seems likely that the heightened risk of failure will apply to all of this type of equipment in service, which could be up to 250 switches. We are planning to carry out detailed inspections and replace or repair all of these units in the first three years of the planning period. Switches will be prioritised based on regular conditions checks, operational criticality and public safety risks.

Ground mount distribution switchgear is inspected on a three-year cycle. This includes partial discharge testing for a sample of equipment and visual checks for rust, vandalism, and obvious signs of damage.

Following an incident on another EDB's network in 2012, and subsequent discussions with the manufacturer, we have a programme to test and maintain all of our ground mount oil switchgear every five years, including:

- test and replace the oil
- clean out any contaminants and sludge in the tank
- check the operating mechanism
- test the resistance of the contacts and fuses.

5.12.6 Renewal programme

Forecast expenditure for the planning period is:

- Install 2 sectionalisers in rural feeders to minimise outage areas during faults.
- Ongoing programme to install 4 new ABS's per year in 11 kV feeders to minimise outage areas during planned outages and fault response.
- Replacement of 11 kV ABS's with insulator failures, as found during specific inspections.
- Replace other switchgear based on condition assessment from scheduled inspections.
- Replace three oil filled ring main units per year to improve operational performance of the network.
- Extra switchgear required as a result of network criticality analysis.

5.12.7 Expenditure forecast

Table 26 –Forecast expenditure for distribution switchgear

Distribution Switchgear Forecast	2019/20 ($)	2020/21 ($)	2021/22 ($)	2022/23 ($)	2023/24 ($)	2024/25 ($)	2025/26 ($)	2026/27 ($)	2027/28 ($)	2028/29 ($)
Operational Expenditure										
Routine and Corrective	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000
Replacement & Renewal	0	0	0	0	0	0	0	0	0	0
Capital Expenditure										
Quality of Supply	602,000	597,000	297,000	123,000	89,000	89,000	89,000	89,000	89,000	89,000
Legislative and Regulatory	0	0	0	0	0	0	0	0	0	0
Replacement & Renewal	280,000	280,000	280,000	280,000	180,000	200,000	200,000	200,000	200,000	200,000

5.13 Distribution transformers

5.13.1 Quantity and life expectancy of distribution transformers

The 11 kV distribution network supplies 2,902 distribution transformers, of which approximately 400 have a capacity in excess of 100 kVA. All new transformers, 200 kVA or over, are ground mount “mini-sub” configured, irrespective of whether they are installed in an underground or overhead reticulated area. LV reticulation in urban areas is typically supplied by 200-500 kVA distribution substations which are located to accommodate three to four LV feeders. Transformer capacity is normally based on an average After Diversity Maximum Demand (ADMD) of approximately 5.6 kW for a domestic consumer.

An LV switchboard is normally housed in or near the transformer cabinet with each feeder being independently fused. The LV switchboard is mounted independently of the transformer cabinet and is fitted with an incomer switch to facilitate isolation and removal of the transformer independent of the LV board. In overhead reticulated areas transformers are protected by pole mounted expulsion fuses and in underground reticulated areas with ground mounted fused oil or vacuum switches. In urban areas, the LV system is run in open rings with tie points brought into ground mounted distribution boxes or jumper cuts in the overhead reticulated system. Earths for ground mounted transformers in urban areas incorporate an equipotential earth loop to control step and touch voltages.

Transformers are arranged in a mesh layout such that neighbouring units can support an outage via LV interconnection. Transformers and cables are designed with sufficient spare capacity for this purpose. Maximum Demand Indicators (MDIs) are fitted to determine the need for capacity upgrade and phase balancing. Larger consumer supplies may have dedicated LV cables back to the LV distribution frame and/or a dedicated transformer on their own site. Rural supplies tend to have smaller dedicated transformers which are pole mounted.

Voltage regulators are a special type of transformer installed on the 11 kV distribution network to improve voltage regulation of feeders, especially where there is load growth due to dairy conversions and irrigation. They are often used as an interim measure until the load growth warrants reinforcement of the supply. We have 14 installations of voltage regulators in service.

The life expectancy that we apply to distribution transformers is shown in Table 27.

Table 27 - Life expectancy for distribution transformers and substations

Asset description	Standard life expectancy (years)
Pole mounted transformer	45
Ground mounted transformer	45
Voltage regulators	55

5.13.2 Management approach

Our distribution transformer fleet is generally reliable and robust. We aim to maximise the utilisation of our transformers without overloading them during normal operation, although we will apply a managed approach to short term overloading in the event of a fault.

MDI readings are utilised to monitor the loading on large transformers. We have completed trials of distribution transformer monitoring (DTM) units in some of our larger urban transformers and are beginning a wider rollout of these units. This system provides cloud-based monitoring of transformer loading and voltages (actual and historical). This allows much greater information on how our assets are being utilised and gives visibility of any overloaded transformers, so we can reduce loading before the transformer life is compromised. We will continue to install DTM units through the planning period, initially at a rate of about 10 per annum.

5.13.3 Age profiles

The latest development period is showing a tendency towards larger sized transformers than the earlier period. The age profile of our ground and pole mounted transformers is shown below.

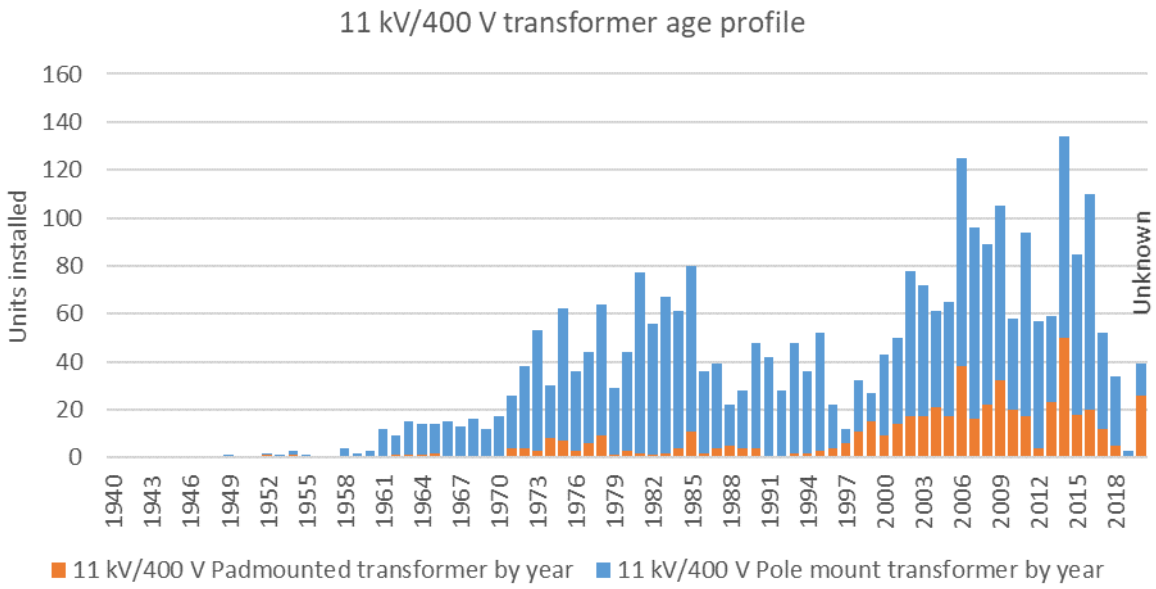


Figure 34 - Age profile of distribution transformers

5.13.4 Asset risk

Both pole and ground mount transformers have proven to be reliable and robust in service, with few equipment failures in general.

The main risks to this equipment class include:

- Lightning – although surge arresters are widely used, a direct strike to a transformer can be destructive.
- For pole mount transformers – Animal contacts, such as possums and rats.
- For ground mount transformers – Vehicle incidents, as many are located in the road reserve.
- Overloading of CBD transformers due to offloading of adjacent transformers during faults or planned outages.

5.13.5 Inspection and maintenance practices

NWL includes management of the other assets associated with distribution substations in our inspection and maintenance cycles.

Pole mount transformers are inspected at the same intervals as the distribution lines on a five-year cycle.

Maintenance actions for ground mount transformers includes:

- Annual MDI reading to estimate transformer loading.
- General maintenance such as fixing leaks, treating rust, addressing vandalism, repainting etc.
- Earth testing on a five-yearly cycle.

5.13.6 Renewal programme

Forecast expenditure for the planning period is:

- General maintenance work
- Condition based replacements
- Replace one ground mount transformer enclosure per year
- Install distribution transformer monitoring at ten sites per year

5.13.7 Expenditure forecast

Table 28 - Forecast expenditure for distribution transformers

Distribution Transformers	2019/20 ($)	2020/21 ($)	2021/22 ($)	2022/23 ($)	2023/24 ($)	2024/25 ($)	2025/26 ($)	2026/27 ($)	2027/28 ($)	2028/29 ($)
Operational Expenditure										
Routine and Corrective	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Replacement & Renewal	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Capital Expenditure										
Quality of Supply	20,000	20,000	20,000	30,000	20,000	20,000	20,000	20,000	20,000	20,000
Legislative and Regulatory	0	0	0	0	0	0	0	0	0	0
Replacement & Renewal	210,000	50,000	220,000	220,000	210,000	210,000	210,000	210,000	210,000	210,000

5.14 Low voltage network

5.14.1 Quantity and life expectancy of distribution and LV cables

LV overhead lines amount to 231 km of our network, with LV reticulation being largely restricted to Oamaru and rural townships. Rural network design does not allow for LV interconnection between distribution transformers due to distance limitations on LV capacity.

Overhead reticulation within residential areas is no longer permitted under the Waitaki District Council District Plan. Therefore, any extension or upgrade work tends to result in conversion to underground for any new subdivisions. We have 112 km of LV cable network. There are no further undergrounding programmes in progress as the community has not expressed a desire for this in community planning processes (Long Term Council Community Plan and District Plan). Asset management drivers, including cost and outage minimisation, favour the retention of overhead assets.

Table 29 - Life expectancy of distribution assets

Asset Description	Standard life expectancy (years)
Overhead conductor	55
XLPE cables installed <1985	45
XLPE cables installed >1985	55
PILC cables	70

5.14.2 Management approach

LV faults generally affect less consumers than faults at the higher voltage levels and therefore do not impact overall performance so heavily.

Voltage complaints at LV level are not trending upwards. Most voltage complaints tend to be related to HV capacity on heavily loaded irrigation feeders rather than being an LV issue. Capacity is primarily addressed by transformer upgrades or installing intermediary transformers.

Our management approach to the LV network is to focus preventative maintenance on safety issues.

5.14.3 Age profiles

Our LV overhead lines show a similar age profile to the HV overhead lines and are predominantly located in urban residential areas. Their age reflects the urban development cycles

Pole management is incorporated into HV pole inspection programmes.

The age profile of the LV lines is shown in the following charts.

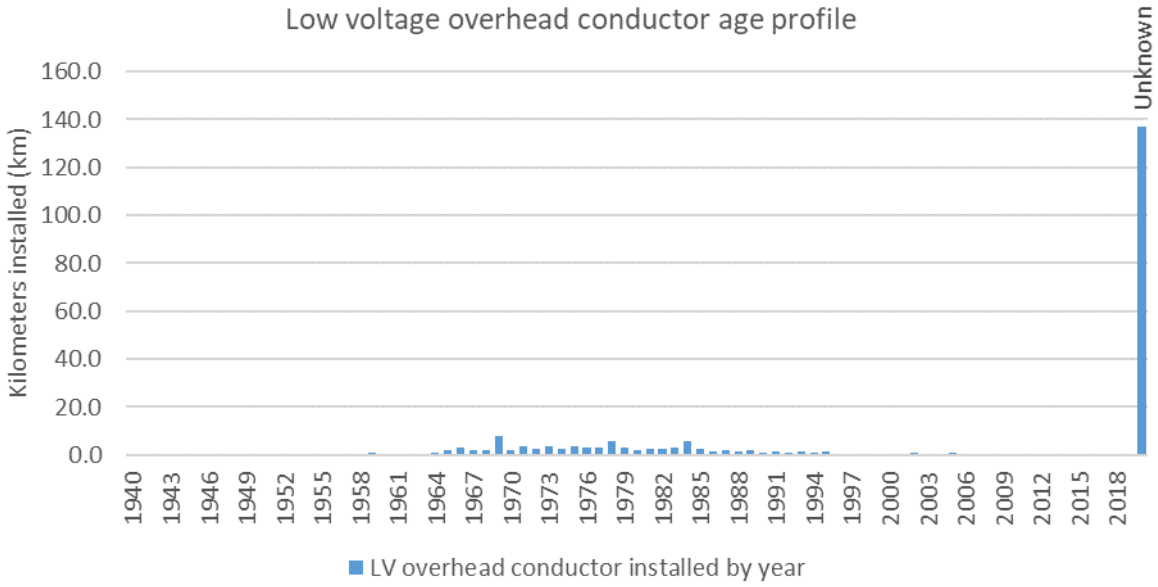


Figure 35 - Age profile of LV overhead network

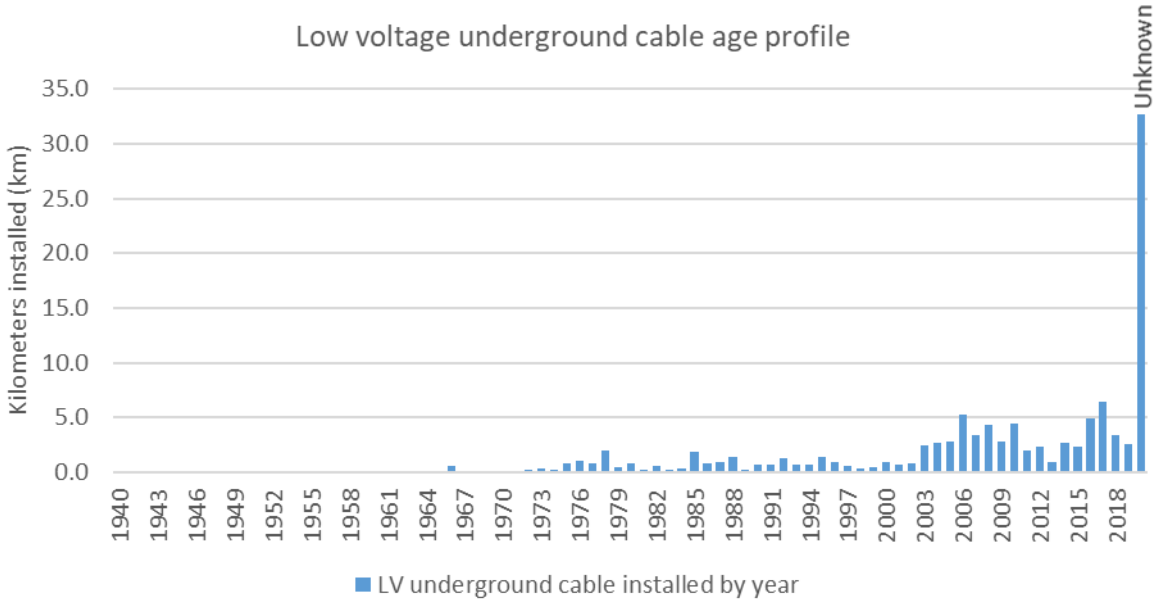


Figure 36 - Age profile of LV cables

5.14.4 Asset risk

The LV network is subject to a number of risks, especially because it is predominantly located within urban areas. These risks include:

- Vehicle impact – much of the network is built in road reserve, near driveways etc.
- External equipment – foreign objects being blown into lines.
- Human interaction – vandalism, contact with wires while painting house.
- Damage to cables from excavation.

The focus of risk management on the LV network is public safety.

5.14.5 Inspection and maintenance practices

NWL owned LV distribution poles are inspected on the same 5-year cycle as for 11 kV distribution poles with the same process being applied to poles that are deemed to be suspect. Associated equipment such as LV cables, service fuse boxes and distribution boxes are visually inspected at the same time, with more rigorous inspections every 10 years.

Cable termination maintenance is identified from cyclic visual inspection.

As can be seen from Figure 35 and Figure 36 above, there are a large number of LV circuits with unknown ages. The condition and remaining life of this equipment is assessed during our 5 yearly line patrols, which largely mitigates the risk of an unknown age profile. We will be using field sampling and referring to older paper based records in the next few years to update these records.

5.14.6 Renewal programme

Forecast expenditure for the planning period is:

- Condition based renewal of low voltage assets.
- Reinforcement of LV network
- Removing low voltage road crossings on several high use road corridors to provide road clearances that are higher than legislation requires – this will make it simpler to transport over height loads through the North Otago region.
- Undergrounding of LV services where subtransmission development dictates

5.14.7 Expenditure forecast

Table 30 - Forecast expenditure for low voltage network

Low Voltage Network Forecast	2019/20 ($)	2020/21 ($)	2021/22 ($)	2022/23 ($)	2023/24 ($)	2024/25 ($)	2025/26 ($)	2026/27 ($)	2027/28 ($)	2028/29 ($)
Operational Expenditure										
Routine and Corrective	10,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Replacement & Renewal	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Capital Expenditure										
Quality of Supply	10,000	0	0	0	0	0	0	0	0	0
Legislative and Regulatory	50,000	50,000	50,000	50,000	0	0	0	0	0	0
Replacement & Renewal	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000

5.15 Low voltage switchgear

5.15.1 Quantity and life expectancy of LV switchgear

We have various types of LV switchgear on our network which may be located in transformer cubicles, stand-alone distribution boxes (DB's), or inside DB's fixed to buildings.

We classify our LV switchgear into two groups:

Enclosed switchgear includes vertical, fully shrouded switchgear, such as the Weber Verti-group unit. These have been installed from the early 1990's until present. We have 160 of these on our network.

J-Type switchgear has a variety of types. These were installed on our network between 1964 and 1997. We have 100 of these on our network.

Life expectancy based on ODV values for this class of asset are shown in the table below:

Table 31 - Life expectancy for distribution switchgear

Asset description	Standard life expectancy (years)
LV Switchgear	45
Service Fuse Box (SFB)	45

5.15.2 Management approach

Low voltage switchgear is inspected every 5 years.

Reactive maintenance may be carried out as a result of inspections.

5.15.3 Age profiles

The age profiles of our LV distribution switchgear are shown in the following figure. It can be seen that the vast majority of the J-Type switchgear has exceeded its standard life.

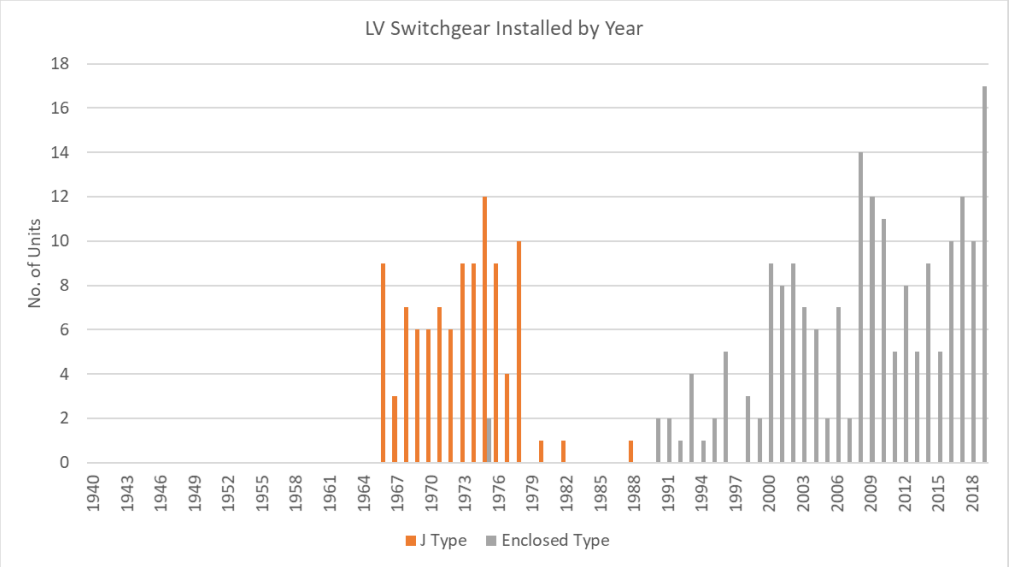


Figure 37 - Age profile of LV switchgear

5.15.4 Asset risk

The operational risk associated with the failure of LV switchgear is dependent on the location and use. Failure of switchgear supplying a large number of consumers can result in large disruption if there is no backup available from another feeder.

Based on experience and incident reports from the industry we have decided that J-Type fuses shall not be operated live on our network unless a risk assessment indicates that it is safe to do so.

There are a number of J-Type fuse boxes mounted above verandas along Oamaru's main street. We no longer allow ladder access to these and consequently any operation requires significant time and effort with a flow on effect on our network reliability.

We plan to replace all J-Type fuses, including over veranda types, over a five-year period for reasons of safe operational flexibility and reliability rather than condition.

5.15.5 Inspection and maintenance practices

LV switchgear is inspected every five years and any resultant reactive maintenance scheduled.

In 2017/18 NWL commenced a five-yearly service fuse box (SFB) inspection program. This involves checking for defects, recording asset condition and labelling assets.

5.15.6 Renewal programme

Forecast expenditure for the planning period is:

- Condition based replacements of service fuses.
- Replace 24 J-Type switchgear distribution boxes per year until all high risk units are removed.
- Condition based replacement of other distribution boxes.

5.15.7 Expenditure forecast

Table 32 - Forecast expenditure for low voltage switchgear

Low Voltage Switchgear Forecast	2019/20 ($)	2020/21 ($)	2021/22 ($)	2022/23 ($)	2023/24 ($)	2024/25 ($)	2025/26 ($)	2026/27 ($)	2027/28 ($)	2028/29 ($)
Operational Expenditure										
Routine and Corrective	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Replacement & Renewal	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Capital Expenditure										
Quality of Supply	0	0	0	0	0	0	0	0	0	0
Legislative and Regulatory	230,000	230,000	240,000	240,000	10,000	10,000	10,000	10,000	10,000	10,000
Replacement & Renewal	0	0	0	0	0	0	0	0	0	0

5.16 Other system fixed assets

5.16.1 Quantity and life expectancy of other system fixed assets

NWL owns and operates Enermet solid state 33 kV Ripple Injection Plants at both the Oamaru and Twizel GXP's. An indoor Enermet solid state 11 kV injection unit is installed at the Kurow Zone Substation and services the load connected to the Waitaki GXP. We own the ripple control relays installed at consumer's premises.

We operate an Abbey Systems Powerlink SCADA system. The SCADA system is connected to all of our zone substations via Abbey Systems RTUs and provides remote control, indication, logging, and alarm status information for key operating assets. In addition, the majority of reclosers and sectionalisers are also connected to the SCADA system and can be remotely controlled.

The SCADA system uses UHF radio data communications provided by our licensed radio network. Radio repeaters are sited at Cape Wanbrow, Station Peak and Cloud Hill. They are shared by the VHF radio telephone system NWL uses for operational voice communications between the control room and field operators.

The life expectancy of this equipment is shown in the Table 33 below:

Table 33 - Life expectancy of other fixed network assets

Asset Description	Standard life expectancy (years)
Ripple Control Transmitter	20
SCADA System	15
Radios	15

5.16.2 Management approach

These systems are managed with the active assistance of manufacturers and suppliers, as we do not have the expertise in house to carry out the higher-level maintenance functions for this equipment.

5.16.3 Age profiles

The age profile in this category is shown in Figure 38

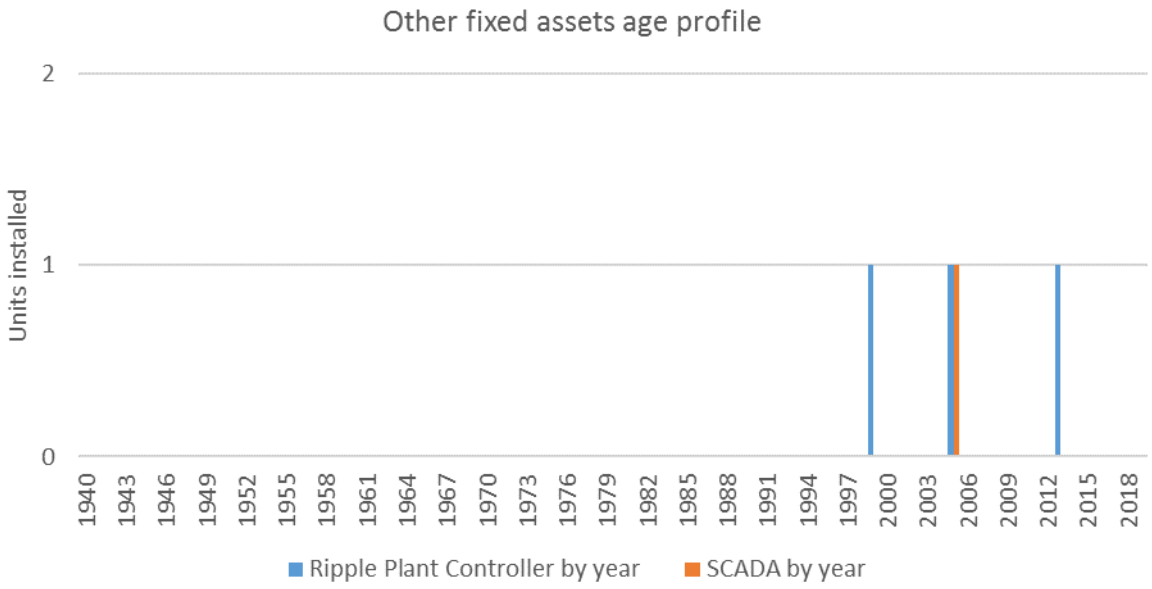


Figure 38 - Age profile of other fixed network assets

5.16.4 Asset risk

Failure of our ripple control plants would have a fairly large impact on our network, as we would lose the ability to reduce load in a non-invasive manner during a constraint and could be left unable to switch hot water systems on or off (depending on the state at the time of failure). If this occurred during constraints on the transmission network, it would lead to rolling blackouts as we disconnected feeders to manage our load levels down.

Failure of the SCADA and/or radio communications system would render the control room inoperative, although a reduced level of network operation could continue in the field using other means of communication, and direct operation at substations and field devices.

The major risks to the Ripple control plants are component failure or that an animal accesses the coupling cells and causes damage.

The major risks to the radio network are the remote locations of our repeater sites – during extended outages due to snow they have failed in the past.

The major risk to our SCADA system is hardware failure, as they operate on specialised PC's. This is to some extent mitigated by having a master and a backup computer. In addition, we are developing an offsite backup site.

5.16.5 Inspection and maintenance practices

Maintenance of the SCADA and Communications Systems involves an annual radio equipment site check and a support contract with the SCADA system provider.

Maintenance of the load control plant involves a two-yearly site check by the New Zealand agent for the ripple plant.

5.16.6 Renewal programme

Forecast expenditure for the planning period is:

- SCADA radio link upgrade (Years 2 and 4).
- Replace old cascade streetlight control system with ripple control as necessary.

5.16.7 Expenditure forecast

Table 34 - Forecast expenditure for other fixed network assets

Other Assets Forecast	2019/20 ($)	2020/21 ($)	2021/22 ($)	2022/23 ($)	2023/24 ($)	2024/25 ($)	2025/26 ($)	2026/27 ($)	2027/28 ($)	2028/29 ($)
Operational Expenditure										
Routine and Corrective	91,000	41,000	41,000	41,000	41,000	41,000	41,000	41,000	41,000	41,000
Replacement & Renewal	0	0	0	0	0	0	0	0	0	0
Capital Expenditure										
Quality of Supply	255,000	53,000	187,000	55,000	85,000	55,000	55,000	25,000	25,000	25,000
Legislative and Regulatory	0	0	0	0	0	0	0	0	0	0
Replacement & Renewal	20,000	20,000	20,000	0	0	0	0	0	0	0

5.17 Other assets

We own three 635 kVA diesel generator sets, one of which is connected onto the 11 kV bus at Otematata Substation to provide support generation in the event of an outage. A second generator is now permanently deployed to the Waitaki District Council's main water reservoir for Oamaru to ensure continuity of water supply during a large-scale power outage. A third unit is mounted onto a trailer with a step-up transformer and 11 kV vacuum switch which can be quickly deployed onto our network in the event of a fault or a large planned outage.

These units are maintained by outside service providers according to the manufacturer's instructions.

The controllers on all three generators have been recently upgraded to allow us to operate our generators in parallel with rental sets, providing greater flexibility of use.

5.18 Renewals and maintenance expenditure summary

Forecast expenditure for renewals and maintenance are summarised by asset category in the figure below:

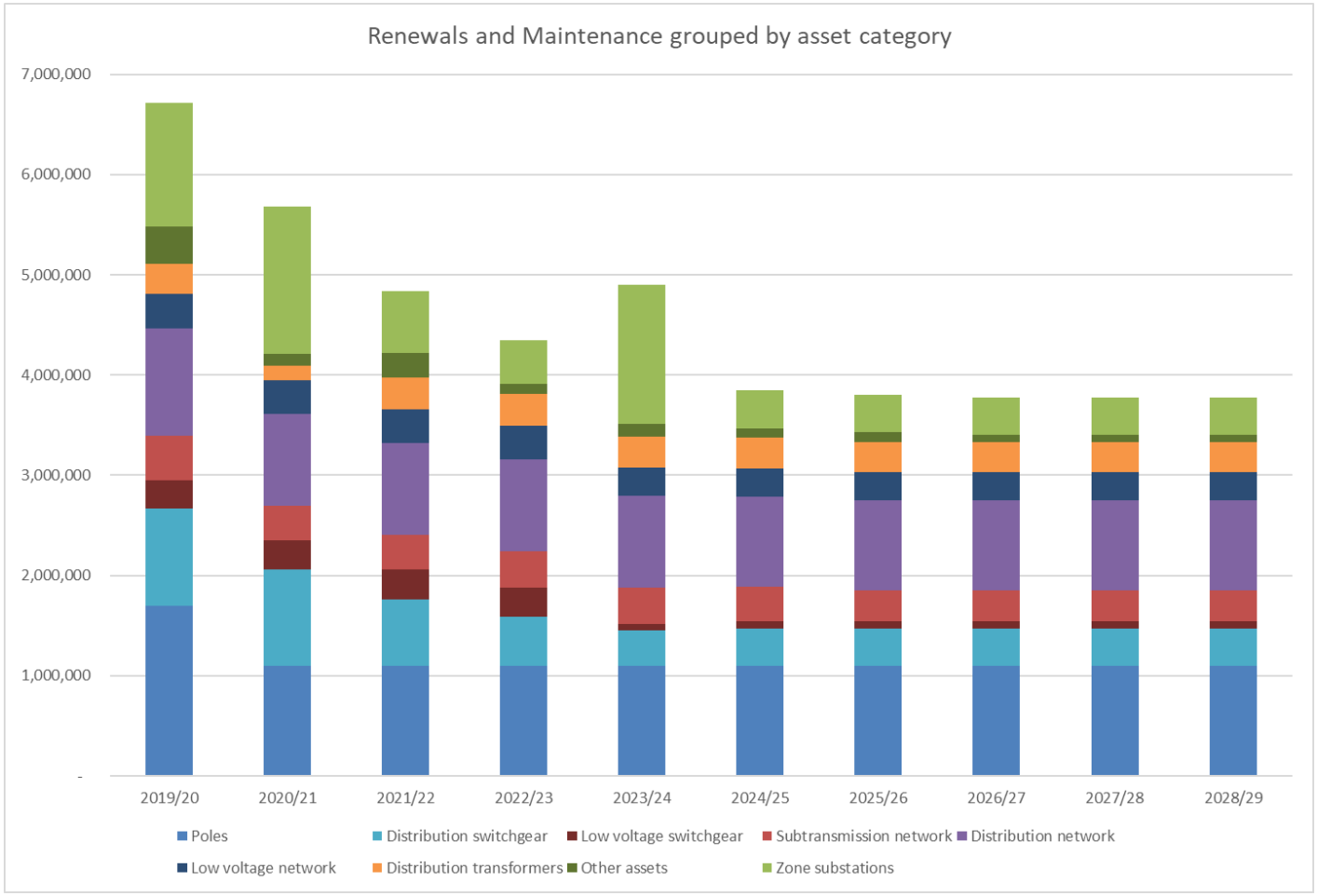


Figure 39 – Renewals and maintenance expenditure forecast by asset category

06. Network Development Plan

This section describes our approach to network development and sets out our Network Development Plan (NDP) for the planning period.This section covers:

Planning approach: explains our focus, development drivers, and the process we use to plan the development of our network.

Planning criteria: explains the security, quality, reliability, and regulatory criteria that we measure against to determine the present and future state of our network.

Demand and constraint forecast: presents, and explains the assumptions behind, our demand and constraint projections for the planning period.

Proposed development programme: a summary of the proposed NDP projects.

6. Network Development Plan (NDP)

6.1 Planning approach

6.1.1 Our mission

Network Waitaki's mission is to be a locally owned and operated electricity distribution company that provides the benefits of local consumer trust ownership by:

- owning and operating a **safe**, **reliable** and **efficient** distribution system that meets the **evolving needs** of its consumers in accordance with the Asset Management Plan.
- supporting the economic growth and wellbeing of the community it serves.

6.1.2 NDP focus

Our NDP treats safety as paramount and focuses on:

- setting and maintaining appropriate security and reliability levels
- forecasting future demand and constraints on our network
- analysing and selecting solutions to deal with future constraints.

6.1.3 Planning process

Figure 40 - Planning process stages

6.1.4 Development drivers

There are six main drivers for network development projects:

- Load growth
- Regulatory compliance
- Security of supply
- System reliability
- Quality of supply
- Readiness for the future

For load growth projects, we will only commit to developing the network once a consumer has made a commitment for the capacity on our network. We endeavour to have capacity available to meet consumers' project timeframes, but this is ultimately dependent on the lead-time given to us by our consumers. For large scale projects we strongly encourage our consumers to contact us at the early stages of their project.

6.2 Planning criteria

6.2.1 Safety criteria

Safety is considered at all stages of the planning and design processes in accordance with our Safety by Design Policy.

6.2.2 Environmental and sustainability criteria

Minimising our impact on the environment is very important to us. When we analyse options for a solution environmental impact and sustainability are factors we consider, as detailed in our environmental policy. The Resource Management Act 1991 and relevant environmental standards are complied with as appropriate.

6.2.3 Climate change

For new assets we consider potential effects from climate change, such as sea level rise when we are selecting the location and construction style of the asset.

We are monitoring industry guidelines as to any changes to design wind speeds and temperatures in regard to overhead line design and equipment rating.

6.2.4 Regulatory criteria

6.2.4.1 Voltage

The Electricity Safety Regulations 2010 require that we maintain the voltage at the point of supply at 230 V +/- 6% (except for momentary fluctuations). This figure influences the design voltage drop that we allow on our network overhead lines and cables. As our rural network loads are generally spread out along long rural feeders, voltage performance is often a common driver for network upgrade projects.

6.2.4.2 Distributed generation

We welcome the connection of Distributed Generation (DG) on our network and if the DG has an approved inverter and is in an uncongested area we will approve the connection within two working days.

We publish a list of areas that are subject to export congestion or are expected to become congested in the next 12 months on our website. www.networkwaitaki.co.nz. Any congested areas identified will be analysed to determine whether they trigger a development driver.

We have no areas subject to congestion as at 1 April 2019 and do not forecast any areas to become congested in the following 12 months.

6.2.4.3 Conductor heights

NZECP34:2001 defines the minimum clearances for conductors from the ground or waterways. As the temperature of an overhead conductor increases, it will increase in length and sag closer to the ground. This code of practice informs our design standards and line ratings.

6.2.5 Security of supply criteria

Security of supply refers to the ability of the network to meet consumer demand for energy delivery without interruption. Our deterministic security criteria are detailed on the following page.

Where deterministic criteria are triggered, and where appropriate, we will conduct probabilistic analysis to allow us to analyse the probability of an outage occurring, the time to repair, and to quantify the risk in dollars.

Security of Supply notes

- Repair time is defined as the time taken to sufficiently repair faulted assets to where they can be livened and will support the required load. It includes the response time taken to locate and isolate the fault and allows for prioritisation of supply restoration. In a large outage we place priority on restoring supply to the maximum number of consumers, ahead of individual security issues.
- Network assets dedicated to a special industrial load may have a security level determined by consumer requirements.
- This security criteria assumes we can interrupt irrigation load for up to 48 hours.

Target repair times

- Overhead lines 4 hours
- Underground cables 6 hours
- Distribution equipment 8 hours
- Sub-transmission equipment 12 hours

6.2.5.1 NWL Security of supply standard - deterministic approach

Table 35- Security of supply - deterministic criteria

Class	Description	Load Size (MVA)	First Outage	Second Outage	Bus Fault or Switchgear Failure
Grid Exit Points (GXPs)					
A1	Urban GXPs	Any	No interruption	Restore 50% in switching time and restore rest in repair time	No interruption for 50% and restore rest in 2hrs
A2	Rural GXPs	>15	Restore 75% in switching time and restore 90% in 8 hrs	Restore 100% in repair time	Restore 100% in repair time
A3	Rural GXPs	<15	Restore 50% in switching time and restore 90% in 12 hrs	Restore 100% in repair time	Restore 100% in repair time
Zone substations and subtransmission feeders					
B1	CBD zone substation	Any	No interruption	Restore 100% in repair time	No interruption for 50% and restore rest in 2hrs
B2	Urban zone substation	Any	No interruption	Restore 100% in repair time	Restore 100% in repair time
B3	Rural zone substation	>12	No interruption for 50% and restore rest in switching time	Restore 100% in repair time	No interruption for 50% and restore rest in switching time
B4	Rural zone substation	2-12	Restore 100% in switching time	Restore 100% in repair time	Restore 100% in repair time
B5	Rural zone substation	<2	Restore 50% in switching time, restore rest in repair time	Restore 100% in repair time	Restore 100% in repair time
B6	Subtransmission feeder	>15	No interruption	Restore 100% in repair time	Restore 100% in repair time
B7	Subtransmission feeder	<15	Restore 100% in repair time	Restore 100% in repair time	Restore 100% in repair time
Distribution feeders and substations					
C1	Urban 11 kV feeders & CBD LV reticulation	1-4	Restore 100% in switching time	Restore 100% in repair time	Restore 100% in repair time
C2	Urban 11 kV spurs & LV reticulation	<1.5	Restore 50% in switching time and restore rest in repair time	Restore 100% in repair time	Restore 100% in repair time
C3	Rural 11 kV feeders	1-4	Restore 50% in switching time and restore rest in repair time	Restore 100% in repair time	Restore 100% in repair time
C4	Rural 11 kV spurs & LV reticulation	<1.5	Restore 100% in repair time	Restore 100% in repair time	Restore 100% in repair time

6.2.5.2 NWL Security of supply standard - Probabilistic approach

A probabilistic assessment of the proposed security of supply is based on the quantification of risk via the following formula:

Risk ($) = probability of outage x cost of unserved energy

Probability of outage = period at risk x risk of an outage occurring

Cost of unserved energy = time to repair outage x value of lost load

This allows cost benefit analysis of any proposed change to network security using a net present value (NPV) calculation. For high impact risks a strict NPV approach is tempered with an assessment against the overall business risk.

The probability of failure for particular classes of equipment is usually taken from generic electrical industry figures[6]. Where we have sufficient data to generate our own failure information these figures are used instead.

The cost of unserved energy is calculated for a particular scenario based on the following values of lost load (VoLL), which were developed based on industry guides[6] and good practice:

- Standard domestic supply — $10/kWh but also test at $20/kWh
- Agricultural/irrigation supply — $40/kWh but also test at $60/kWh
- Light industrial/commercial supply — $40/kWh but also test at $60/kWh
- Large consumers — Develop a value with the consumer

The use of two values of VoLL allow us to perform a sensitivity analysis which will illustrate when a project is near the approval threshold.

6.2.6 Reliability criteria

These criteria are presented in more detail in Section 3 Service Level: Reliability.

6.2.6.1 Consumer surveys

Consumer surveys are conducted every two years with the next survey scheduled for April 2019.

The 2017 surveys indicated that residential survey respondents were very satisfied with the reliability of their power supply, with a mean rating of 9.3 and commercial respondents were satisfied, with a mean rating of 8.5 out of 10.

This informs our view that existing reliability levels should be maintained.

[6] EEA Guide for Security of Supply August 2013

6.2.6.2 SAIDI and SAIFI

These are lagging indicators of our overall reliability in a year. Our SAIDI results were lower than our target for the 2017/18 year. This supports our view that existing reliability levels are suitable.

6.2.6.3 Reduction in live line work

The reduction in the amount of live line work performed on our network has had an impact on our reliability levels. We have not performed a consumer survey since this change so are yet to quantify the effects on perceived reliability.

Historically, much of our network was designed on the premise that outages can be avoided or minimised using live line techniques.

With this being a long-term change in practice, we will be examining the impacts on our reliability levels and note that additional investment may be required to maintain existing reliability levels.

6.2.7 Quality of supply

Voltage drop limits on network components are detailed in our Network Design Standard NS10-10.

Harmonic voltage limits are specified in our Network Harmonics Standard NS15-05 and NZECP36:1993 *New Zealand Electrical Code of Practice for Harmonic Levels*.

6.2.8 Equipment rating and selection

6.2.8.1 Ratings

Where available, equipment ratings are taken directly from nameplate data or manufacturers' published data. Where this is unavailable, ratings are either calculated from first principles or estimated from similar equipment.

6.2.8.2 Selection

Conductor, cables and switchgear are generally sized for projected ultimate loadings provided the incremental cost of upsizing is less than the cost to upgrade the equipment once it is in service. Depending on the timeframe of projected loads, distribution transformers may be sized for medium term loads and upgraded as required for ultimate loads. This approach minimises operating losses and the risk of over investment if the consumer's load does match projections.

6.2.8.3 Standardisation

Where appropriate, network assets are designed using standard sizes or models to minimise spares, maximise interchangeability and reduce stock levels. Standard equipment sizes are specified in our design standards.

Membership of the Southern Buyers Group gives us the opportunity to standardise equipment and materials between member EDBs and allows increased purchasing power. An initial consideration in any design process is to check whether a standard design can be used (or adapted for re-use).

6.2.9 Energy efficiency

At times of maximum demand, the network is configured to minimise voltage drop and maximise efficiency.

At feasibility stage for new builds or for network strengthening projects, the present value of energy losses is factored into cost benefit calculations. For example, this may result in a larger conductor being selected to minimise lifecycle energy losses.

6.3 Forecast demand and constraints

Over the past decade a significant portion of network investment has been driven by load growth and related security upgrades. The majority of this growth has been due to the increased uptake of spray irrigation, either new schemes or the conversion of existing gravity-fed schemes to electric pumping.

A benefit of this demand driven investment is that it has resulted in the upgrade of many rural parts of the network prior to reaching condition-based investment triggers.

In 2003 our network changed from a winter to a summer peaking network, with peaks now occurring between December and February.

There may be projects being planned that we are not yet aware of, and we encourage any stakeholders with knowledge of significant developments in our area to get in touch with our planning department, so we can consider their needs as we plan our network.

6.3.1 Methodology

The development of a robust demand forecast is complex and has many inputs and assumptions.

The process to establish the demand forecast for our network is as follows:

- Where appropriate, our baseline maximum demand (MD) is set to match the MD recorded during the previous year. For most rural substations the MD is due to irrigation load. For baseline GXP MD we use Transpower's published figures. If climatic conditions in the previous year have not resulted in irrigation reaching peak levels, we may instead use the figures from the most recent dry year (with an allowance added for load growth).
- Historical MD records are analysed at substation level and split into domestic, commercial and farming load groups.
- Forecast demands in each of these categories are estimated for expected and prudent load growth scenarios as per the demand forecast inputs.
- The ratio of Transpower's GXP maximum demand and the sum of all substations' maximum demands on the GXP are used to calculate a baseline diversity factor. This diversity factor is applied to future years' forecasts to predict GXP MDs. (These GXP level forecasts provide an input to Transpower's network planning).

6.3.2 Demand forecast assumptions

- All demands and constraints are presented as apparent power (MVA). To allow addition of apparent power figures a power factor of 0.95 lagging is assumed for all loads.
- Maximum demand is assumed to be coincident at GXPs when shifting loads between GXPs.
- Forecast probable loads are added to the demand forecast after the base growth has been applied.

6.3.3 Demand forecast inputs

6.3.3.1 Domestic

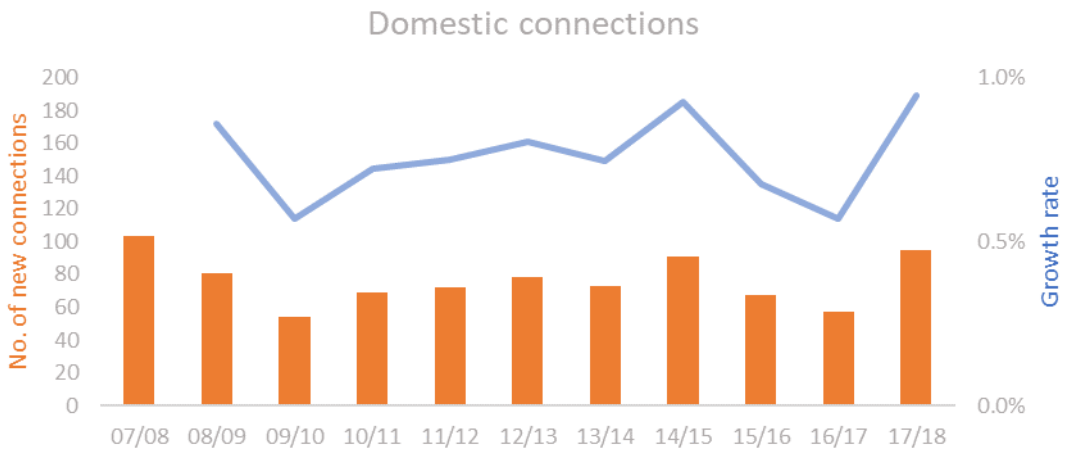


Figure 41 - Domestic connections

Domestic connections have been steadily increasing over the last five years at an average yearly rate of 0.75%.

Population growth is recorded for Oamaru as an average of 0.6% per year from 2006-2013 and 0.9% per year from 2014-2017. ECAN predicts that population growth will be low over the planning period at 0.4 - 0.8%[7].

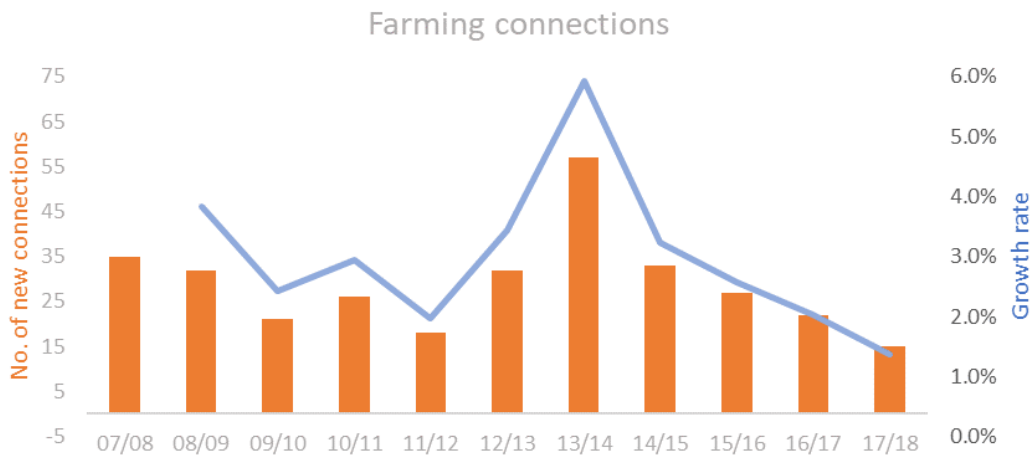
We have chosen to model domestic demand growth using two scenarios:

Expected growth	0.8%
Prudent growth	0.9%

[7] https://www.ecan.govt.nz/your-region/living-here/regional-leadership/population/projections/

6.3.3.2 Farming sector

Figure 42 - Farming connections



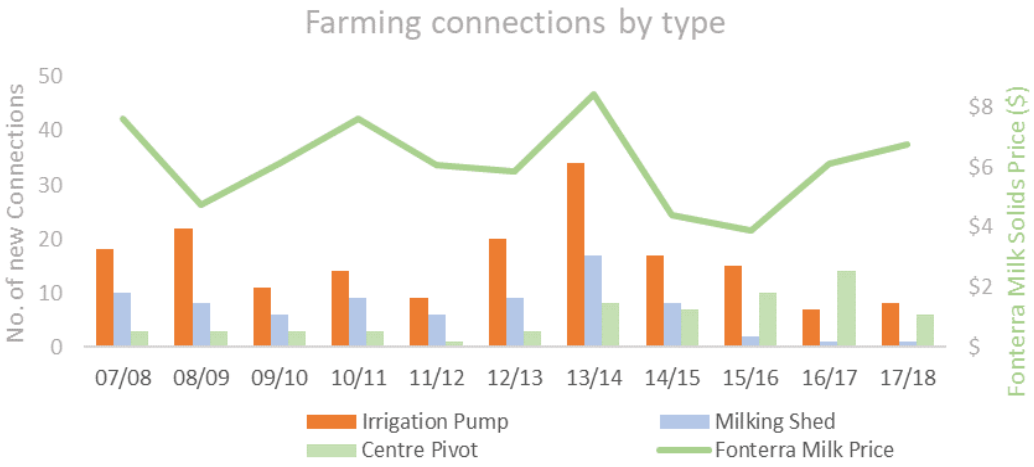


Figure 43 - Farming connections by type

Dairy shed conversions and irrigation connections have markedly dropped off since 2013/2014 when milk solids prices also dropped significantly.

The Fonterra 2018/19 farmgate milk price forecast is \$6.00-\$6.30 per kg[8] and the break-even price is estimated to be \$5.40[9].

We are yet to see an increase in farming load following the recovery above break-even price in 2016 but we expect farming load will increase if the prices stabilise at these levels.

Figure 43 shows a notable increase in centre pivot connection between 2015 and 2017 which was largely due to North Otago Irrigation Company's (NOIC) Stage 2 expansion commissioned in 2017.

[8] https://www.fonterra.com/nz/en/investors/farmgate-milk-prices.html (Update 6 December 2018)
[9] https://www.dairynz.co.nz/news/latest-news/milk-price-great-news/

Border-dyke to spray irrigation conversion

We analysed the results of a study by the Ministry for the Environment (MFE) performed in 2017 (using 2016 data). This desktop exercise used high resolution aerial photographs, Landsat imagery, and satellite photos to determine the types of irrigation in the district. Results from the Otago area were classed as high accuracy.

The largest area of border-dyke irrigated land is in the Waitaki Plains area which is primarily supplied water by the Lower Waitaki Irrigation Company (LWIC). Of the 16,500 Ha of land shown in the polygon in Figure 44 below, 9,400 Ha as either border-dyke or unknown[10]. We are presently working with LWIC to further refine these figures.

At 0.7 kW per Ha, this equates to between 5 and 6 MVA of extra load in this area as farms convert to spray irrigation. This load has been added to the forecast model separately in Table 36 - Forecast probable loads. We are advised that a significant number of farms are likely to convert within the planning period.

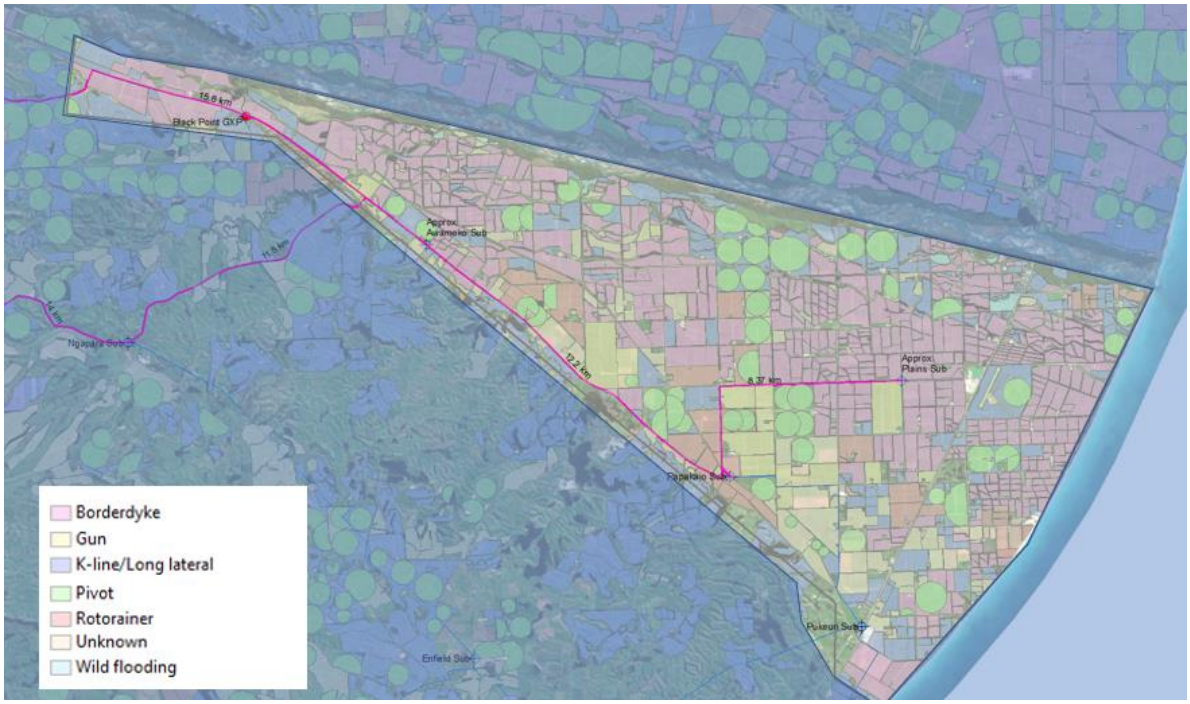


Figure 44 - Waitaki Plains Irrigation by type

We have chosen to model base farming growth using two scenarios.

Expected growth	2.0%
Prudent growth	2.5%.

[10] http://www.mfe.govt.nz/fresh-water/technical-guidance-and-guidelines/irrigated-land-new-zealand

6.3.3.3 Commercial & industrial

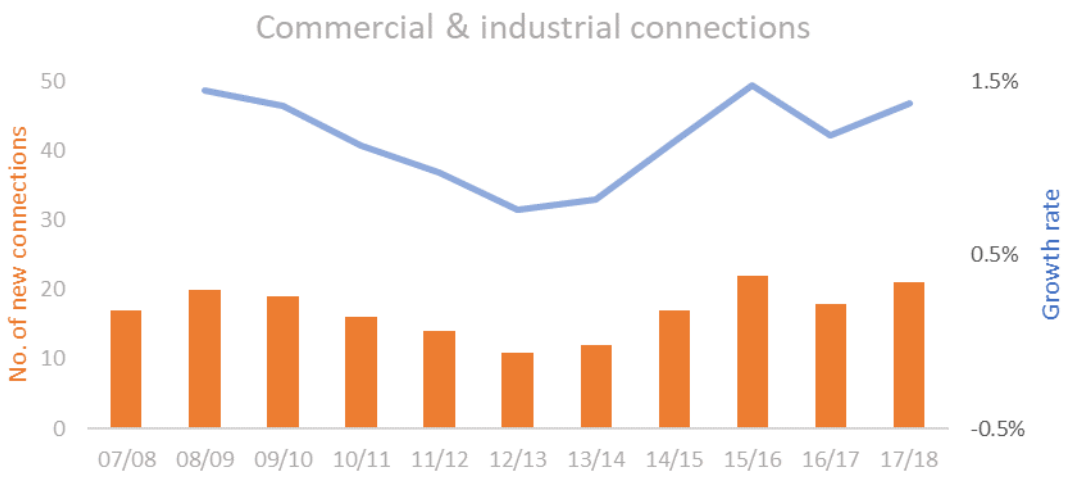


Figure 45 - Commercial and industrial connections

This category includes all load that is not classed as domestic or farming. Numbers of new connections have been on the rise since 2012/2013 and there are signs that this growth will continue during the planning period.

We have chosen to model commercial growth using two scenarios:

Expected growth	1.0%
Prudent growth	1.5%.

6.3.3.4 Electric vehicles (EV)

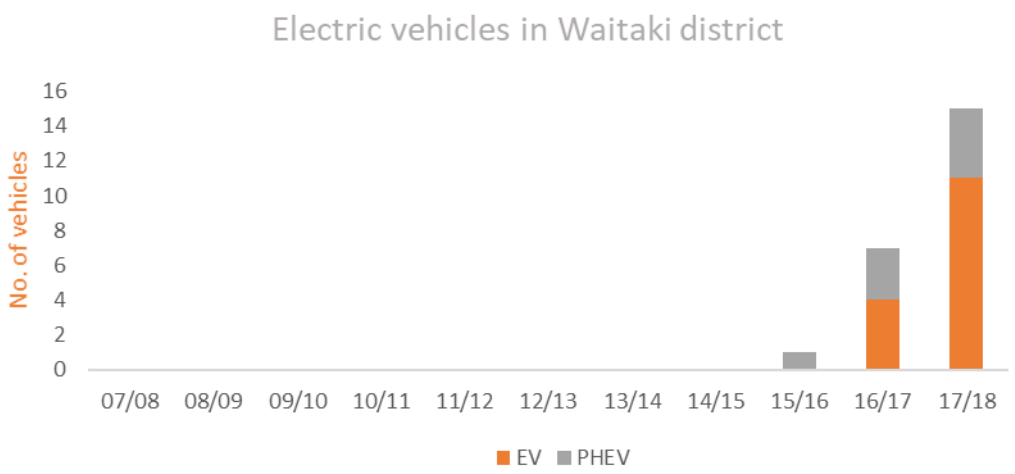


Figure 46 - Electric vehicles in Waitaki District

We presently have low levels of EVs on our network (11 EV and 4 Petrol Hybrid EV)

The rate of uptake of EVs in New Zealand and the impact that these will have on our electricity networks is subject to a high level of uncertainty over the planning period.

For the purposes of modelling, we have based our figures on MBIEs Global Low Carbon Emissions Scenario which estimates 24% penetration of EV vehicles by 2030 and 42% by 2040. This aligns with the Ministry of Transport estimate of 40% by 2040 but is less than Transpower's Te Mauri Hiko report which projects 40% penetration by 2030. We are comfortable with this as we expect that the uptake of EVs will be higher in large urban centres than in the provinces.

Waitaki District (less Palmerston) has a population of 21,505 people. Based on the current New Zealand light vehicle fleet makeup of 833 vehicles per 1000 people, the vehicle fleet in our supply area is estimated at 18,000 vehicles. This would result in 4,320 EVs by 2030 and 7,200 by 2040.

We have allocated EV energy demand by hour of the day based on the following assumptions[11]

- 80% of charging occurs between 11pm and 5am
- 10% of charging occurs between 5pm and 11pm
- 10% of charging occurs during the day evenly allocated between 9am and 5pm

To allow for the uncertainty in the charging regime, the proportion of EVs charging during our summer maximum demand has been modelled for expected growth at 10% with an average 3 kW charger size and prudent growth at 20% with an average 5 kW charger size.

We haven't modelled any effects of vehicle to grid power flows over the planning period but are actively watching developments in this area.

[11] MBIE, Electricity demand and generation scenarios, August 2016

6.3.3.5 Distributed generation (DG)

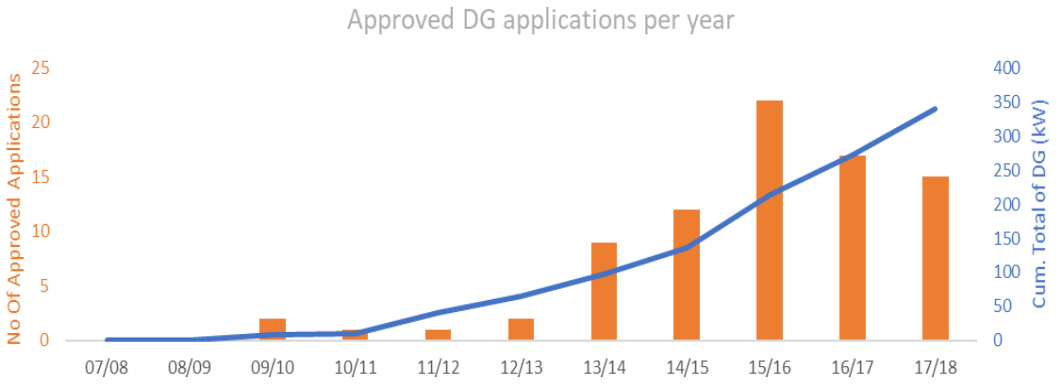


Figure 47 - Distributed generation

DG in our region is predominantly photovoltaic panels and this continues to grow although there were 15 applications approved last year down from a high of 22 in 2015/16. There are 87 DG connections approved on the network comprising 0.68% of all connections and equal to a 0.3% reduction in maximum demand (after de-rating to 40%). The average photovoltaic DG installation is 3.5 kW.

Distributed generation has been modelled in the expected growth model at 8% penetration by the end of the planning period and in the prudent growth model at 6% penetration. We acknowledge that the rate of uptake for DG may increase due to reductions in supply price, increases in electricity supply costs, or changes to regulations. We will continue to refine our models and collaborate with other similar EDBs to share knowledge.

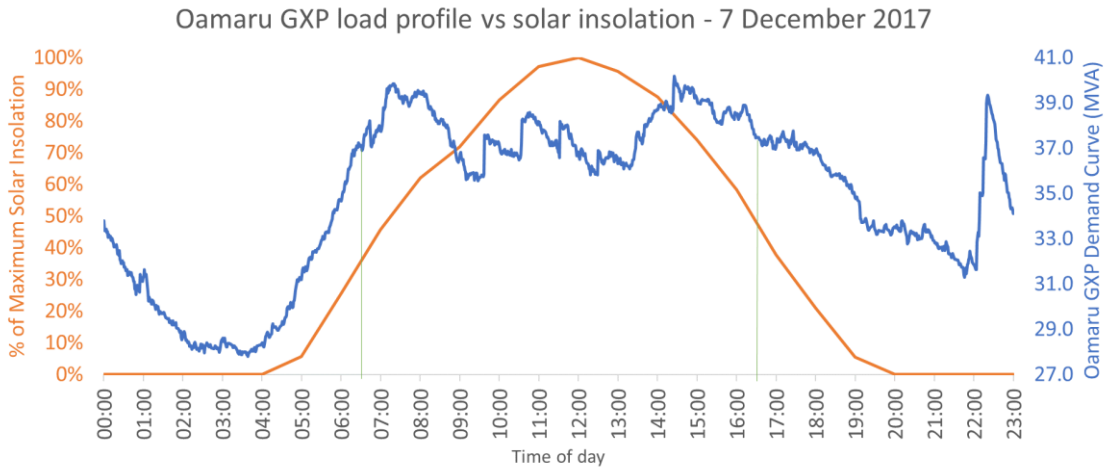


Figure 48 - Oamaru GXP load profile vs solar insolation

The graph above shows the demand (blue curve) for the heaviest loaded day in 2017 compared with the solar insolation figures for Oamaru (orange curve) on the same day. Taking a conservative approach and setting the start of the morning peak at 06:30 and the end of the afternoon peak to 16:30 gives a best-case average solar output of 40% of maximum.

DG solar connected to the network will be de-rated to 40% of their rated output when considering the contribution towards reducing the network maximum demand.

6.3.3.6 Battery storage

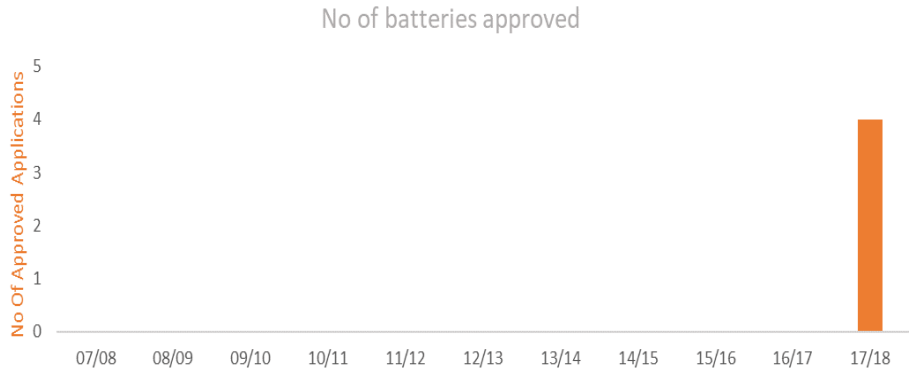


Figure 49 - Batteries approved on network

In 2018, we approved the first four consumer owned battery installations on our network. As battery technology improves and costs fall we will see an increase in the number of distributed batteries connected to our network. This may have the effect of minimising part of our summer peak, but this will be highly dependent on pricing and associated consumer behaviour. For example, consumers may choose to use this energy after 5pm when our system demand is reducing from peak values.

The rate of potential uptake of consumer batteries is unknown. We will continue to investigate good practice in this area and will collaborate with other similar EDBs to build and share knowledge.

6.3.3.7 Energy efficiency

The transition of domestic and commercial consumers towards LED lighting, higher efficiency appliances and better insulation performance of our buildings, will result in a decrease in the existing maximum demand and energy throughput. The effects of EVs, DG, and batteries will be added to the model separately.

The impact from energy efficiency has been modelled as:

Expected growth	0.50%[12]
Prudent growth	0.25%.

[12] The higher efficiency figure of 0.5% has been applied to the expected growth scenario as this translates to a reduction in maximum demand.

6.3.3.8 Demand management

The impact of traditional network-controlled load management (space heating and hot water) is minor during the summer peaks and for these reasons we have not included the effect of this in the demand forecasts.

The control of irrigation load is a tool reserved for managing unusual conditions on the network and is not regularly used. Wherever possible we will continue to design our network to provide capacity for all irrigation consumers, without the requirement to utilise load control in day to day operation.

We are yet to see the impact of consumer demand side management. With the proliferation of smart meters, we expect there will be an increase of retailer led pricing signals to consumers to encourage demand management.

We note that outcomes of retailer-initiated campaigns such as Electric Kiwi's "hour of free power" or future retailer spot pricing schemes could create artificial demand peaks on our network which are not able to be reliably forecasted or controlled. We will be watching developments in this area closely.

6.3.3.9 Heat pumps

The largest heat pump installer in our region estimates that between 6000-7000 homes have a single heat pump and 1000 have two.

Newer inverter heat pumps are more efficient and have less impact on the network when starting but this may be offset by anecdotal evidence from the heat pump supplier that, where in past winters the average customer would set their thermostat at 18°, many are now setting this as high as 21°C.

Heat pumps in our region are not typically used for cooling so will have a minimal contribution to the summer peak, although there is a risk that if we experience hotter days and/or consumer behaviour changes that this may have an effect on our summer peak. This effect has not been allowed for in our modelling and would be mitigated by shedding of controllable load if it occurred during a constraint period.

6.3.3.10 Forecast probable loads

Where a load that has a high probability of eventuating and the applicant can advise:

- the location of the load
- the size of the load
- the expected timeframe of the load

we will add the loads directly into our load growth model. If the load is for an irrigation scheme, a large site upgrade, or a large development we may choose to add this in addition to the load growth scenarios detailed in the Demand Forecast Inputs.

Table 36- Forecast probable loads

Substation	Load Type	2019 2020	2020 2021	2021 2022	2022 2023	2023 2024	2024 2025	2025 2026	2026 2027	2027 2028	2028 2029
Kurow	Irrigation Scheme	0.3				0.2					
Otekaieke	Irrigation Scheme	1.7				0.4					
Papakaio	Gravity to Spray Irrigation conversion	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
Pukeuri	Gravity to Spray Irrigation conversion	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
Chelmer	Resthome/Subdivision development	0.2	0.2	0.2	0.2						
Chelmer	Other company EV fast Chargers	0.1	0.1	0.1	0.1	0.1					
Redcastle	Meat Processor expansion	0.8	0.3								
Redcastle	Business Park new load	0.2	0.2								
Five Forks	On farm Irrigation	0.1	0.1	0.1							
Maheno	On farm Irrigation	0.1	0.1	0.1							
Hampden	Poultry farm	0.9									

6.3.4 Transpower regional transmission

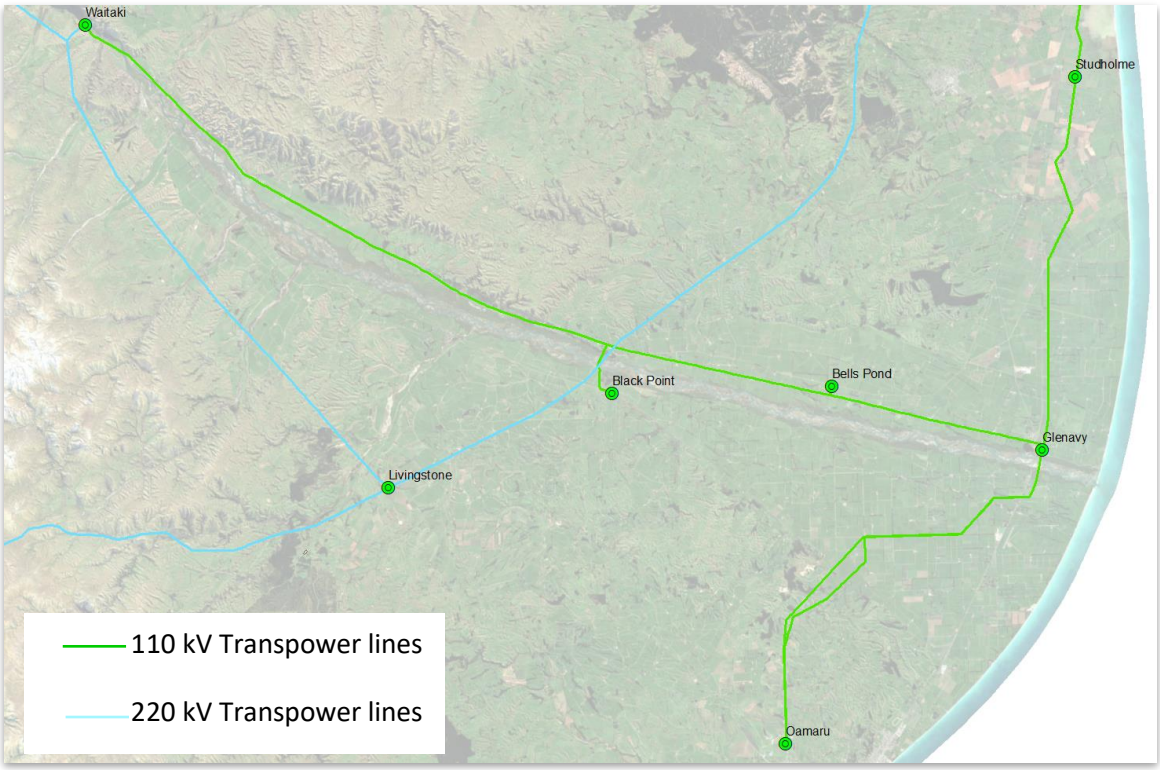


Figure 50 - Transpower regional transmission

The circuits from Waitaki Dam to Glenavy are classed by Transpower as *Interconnection Assets-non-core grid* and both circuits share towers for most of the length of the line.

The 110 kV circuits from Glenavy to Oamaru GXP are classed as *Connection Assets* and each circuit has a separate pole line. The two 110 kV circuits are not connected at 110 kV but can circulate power via our 33 kV bus at our Weston Switching Station.

6.3.4.1 Transmission rating

NWL's Oamaru GXP is supplied by two 110 kV Transpower circuits originating at the Waitaki Dam.

The 220/110 kV transformers at Waitaki Dam are rated at 100 MVA per circuit and the 110/33 kV transformers at Oamaru GXP are rated at 60 MVA per circuit.

The 110 kV lines from Waitaki Dam to Glenavy are rated at 63 MVA (summer noon) at nominal voltage (110 kV). The lines from Glenavy to Oamaru are thermally rated at 50 MVA (summer noon) at nominal voltage.

Network Waitaki has a Wider Voltage Agreement in place with Transpower that allows the voltage at Oamaru GXP to be as low as 87.5% of nominal voltage.

6.3.4.2 Transmission constraints

Transpower advise that there is a 42 MVA pre-contingency constraint between Bells Pond and Waitaki Dam. When loading on this section of line reaches 40 MVA Transpower will call for demand response in the lower Waitaki Valley area and if this is not sufficient they will apply a system split between Glenavy and Studholme, shifting Studholme GXP onto Timaru at *N security*.

In December 2018, Transpower commissioned Variable Line Rating (VLR) on Glenavy-Oamaru and Black Point-Oamaru 110 kV circuits increasing the post-contingency constraint at Oamaru GXP to:

Table 37 - VLR rating impact on constraint

n-1 rating	Month	Start Time	End Time
44 MW (45 MVA)	January February	09:00 11:00	11:00 13:00
45 MW (46 MVA)	December February March	11:00 09:00 11:00	13:00 11:00 13:00
47 MW (48 MVA)	December January February	09:00 11:00 13:00	11:00 13:00 15:00
48 MW (49 MVA)	January March	07:00 13:00	09:00 15:00
50 MW (51 MVA)	Remainder of year		

There is a voltage stability constraint when Oamaru load exceeds 50 MVA with the Studholme - Timaru 110 kV circuit out of service and 56 MVA when the circuit is in service. This means that the voltage at Oamaru could collapse in the event of the outage of one of the 110 kV circuits.

We are working with Transpower, Alpine Energy, and our other stakeholders regarding managing the constraints on this line. Transpower have signaled that any investment required on the interconnected portion of line (Waitaki to Glenavy) would not pass the Grid Investment Test and must be completely funded by Alpine and/or NWL. Any work on the NWL connection assets (Glenavy to Oamaru) must be funded by NWL.

6.3.5 Twizel GXP and substations

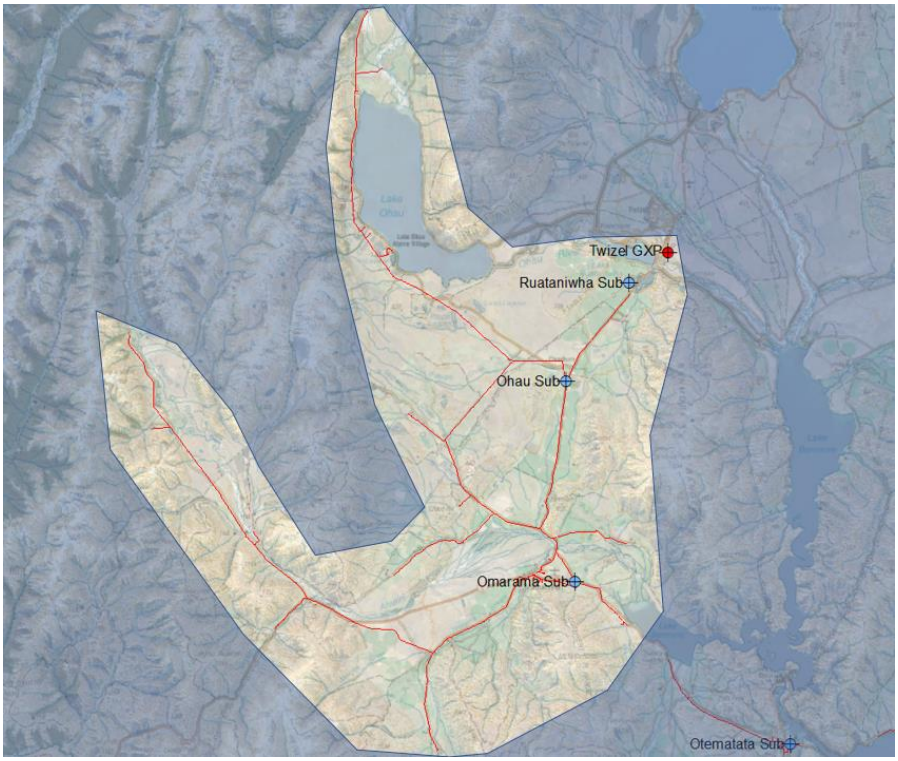
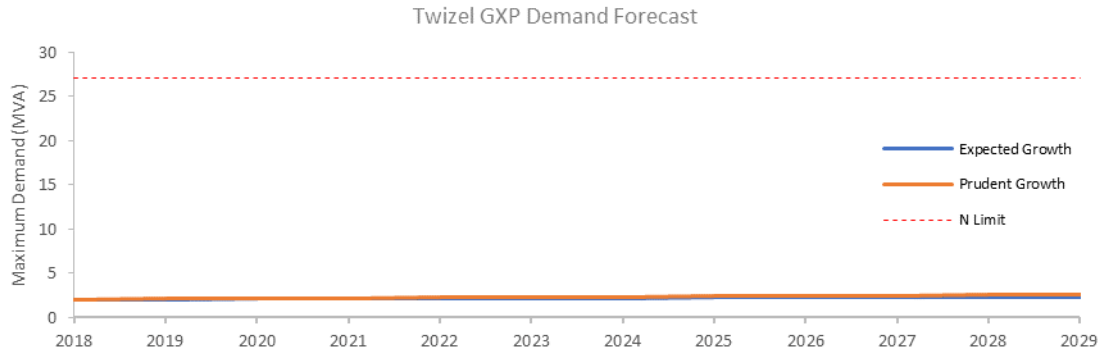


Figure 51 - Twizel GXP supply area

6.3.5.1 Twizel GXP capacity

The Twizel GXP supplies NWL and Alpine Energy networks. The GXP has dual transformers and is operated with a split 33 kV bus with one side feeding each network, providing *27 MVA, N-1 Switched* security level to NWL.

6.3.5.2 Twizel GXP demand forecast



Load Growth Scenario	N-1 Switched Security Limit (MVA)	N Security Limit (MVA)	2017 / 2018	2018 / 2019	2019 / 2020	2020 / 2021	2021 / 2022	2022 / 2023	2023 / 2024	2024 / 2025	2025 / 2026	2026 / 2027	2027 / 2028	2028 / 2029	Average Annual Growth Rate AMP
Scenario 1 - Expected demand	27	27	2.0	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.3	2.3	2.3	1.4%
Scenario 2 - Prudent demand	27	27	2.0	2.1	2.1	2.2	2.2	2.3	2.3	2.3	2.4	2.4	2.5	2.6	2.2%

Figure 52 - Twizel GXP demand forecast

6.3.5.3 Twizel GXP constraints

The Twizel GXP has sufficient capacity to meet our load within the planning period.

There are no constraints forecast at the Twizel GXP during the planning period.

6.3.5.4 Twizel GXP zone substations – demand forecasts

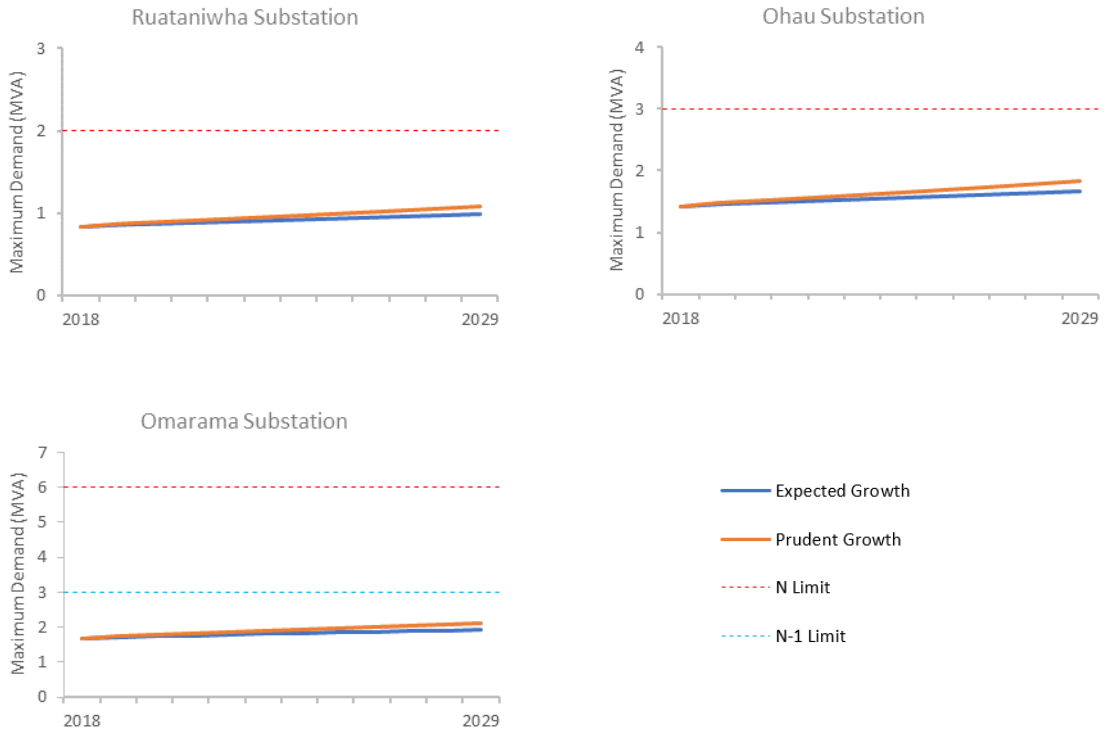


Figure 53 - Twizel GXP substations - demand forecasts

6.3.5.5 Twizel GXP zone substations – constraint forecasts

The three substations normally supplied by Twizel GXP are predicted to be operating free of constraints during the planning period.

6.3.6 Waitaki GXP and substations

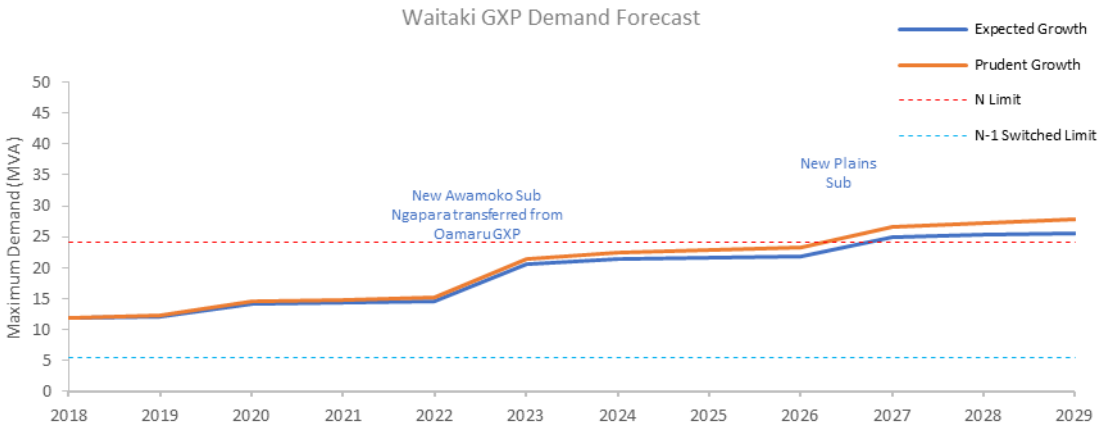
Figure 54 - Waitaki GXP supply area

6.3.6.1 Waitaki GXP capacity

The Waitaki GXP is rated at *24 MVA N security* and *5.5 MVA N-1 Switched.*

NWL own the 20/24 MVA 11/33 kV GXP transformer which is supplied from the Waitaki Power Station 11 kV generator bus.

6.3.6.2 Waitaki GXP demand forecast



Load Growth Scenario	N-1 Switched Security Limit (MVA)	N Security Limit (MVA)	2017 / 2018	2018 / 2019	2019 / 2020	2020 / 2021	2021 / 2022	2022 / 2023	2023 / 2024	2024 / 2025	2025 / 2026	2026 / 2027	2027 / 2028	2028 / 2029	Average Annual Growth Rate AMP
Scenario 1 - Expected demand	5.5	24	11.8	12.0	14.2	14.4	14.6	20.5	21.3	21.6	21.9	25.0	25.3	25.6	7.3%
Scenario 2 - Prudent demand	5.5	24	11.8	12.2	14.5	14.8	15.1	21.4	22.4	22.9	23.3	26.7	27.2	27.8	8.1%

Figure 55 - Waitaki GXP demand forecast

6.3.6.3 Waitaki GXP constraints

The GXP is expected to reach the *N Security* limit between 2026 and 2027 when Ngapara Zone Substation is moved onto Waitaki GXP from Oamaru GXP.

A potential planned GXP upgrade project is to install a second 20/24 MVA transformer to upgrade the security level to *24 MVA N-1***.** This will be required to meet our grid security standard once GXP demand exceeds 15 MVA in 2021/22.

Near the end of the planning period some load will be subjected to N security at times of maximum summer demand. This may trigger the requirement for a new GXP in the Livingstone/Black Point areas.

6.3.6.4 Waitaki GXP zone substations - demand forecasts

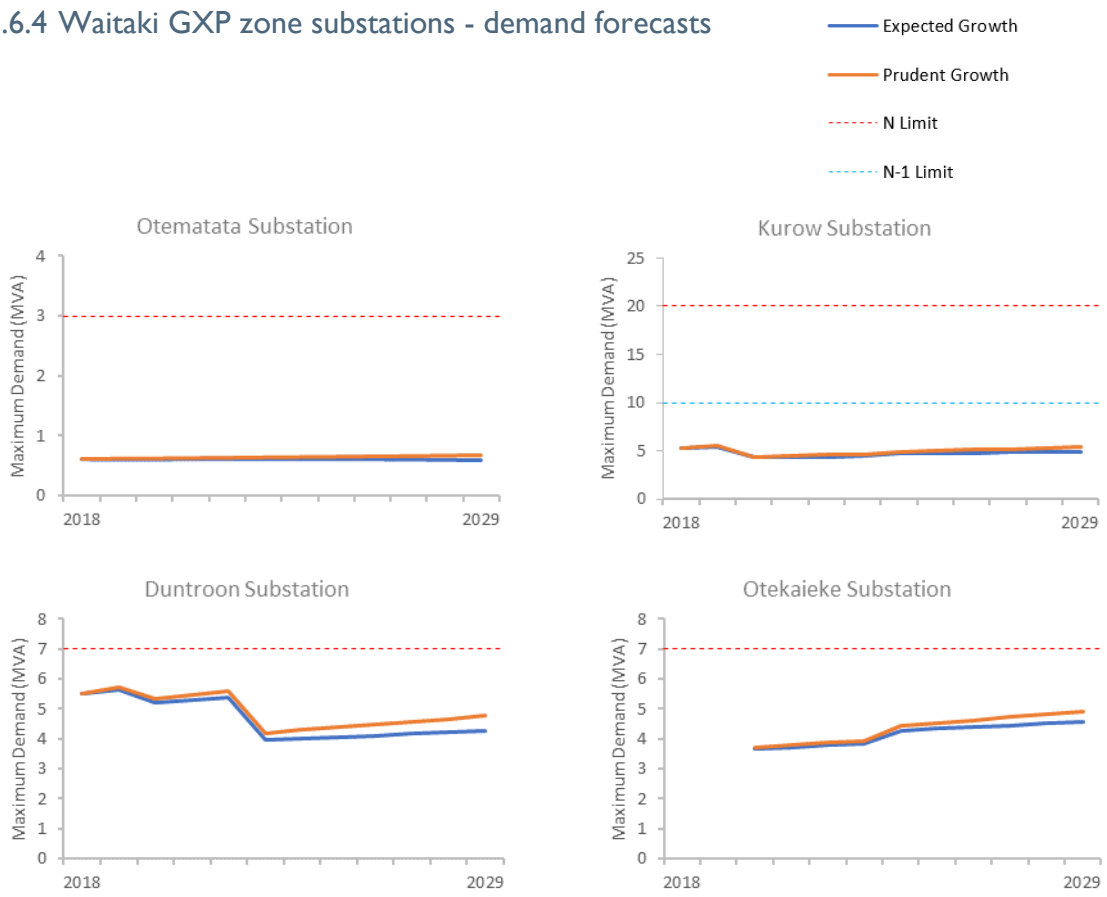


Figure 56 - Waitaki GXP substations demand forecasts

Waitaki GXP currently services three substations, Otematata, Kurow and Duntroon.

In 2019/2020 a new substation will be commissioned at Otekaieke, midway between Duntroon and Kurow to remedy constraints and to alleviate security issues between these substations.

Rearrangement of the 11kV feeders in the area will reduce loadings on Kurow and Duntroon substations by moving load onto the new Otekaieke Substation

With timing dependent on the emergence and location of irrigation load, two further substations are planned to be added to the Waitaki GXP.

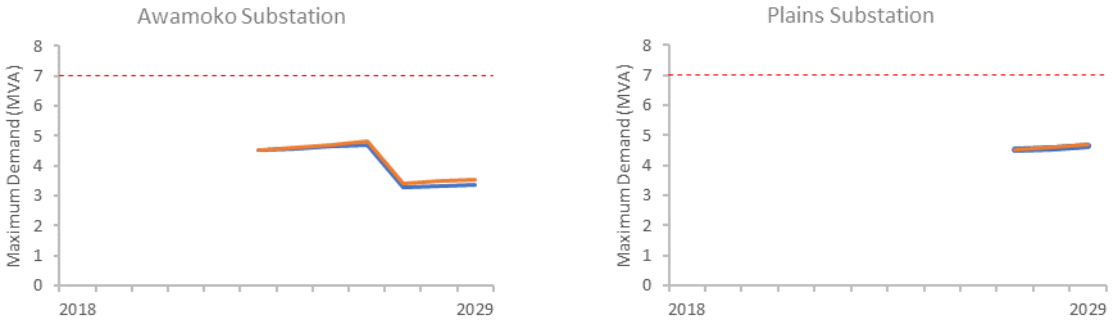


Figure 57 - Waitaki GXP proposed substations - demand forecasts

Awamoko substation is planned for commissioning in 2022/2033 and will reduce loading on both Duntroon and Papakaio substations. A new "Plains" substation is planned for 2026/2027 and will reduce loading on Awamoko and Papakaio substations. These are presently in the Oamaru GXP supply area but new subtransmission lines would be constructed to supply these from Waitaki GXP.

6.3.6.5 Waitaki GXP zone substations - constraint forecasts

With the addition of Otekaieke, Awamoko and "Plains" substations, all substations on the Waitaki GXP will be operating within their constraints during the planning period.

6.3.7 Oamaru GXP and substations

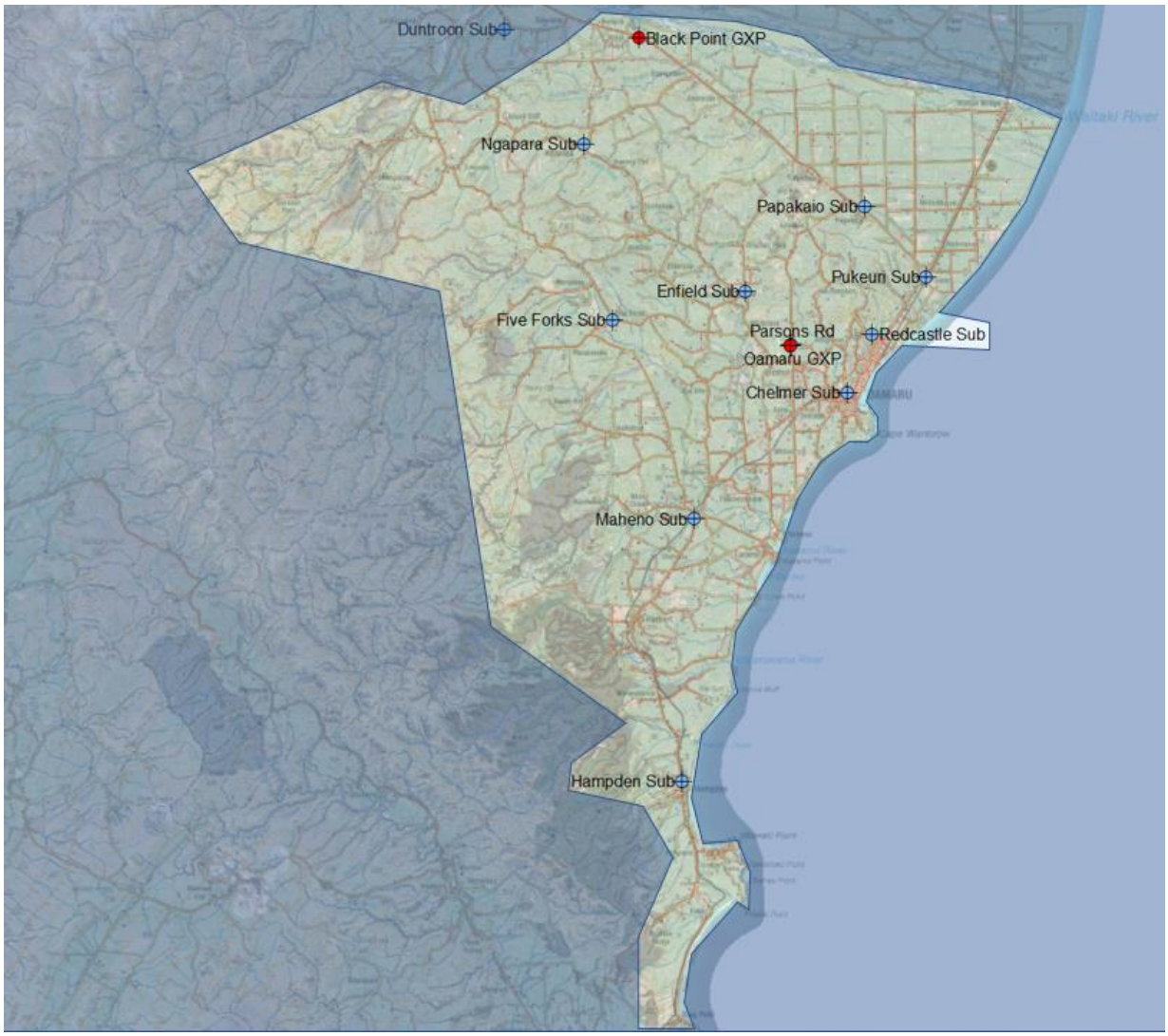


Figure 58 - Oamaru GXP supply area

6.3.7.1 Oamaru GXP capacity

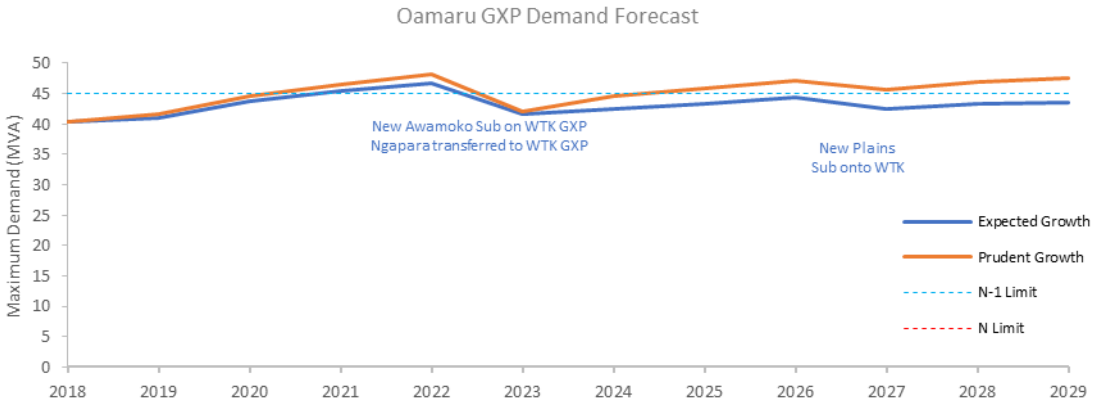
The Oamaru GXP is a Transpower 110/33 kV substation currently supplying a peak load of 40.3 MVA as recorded in December 2017. The Oamaru Transformers have a rating of 60 MVA, *N-1 Security*

6.3.7.2 Oamaru GXP constraints

In practice, the 110 kV Transpower overhead lines between Lake Waitaki and the Oamaru GXP have a dynamic operational constraint which limits the *N-1* capacity at this Oamaru GXP as detailed in Section 6.3.4.2 Transmission constraints.

Options that have been considered to alleviate the 110 kV system constraints are detailed further in Section 6.4.1.

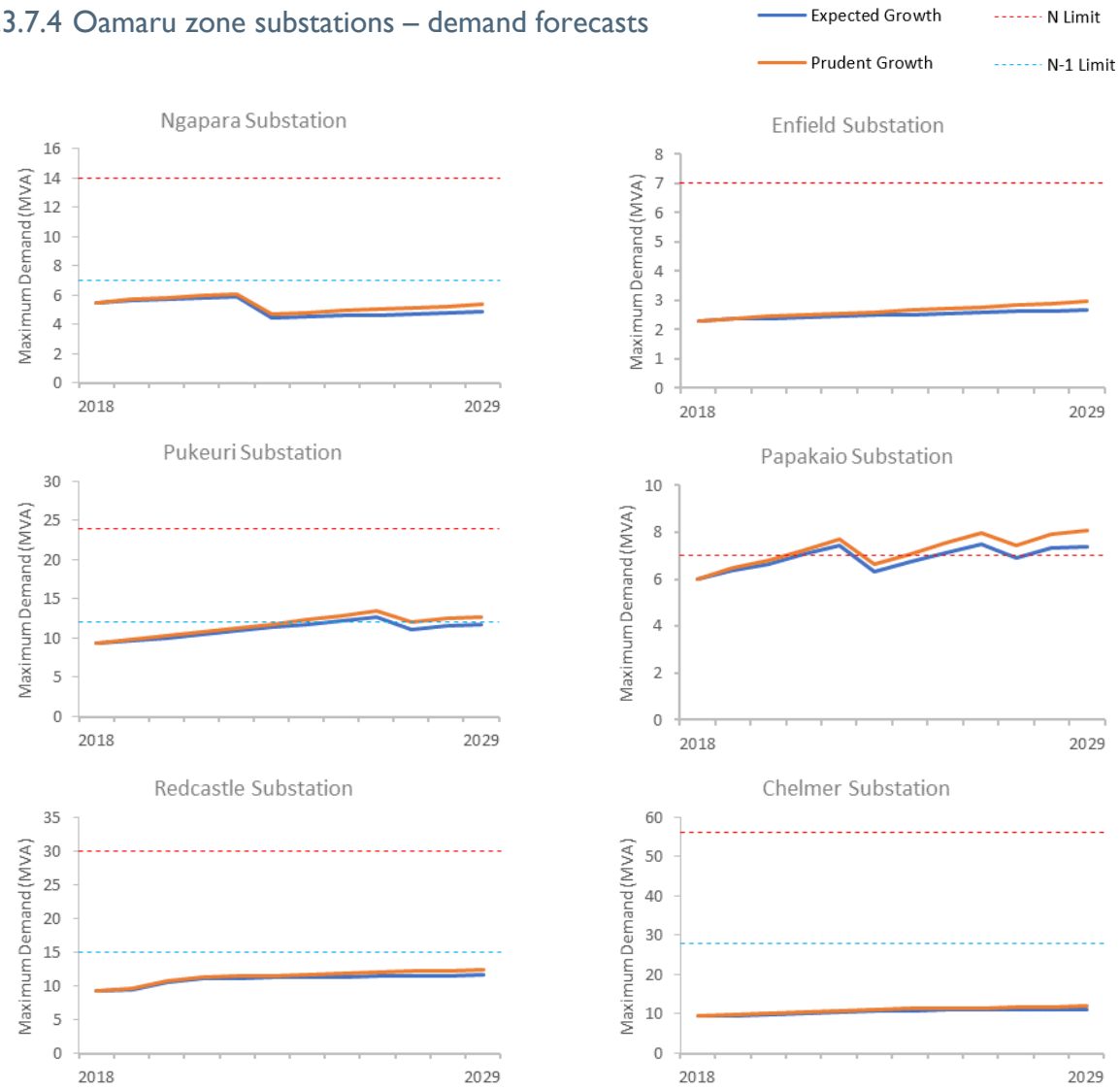
6.3.7.3 Oamaru GXP demand forecast



OAM GXP	Load Growth Scenario	N-1 Security Limit (MVA)	N Security Limit (MVA)	2017 / 2018	2018 / 2019	2019 / 2020	2020 / 2021	2021 / 2022	2022 / 2023	2023 / 2024	2024 / 2025	2025 / 2026	2026 / 2027	2027 / 2028	2028 / 2029	Average Annual Growth Rate AMP
GXP Summer MD	Scenario 1 - Expected demand	45	45	40.3	41.0	43.7	45.3	46.7	41.6	42.6	43.4	44.3	42.5	43.3	43.6	0.7%
GXP Summer MD	Scenario 2 - Prudent demand	45	45	40.3	41.6	44.5	46.5	48.2	42.0	44.6	45.8	47.0	45.6	46.8	47.5	1.5%

Figure 60 - Oamaru GXP demand forecast

6.3.7.4 Oamaru zone substations – demand forecasts



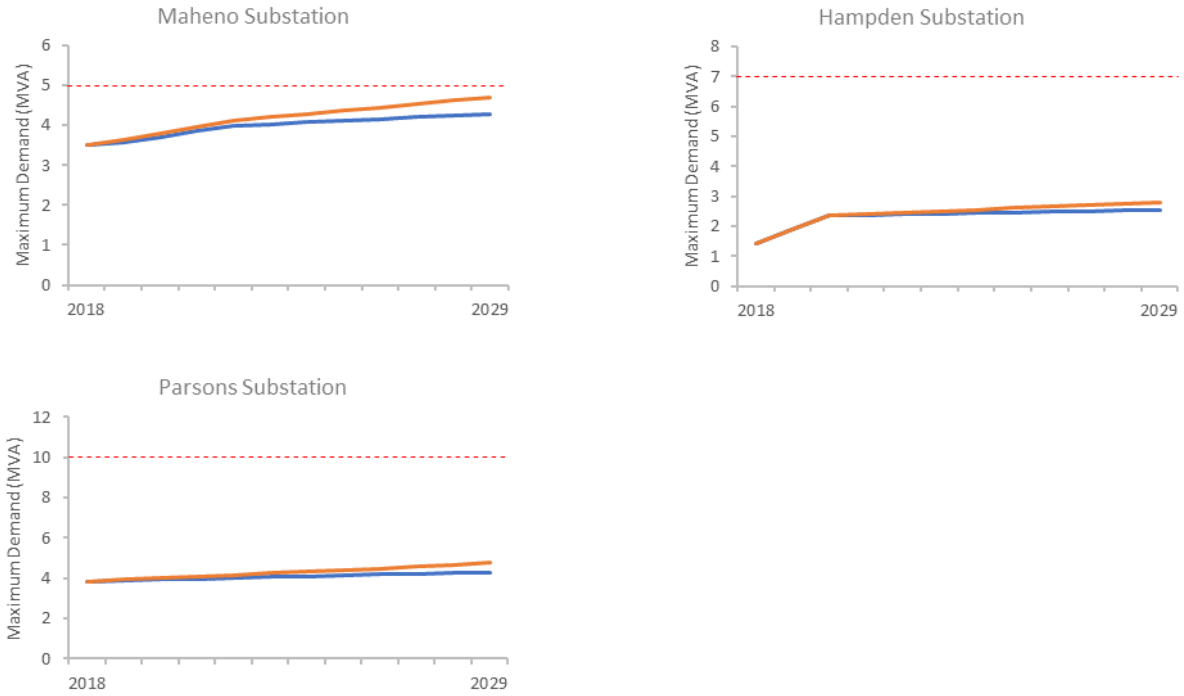


Figure 61 - Oamaru GXP substations - demand forecasts

6.3.7.5 Oamaru zone substations – constraint forecasts

Under the prudent load growth scenario Pukeuri Substation will expose a small portion of its irrigation load at *N Security* for a short period of the year from 2024(In the event of an outage on one transformer, we may shed irrigation load using our load control system). We may choose to manage this constraint by shifting load from Pukeuri to Redcastle substation.

Papakaio Substation is at risk under the high load growth scenario of exceeding the *N* security rating of 7 MVA during the summer of 2021/22. This constraint is alleviated once Awamoko Substation is commissioned in 2022/23. If this load eventuates earlier, it will be managed in the short term by moving some load to Enfield and Duntroon substations or by using load control of irrigation during constraint periods.

Ngapara Substation is proposed to be moved onto Waitaki GXP in 2022/23 to reduce loading on the transmission network supplying Oamaru GXP.

All remaining substations on the Oamaru GXP are predicted to have sufficient capacity for expected and prudent load-growth scenarios in the planning period. Analysis of 11 kV inter-tie capacity and security will be completed during the 2019/20 period. The outcome of this work may be the strengthening and upgrading of various 11 kV feeders across the network to adequately support load transfer between substations.

6.3.8 Black Point GXP

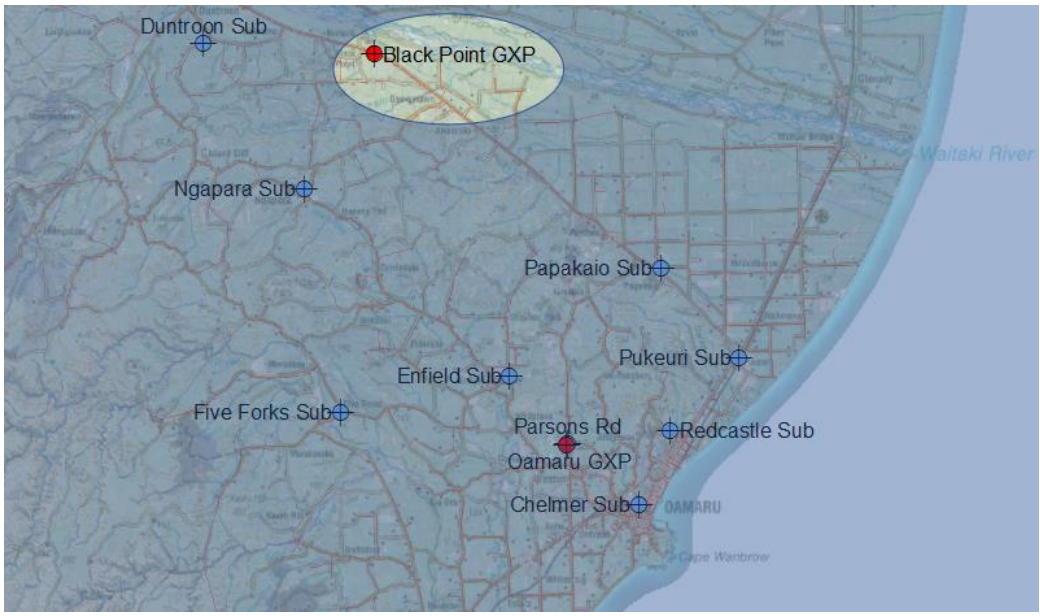


Figure 62 - Black Point GXP location

6.3.8.1 Black Point GXP capacity

The Black Point GXP is dedicated to the NOIC Irrigation Scheme, which was commissioned in 2006 and is rated as *25 MVA, N security*.

6.3.8.2 Black Point GXP constraints

NOIC recently completed an expansion to raise their maximum demand from 10.7 MVA to approximately 16 MVA.

Constraints on the Transpower 110 kV supply required the installation of a special protection (load control) scheme between Waitaki GXP, Oamaru GXP, Black Point GXP, Bells Pond and Studholme to allow NOIC to increase their load beyond 10.7 MVA.

In the event of a contingent event (fault on the Waitaki-Bells Pond-Oamaru 110 kV line) during a constraint period the special protection scheme may operate to reduce the NOIC pumping load below the constraint.

6.3.8.3 Black Point demand forecast

Table 38- Black Point GXP demand forecast

Black Point GXP	N-1 Security	N Security	2017 / 2018	2018 / 2019	2019 / 2020	2020 / 2021	2021 / 2022	2022 / 2023	2023 / 2024	2024 / 2025	2025 / 2026	2026 / 2027	2027 / 2028	2028 / 2029
GXP Summer MD	-	25	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1

There are no known developments at Black Point during the planning period.

6.4 Proposed development programme

Our ongoing collaboration with Transpower, Alpine Energy and other regional stakeholders may lead to a revision of our development programme for the planning period.

Until an outcome emerges, we will continue to develop the network according to our current plan. In the short term we will, if possible, defer any projects that would be rendered unnecessary if one of the possible long-term solutions is approved. The risk to our security of our network will be considered before any decision is made to defer investment.

6.4.1 Transmission development

Load growth projections indicate that Oamaru and Waitaki GXPs may reach their capacity limits near to the end of this planning period.

The 110 kV lines supplying Oamaru cannot be upgraded any further without prohibitive capital outlay. Waitaki GXP and the associated subtransmission system cannot support enough load to offload Oamaru GXP sufficiently.

In collaboration with Transpower, Alpine Energy and other stakeholders, we are presently refining our long list of solutions for both short-term and long-term scenarios. Each solution will be subject to cost benefit analysis and checked for compliance with our strategic plan including environmental sustainability.

6.4.1.1 Short term - long list

Variable Line Rating (VLR) was identified as a short-term solution and has now been commissioned on the Glenavy-Oamaru and Black Point-Oamaru 110 kV circuits as detailed previously in section 6.3.4.2 Transmission constraints.

Other short-term options being evaluated include:

- capacitor banks on NWL network to improve the power factor at Oamaru GXP
- reduce security of some load on Oamaru GXP to *N Security* at times of constraint.
- grid scale batteries and/or photovoltaic panels
- diesel generation, either at the GXP or distributed at zone substations.

6.4.1.2 Long term – long list

Two options are presently being considered.

- a new 220/66 kV GXP at Transpower's Livingstone site
- a new 220/110/66 kV GXP under the 220 kV lines in the Black Point region

NWL commissioned Transpower to produce a Solution Study Report for a new GXP at Livingstone in 2013 and are continuing to refine costs and benefits of these two GXP options

6.4.1.3 Transpower investment approval process

For **connection assets** (Glenavy to Oamaru 110 kV circuits), investments are paid for by Network Waitaki through a Transmission Works Agreement (TWA). Investments must meet Grid Reliability Standards (GRS), which do not require *N-1 security* and benefits must outweigh costs. If costs outweigh benefits, investment may still proceed provided we consult, and gain approval from, our consumers.

For **interconnection assets**, Investments must meet the GRS and are subject to the Grid Investment Test (GIT).

- **Core grid assets** are required to meet the deterministic *N-1 Security* standard and security projects may be funded by Transpower even if the costs outweigh benefits.

- **Non-core grid assets** (Waitaki to Glenavy twin 110 kV circuit) are not required to meet the *N-1* standard by the GRS. For any upgrades to be funded by Transpower benefits must outweigh costs. Transpower advise that this is unlikely due to the short period of our maximum demand.

We consider that this process significantly disadvantages our region, and the classification of non-core grid is largely due to historical decisions on how the Transpower network in North Otago has been maintained. This has the potential to hold back our regional economic growth compared with regions that happen to be connected to core grid assets.

To this end, we are in the process of submitting an Expression of Interest (EoI) to the Provincial Growth Fund (PGF) for possible funding towards a long-term transmission solution. This fund has been created by central government to invest $1 billion per annum over three years in regional economic development. A letter of support has been received from Waitaki District Council in this regard.

We are engaging with stakeholders to support the EoI, including

- The Waitaki Power Trust
- Otago Regional Council
- Waitaki District Council
- Environment Canterbury
- Federated Farmers

6.4.2 GXP development

6.4.2.1 Waitaki GXP security upgrade

This will involve the installation of a second transformer to increase the capacity of the GXP to a minimum of *24 MVA N-1 Security.*

This work is required once load reaches our *N-1* security trigger of 15 MVA. Our forecast for this trigger is for Summer 2022 when Ngapara substation is transferred from Oamaru GXP.

This upgrade will provide *N-1 Security* for this GXP until 2026 after which some irrigation load may be subject to *N Security* at certain times of the season.

We will to proceed with the design stages of this project as this transformer will be required in 2021/22 if our current development plan is retained. We will defer this investment if the outcome of negotiations with Transpower render this option unnecessary.

Project Name	Components	Year (s)	Budget cost
Waitaki GXP Stage 2	• Preliminary design • Final design/easements • Purchase Transformer • Install Transformer	2019/20 2020/21 2021/22 2021/22	$50,000 $100,000 $850,000 $600,000

6.4.2.2 New GXP

GXP options have previously been mentioned in section 6.4.1.2 on the preceding page.

Costs will be refined and presented once an option is selected.

6.4.3 Subtransmission development

To reduce load on the constrained 110 kV transmission lines supplying Oamaru GXP we plan to transfer Ngapara substation onto Waitaki GXP in 2022. New load in the Waitaki Plains area will be supplied with development of the Awamoko and "Plains" substations supplied from the Waitaki GXP.

This project involves creating a 66 kV network running from Waitaki GXP to Ngapara in the south and Papakaio in the east. The planned configuration is shown below.

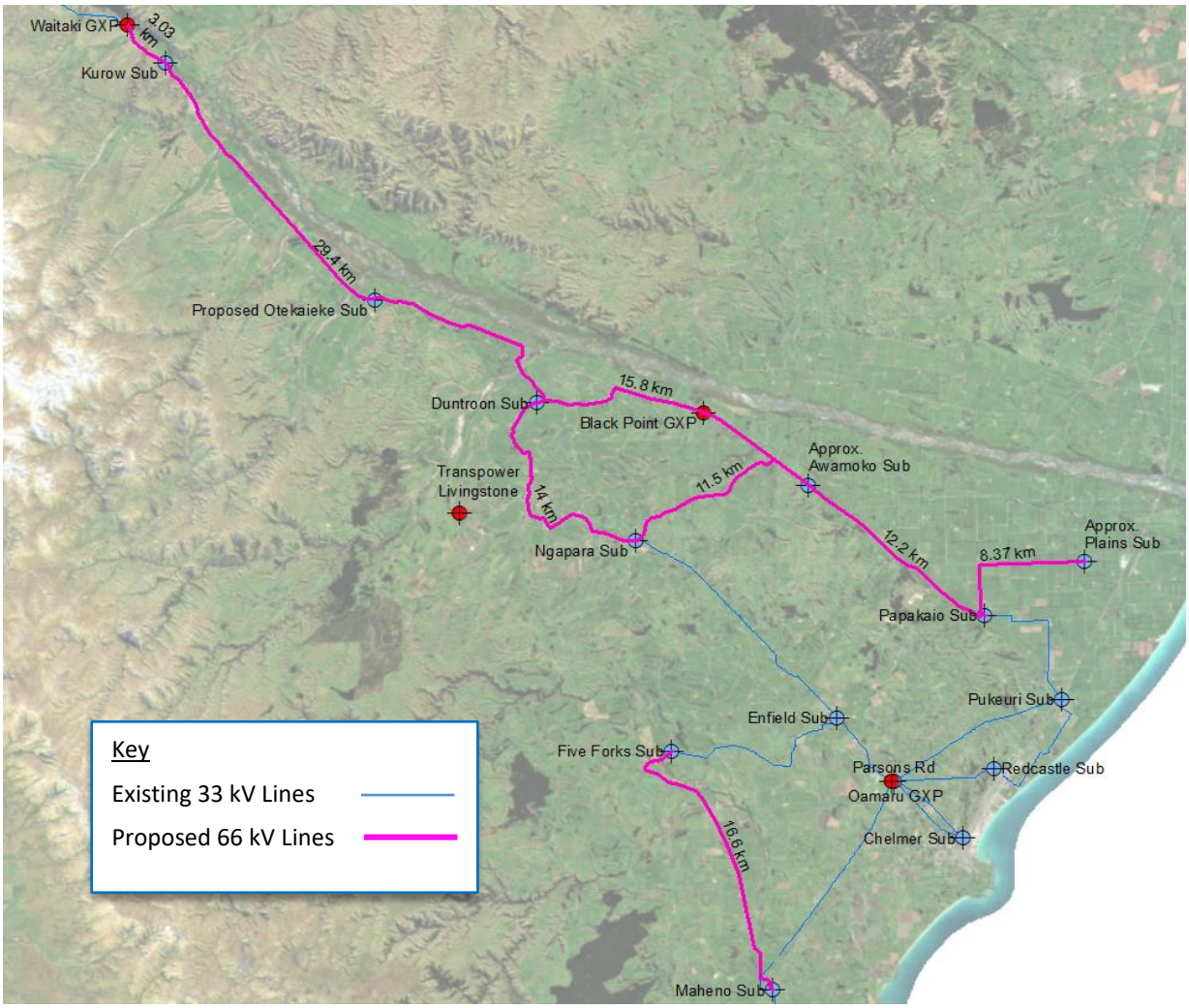


Figure 63 – 66 kV Subtransmission development summary – Waitaki GXP to Papakaio

The first stage of this work was the construction of a new subtransmission line between Kurow and Duntroon Substations, which was completed in the summer of 2015. This allowed us to shift about 5 MW of load (Duntroon substation) from the Oamaru GXP to the Waitaki GXP.

This subtransmission circuit is presently operated at 33 kV but was designed and constructed for 66 kV operation. It is planned to convert to the higher voltage in 2021/22.

The next phases of the 66 kV subtransmission system development are discussed further in the following sections.

6.4.3.1 Subtransmission expenditure summary

The table below lists the expected timing and costs of major subtransmission development projects:

Table 39 - Sub-transmission projects in the planning period

Project Name	Components	Year (s)	Budget cost
Convert Duntroon-Ngapara to 66 kV	• Reinsulate existing 33 kV line	2019/20	$330,000
New 66 kV Line from Waitaki GXP to Kurow	• Duplicate 3.3km, 66 kV supply to Kurow	2020/21	$630,000
Kurow to Ngapara 66 kV conversion Stage 1	• Design work, land/easements • Install autotransformers	2019/20 2020/21	$70,000 $1,700,000
Kurow to Ngapara 66 kV conversion Stage 2	• Purchase and install 66/11 kV transformers for Otekaieke/Duntroon • Test and commission line at 66 kV	2021/22 2021/22	$1,200,000 $100,000
Duntroon to Awamoko 66 kV	• Design, easements, studies • New 16km, 66 kV subtransmission line	2020/21 2022/23	$100,000 $3,000,000
New Awamoko Zone Substation	• Design, Geotech study, land purchase. • New 66/11 kV, 5/7 MVA rural substation in Awamoko area	2020/21 2022/23	$195,000 $1,800,000
Awamoko to Papakaio 66 kV line	• Design and procure easements • New 12.5km, 66 kV subtransmission line	2021/22 2023/24	$100,000 $2,350,000
Papakaio 66/33 Autotransformer	• Design and procure land • Install autotransformer at Papakaio substation	2021/22 2024/25	$100,000 $1,050,000
Papakaio to “Plains” 66 kV line	• Design and procure easements • New 12.5km, 66 kV subtransmission line	2021/22 2026/27	$100,000 $1,600,000
New “Plains” Zone Substation	• Design and procure land, Geotech study • Purchase transformer and install substation.	2024/25 2026/27	$300,000 $1,800,000
Ngapara to Awamoko 66 kV	• Design and procure easements • New 11.5km, 66 kV subtransmission line	2022/23 2025/26	$100,000 $2,200,000
66/11 kV line Five Forks to Maheno	• Design and procure easements • New 17km, 66 kV subtransmission line	2023/24 2027/28	$100,000 $3,200,000

6.4.3.2 Convert Ngapara - Duntroon to 66 kV (2019-2020)

Figure 64 - Convert Ngapara - Duntroon to 66 kV

This project will enable Ngapara Substation to be supplied from the Waitaki GXP via the 66 kV subtransmission network.

The existing 33 kV line was designed and constructed with future conversion in mind and will involve replacing existing 33 kV insulators and hardware with 66 kV equipment.

This project is required under all scenarios. If a new GXP is constructed at Livingstone or Black Point, it will be constructed at 66 kV and will require a 66 kV subtransmission network between Kurow and Ngapara.

Design will be completed, and materials ordered in 2018/19 and work will be programmed for completion in Autumn/Winter 2019.

Project Name	Components	Year (s)	Budget cost
Convert Duntroon to Ngapara to 66 kV	Reinsulate existing 33 kV line	2019/20	$330,000

6.4.3.3 New 66 kV Line from Waitaki GXP to Kurow (2020-2021)

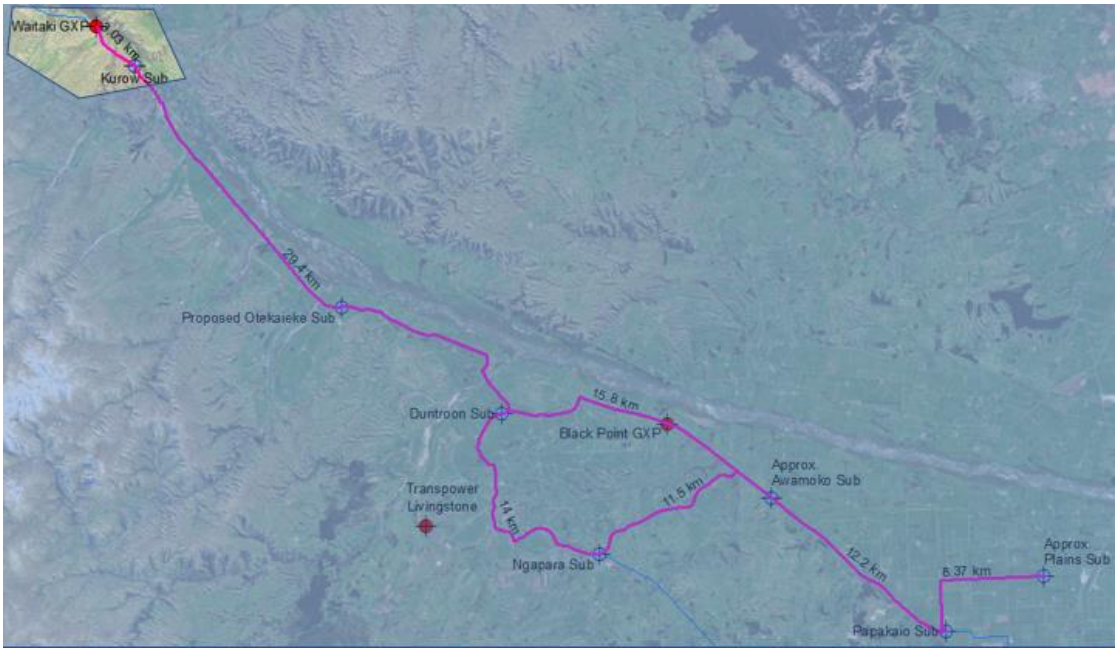


Figure 65 - New 66 kV Line from Waitaki GXP to Kurow

A second 3.3 km subtransmission line is to be constructed from Waitaki GXP to Kurow Zone Substation. This will be 66/11 kV construction and will be configured so that Kurow can be supplied from either line, and so that the subtransmission supply to Duntroon can bypass Kurow completely. A fibre optic cable will also be installed to provide protection functions.

This project was originally scheduled for completion in 2017/18 but has been placed on hold as it will not be required if a new GXP solution is selected as part of our present consultation with Transpower.

The design has been completed and this project has been moved to the 2020/21 period.

Project name	Components	Year (s)	Budget cost
66/11 kV Line from Waitaki GXP - Kurow	Duplicate 66 kV supply to Kurow	2020/21	$630,000

6.4.3.4 Kurow to Ngapara 66 kV conversion (2020-2022)

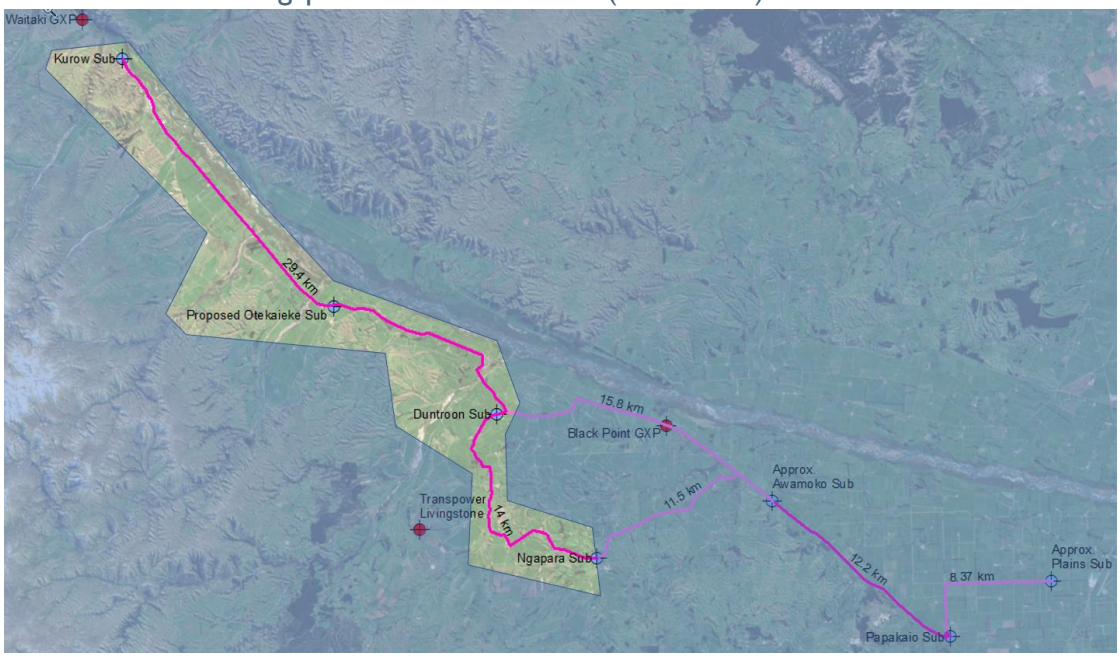


Figure 66 - Kurow to Ngapara 66 kV conversion

Stage 1

66/33 kV auto transformers will be installed at Kurow and Ngapara substations in Autumn/Winter 2020. This project will be required under all scenarios. If a new GXP is constructed at Livingstone or Black Point, we will require a 66 kV subtransmission network between Kurow and Ngapara.

Project name	Components	Year (s)	Budget cost
Kurow-Ngapara 66kV conversion Stage 1	Design work, land/easements	2019/20	$70,000
	Install Autotransformers	2020/21	$1,700,000

Stage 2

In Autumn/Winter 2020, Otekaieke and Duntroon zone substations will be taken out of service and their load supplied from Kurow and Ngapara substations.

New 66/11 kV transformers will be ordered to arrive early April 2021 and installed at Otekaieke and Duntroon during the Winter of 2021. This will allow conversion of the line between Kurow and Ngapara to 66 kV.

The line from Kurow to Duntroon will be re-commissioned at 66 kV and Ngapara substation will be re-supplied from Waitaki GXP, reducing the load on Oamaru GXP.

Project name	Components	Year (s)	Budget cost
Kurow-Ngapara 66kV conversion Stage 2	Purchase and install 66/11 kV transformers for Otekaieke/Duntroon	2021/22	$1,200,000
	Commission line at 66 kV	2021/22	$100,000

6.4.3.5 New 66 kV Line - Duntroon to new Awamoko substation (2022-2023)

Figure 67 - New 66 kV Line - Duntroon to new Awamoko substation

The growth in the Duntroon/Awamoko/Papakaio area is forecast to be consistent over the planning period, and the existing substations (Duntroon and Papakaio) and 11 kV feeders serving this load are becoming constrained. If either of these substation transformers has an outage it can be difficult to supply the peak load of these substations from neighbouring substations on the 11 kV network and this situation will worsen with time. We are also working with stakeholders to quantify potential irrigation load growth in the area, which will help us firm up the timing and location of new infrastructure.

Forecast load growth indicates that we will require a new zone substation in the Awamoko area in the 2022/23 period. The substation will be a 5/7 MVA single transformer rural type substation, with a primary voltage of 66 kV to allow direct connection to the Waitaki 66 kV supply. Distribution feeders in the area will be reconfigured to suit the new location and to shift the load on Awamoko Zone Substation from its neighbouring zone substations, Ngapara, Duntroon, and Papakaio.

A new 16 km, 66/11 kV subtransmission line will be constructed from the existing Duntroon substation, connecting Awamoko via the Kurow to Duntroon subtransmission network to the Waitaki GXP.

Project Name	Components	Year (s)	Budget cost
Duntroon to Awamoko 66 kV	Design, easements, studies	2020/21	$100,000
	New 66 kV subtransmission line	2022/23	$3,000,000
New Awamoko Zone Substation	Design, Geotech, land purchase.	2020/21	$195,000
	New 66/11 kV, 5/7 MVA rural substation	2022/23	$1,800,000

6.4.3.6 New 66 kV Line - Awamoko to new "Plains" substation (2023-2027)

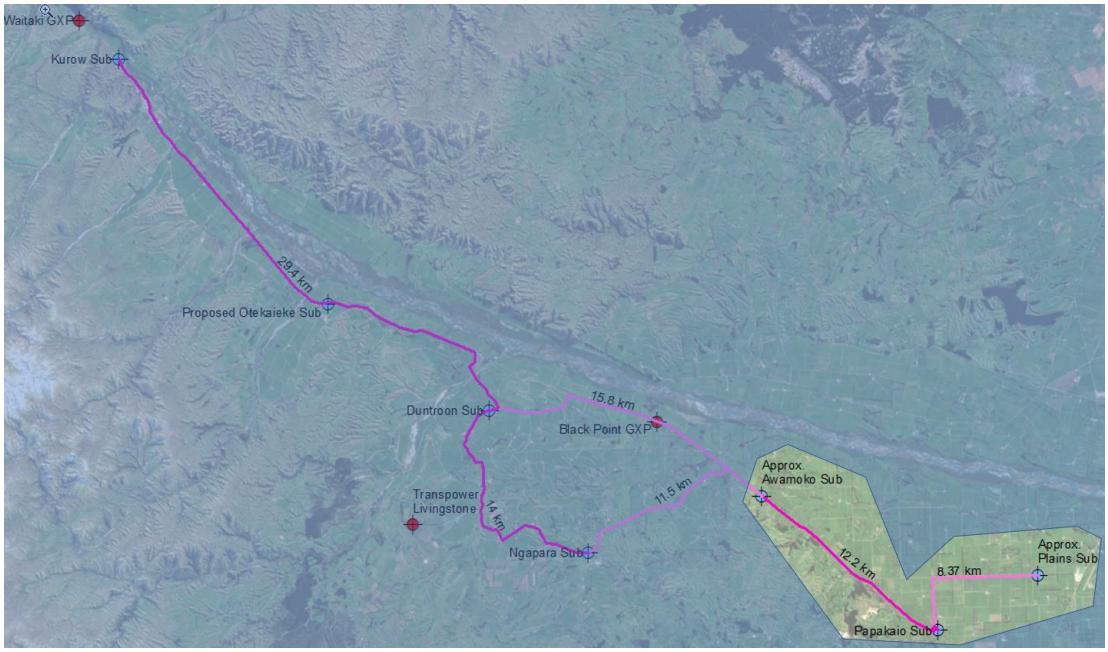


Figure 68 - New 66 kV Line - Awamoko to new "Plains" substation

Forecasts for the prudent load growth scenario in the lower Waitaki plains area indicate that Papakaio Zone Substation will reach its capacity limit between 2021 and 2022 and Pukeuri Zone Substation exceeding its firm capacity limit in 2025.

A new zone substation may be required in the "Plains" area to provide security to irrigation load. This will reduce loading on Papakaio and Pukeuri substations and further offload Oamaru GXP onto Waitaki GXP.

The new 12.5 km, 66/11 kV subtransmission line will be built from Awamoko substation to Papakaio substation where a 66/11 kV autotransformer will connect to the existing 33 kV subtransmission back to Oamaru GXP. The 66/11 kV subtransmission line will continue approximately 8.5 km to the new "Plains" substation (to be located in a position yet to be determined on the Waitaki Plains).

Project Name	Components	Year (s)	Budget cost
Awamoko to Papakaio 66 kV line	Design and procure easements New 12.5 km, 66 kV subtransmission line	2021/22 2023/24	$100,000 $2,350,000
Papakaio 66/33 Autotransformer	Design and procure land Install autotransformer at Papakaio substation	2021/22 2024/25	$100,000 $1,050,000
Papakaio to Plains 66 kV line	Design and procure easements New 66 kV subtransmission line	2021/22 2026/27	$100,000 $1,600,000
New "Plains" Zone Substation	Design and procure land, Geotech study Purchase transformer and install substation.	2024/25 2026/27	$300,000 $1,800,000

6.4.3.7 New 66 kV line – Ngapara to Awamoko (2025-2026)

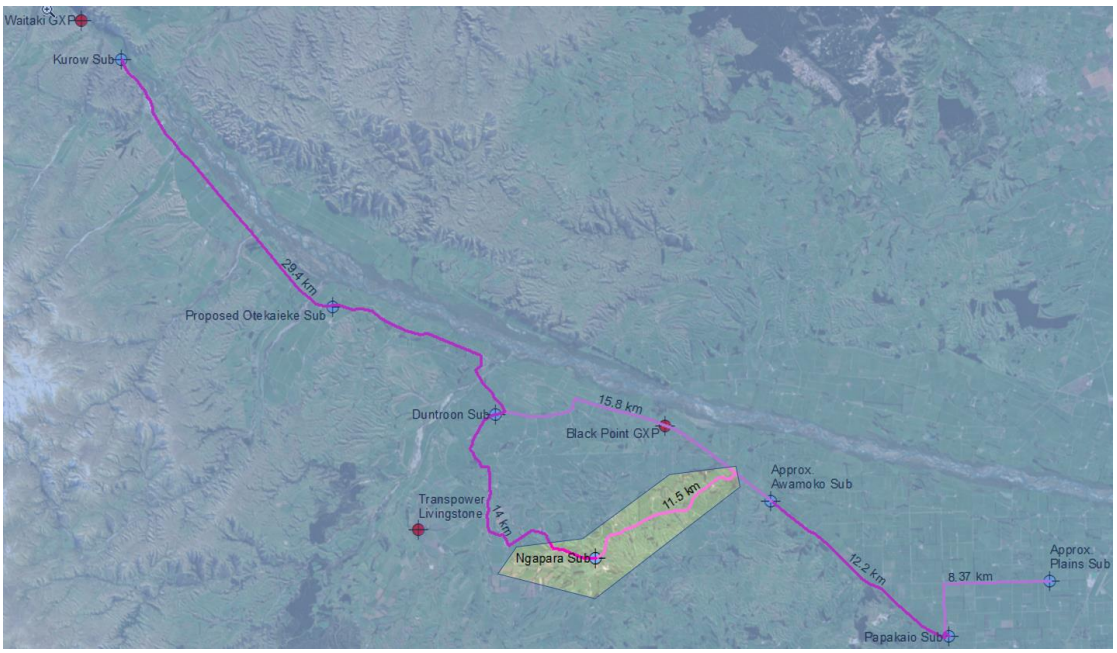


Figure 69 - New 66 kV line Ngapara to Awamoko

This 11.5 km 66/11 kV line will connect the new substation at Awamoko with the existing Ngapara substation and close the 66 kV Duntroon/Ngapara/Awamoko ring. This configuration will provide operational flexibility for the subtransmission supply in the area, with most circuits being able to be isolated to deal with a fault or planned maintenance without disconnecting load.

Project Name	Components	Year (s)	Budget cost
Ngapara to Awamoko 66 kV	Design and procure easements New 66 kV subtransmission line	2022/23 2025/26	$100,000 $2,200,000

6.4.3.8 New 66 kV line - Five Forks to Maheno (2027-2028)

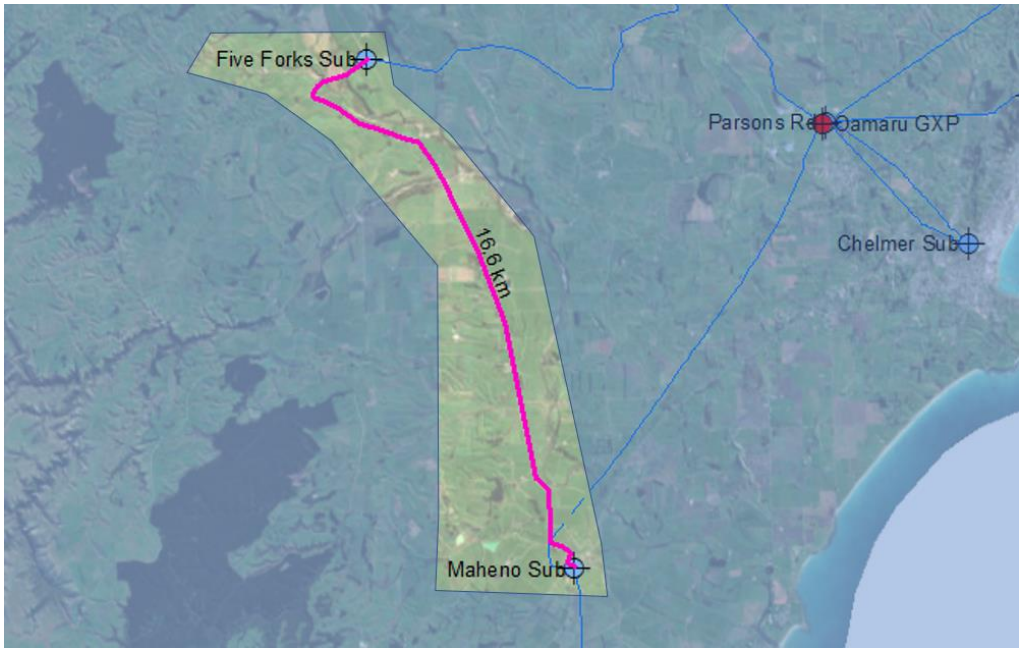


Figure 70 - New 66 kV line - Five Forks to Maheno

At present, an outage on the Weston-Maheno 33 kV line takes both Maheno and Hampden substations out of service. The load at Hampden cannot all be supplied via the 11 kV network from other zone substations due to excessive voltage drop.

A 17 km, 66 kV/11 line (operated at 33 kV) will provide backup to Maheno substation and allow Hampden to be supplied at 11 kV from Maheno in the event of a subtransmission fault between Maheno and Hampden.

Project Name	Components	Year (s)	Budget cost
66/11 kV line Five Forks to Maheno	Design and procure easements New 66 kV subtransmission line	2023/24 2027/28	$100,000 $3,200,000

6.4.4 Distribution development

6.4.4.1 Distribution expenditure summary

Table 40 - Distribution network development items

Project Name	Components	Year (s)	Budget cost
Install distribution transformers for growth	• Install 11 kV distribution transformers where required to account for growth. • Upgrade existing transformers	2019/20 2020/21 2021/22 2022/23 2023/24	$80,000 $80,000 $80,000 $80,000 $80,000
11 kV voltage regulators	• Install 11 kV voltage regulators on 11 kV feeders where cost effective to correct voltage issues	2019/20 2020/21 2021/22 2022/23 2023/24	$150,000 $150,000 $150,000 $150,000 $150,000
11 kV inter-tie upgrade	• Identify substandard, critical interties, and upgrade as necessary	2019/20 2020/21 2023/24 2024/25	$500,000 $500,000 $500,000 $500,000
Consumer Dependent developments			
New 11 kV feeder at Pukeuri	• Develop 11 kV network to support growth in Lower Waitaki Plains	2019/20	$370,000
New 11 kV feeder Redcastle substation	• Subject to increase in load at industrial site	2019/20	$600,000
New 11 kV feeder Kurow substation	• Subject to new irrigation scheme	2019/20	$100,000
Network upgrades Kurow/Duntroon	• Subject to new irrigation scheme	2019/20	$120,000

6.4.4.2 Install distribution transformers for load growth

The majority of load growth in our network is due to new irrigation projects, which typically have dedicated transformer assets. However, we are forecasting that a moderate number of transformers will need to be installed to deal with load growth. These will most likely be in the township areas, and will be identified by regular modelling of loads, and based on readings of maximum demand indicators (MDIs) of existing transformers.

6.4.4.3 Install voltage regulators

In the first five years of the planning period we are planning to install at least one set of 3 phase voltage regulators per year on the distribution network.

We have found regulators to be a cost-effective solution to provide voltage support where load growth has eroded the available distribution network capacity during an abnormal configuration, e.g. during a feeder tie situation while restoring power after a fault. This work will be coordinated in conjunction with the inter-tie investigation project and will improve our ability to minimise the effect of planned and unplanned outages.

6.4.4.4 11 kV substation inter-tie upgrades

Where once inter-ties between 11 kV feeders could be used year-round to provide backup between substations, we are increasingly running into capacity issues on these inter-ties when used during the irrigation season.

An investigation is underway to model the performance of the lines under maximum demand conditions to identify inter-ties that may not perform as required by our security standard. Remedial work will be carried out where risk assessment shows that it is cost effective.

It is likely that similar work will also be necessary in the second half of the planning period as growth eats into the spare capacity of substation inter-ties.

6.4.4.5 Consumer dependent developments

Various 11 kV distribution projects have been identified that are dependent on third party developments. Due to uncertainty in the projects they are provisional both in scope and budget. It is likely that if the consumer projects are given the go ahead the timing will place these in the first year of the planning period.

6.4.5 LV development plan

Our LV development plan has historically been based around response to consumer load growth. Typically, the only data collected for our LV network has been from transformer Maximum Demand Indicators (MDIs) which are recorded once each year. These are used for determining how heavily loaded the transformer is, but they can present false high readings when a transformer is loaded up due to its neighbour being taken out of service and the MDIs are not reset. Due to this and the aggregation of multiple load types, no meaningful load profiles can be derived from this data.

Emerging technologies such as electric vehicles, distributed generation, and battery storage have the potential to significantly change the load profile on our low voltage systems. The amount of the change is highly uncertain. To prudently determine the impact on our low voltage networks we need to start collecting data and monitoring the performance of our assets. This will allow us to develop a base-line of our existing load profiles and to optimise the timing and the quantity of any investment required.

We have completed a successful trial and are embarking on a program to install distribution transformer monitoring (DTM) on our larger urban transformers. Following a successful trial of 8 DTM units we plan to install 10 units per year starting with the larger urban transformers. We expect that once we gain familiarity with these devices and start using the data we will increase the rate at which we install these.

To model performance of the LV network below the transformer requires voltage and currents from the consumer end of the feeder. The ideal source of this data is the consumer smart meter.

To date, retailers have been reluctant to provide this information, so in the near future we will investigate other options to obtain this data.

Project Name	Components	Year (s)	Budget cost
Investigate LV consumer monitoring	Investigate setting up real time access to retailer data or installing duplicate meters at consumer locations.	2019/20	$10,000

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07. Non-network investment plan

7. Non-network investment plan

7.1 Asset information systems

Our Asset Management attribute, condition and operational information has been traditionally stored in a number of disparate systems and databases. We are well along in the process of integrating these information sources to our new GIS system. The new system is an ESRI product and provides a more flexible and easier to use analytic platform than the system that was previously in use.

7.2 Electric vehicle charging systems

In the 2016/17 works programme we installed high power electric vehicle chargers at Oamaru, Hampden, Kurow, and Omarama.

The purpose of this was to gain data and experience of the impact that electric vehicle charging may have on our network in the future.

The chargers are remotely monitored and usage figures since commissioning are shown in the graph below

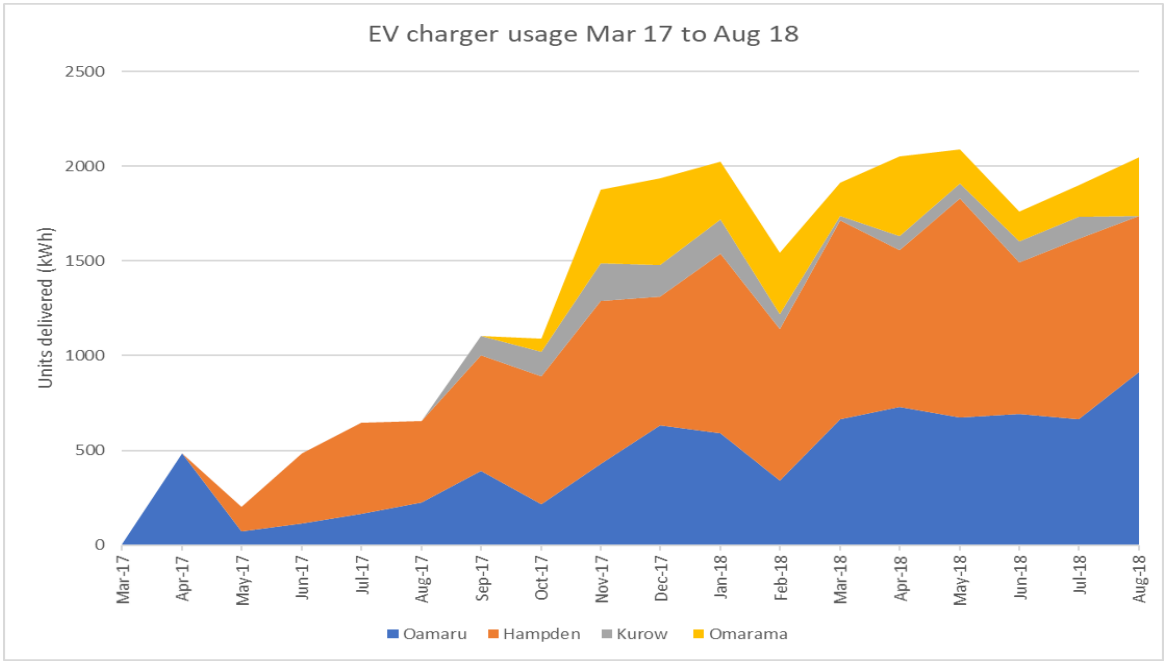

Figure 71- Energy delivery to electric vehicles via NWL rapid charger, March 17 to August 2018

This shows that electric vehicle use on State Highway 1 is growing steadily. The inland chargers at Kurow and Omarama have shown a reduction in energy delivered over Winter and we will be able to comment on trends on this route once data is available for the next Summer season.

In conjunction with data from other sources this charging information will help inform future revisions of the Network Development Plans.

08. Summary of expenditure forecasts

8. Summary of expenditure forecasts

The summary of our forecast expenditure for the planning period is shown in Table 41 and Figure 72, presented on the next pages. Figure 39, which shows renewals and maintenance expenditure by asset category and was originally presented in section 5.18, is also repeated here.

These forecasts are considered to be reasonably accurate for the first five years of the planning period, with the figures being indicative beyond that point. Many of our investment, maintenance and renewal decisions will be very dependent the outcomes of inspections in the first five years, consumer growth, and other issues that are currently out of our control, such as the development of the Transpower transmission network.

Table 41 - Summary of expenditure forecasts

Forecast Expenditure ($)										
Capital Expenditure	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
Consumer connection	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
System growth	3,320,000	3,455,000	2,680,000	5,730,000	3,180,000	2,110,000	2,960,000	4,160,000	3,960,000	760,000
Asset replacement and renewal	3,460,000	3,080,000	2,500,000	2,330,000	3,170,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000
Asset relocations	0	0	0	0	0	0	0	0	0	0
Reliability, safety, and environment: Quality of supply	1,132,000	735,000	659,000	339,000	329,000	229,000	189,000	159,000	159,000	159,000
Reliability, safety, and environment: Legislative and regulatory	480,000	480,000	290,000	290,000	10,000	10,000	10,000	10,000	10,000	10,000
Other reliability, safety, and environment	0	0	0	0	0	0	0	0	0	0
Subtotal Capital Expenditure	**9,642,000**	**9,000,000**	**7,379,000**	**9,939,000**	**7,939,000**	**5,839,000**	**6,649,000**	**7,819,000**	**7,619,000**	**4,419,000**
Operational Expenditure										
Service interruptions & emergencies	494,000	494,000	494,000	494,000	494,000	494,000	494,000	494,000	494,000	494,000
Vegetation management	599,000	599,000	599,000	599,000	599,000	599,000	599,000	599,000	599,000	599,000
Routine & corrective maintenance & inspection	1,131,000	928,000	928,000	928,000	928,000	908,000	908,000	908,000	908,000	908,000
Asset replacement & renewal	590,000	490,000	490,000	490,000	490,000	490,000	490,000	490,000	490,000	490,000
Subtotal Operational Expenditure:	**2,814,000**	**2,511,000**	**2,511,000**	**2,511,000**	**2,511,000**	**2,491,000**	**2,491,000**	**2,491,000**	**2,491,000**	**2,491,000**
Total Expenditure	12,456,000	11,511,000	9,890,000	12,450,000	10,450,000	8,330,000	9,140,000	10,310,000	10,110,000	6,910,000

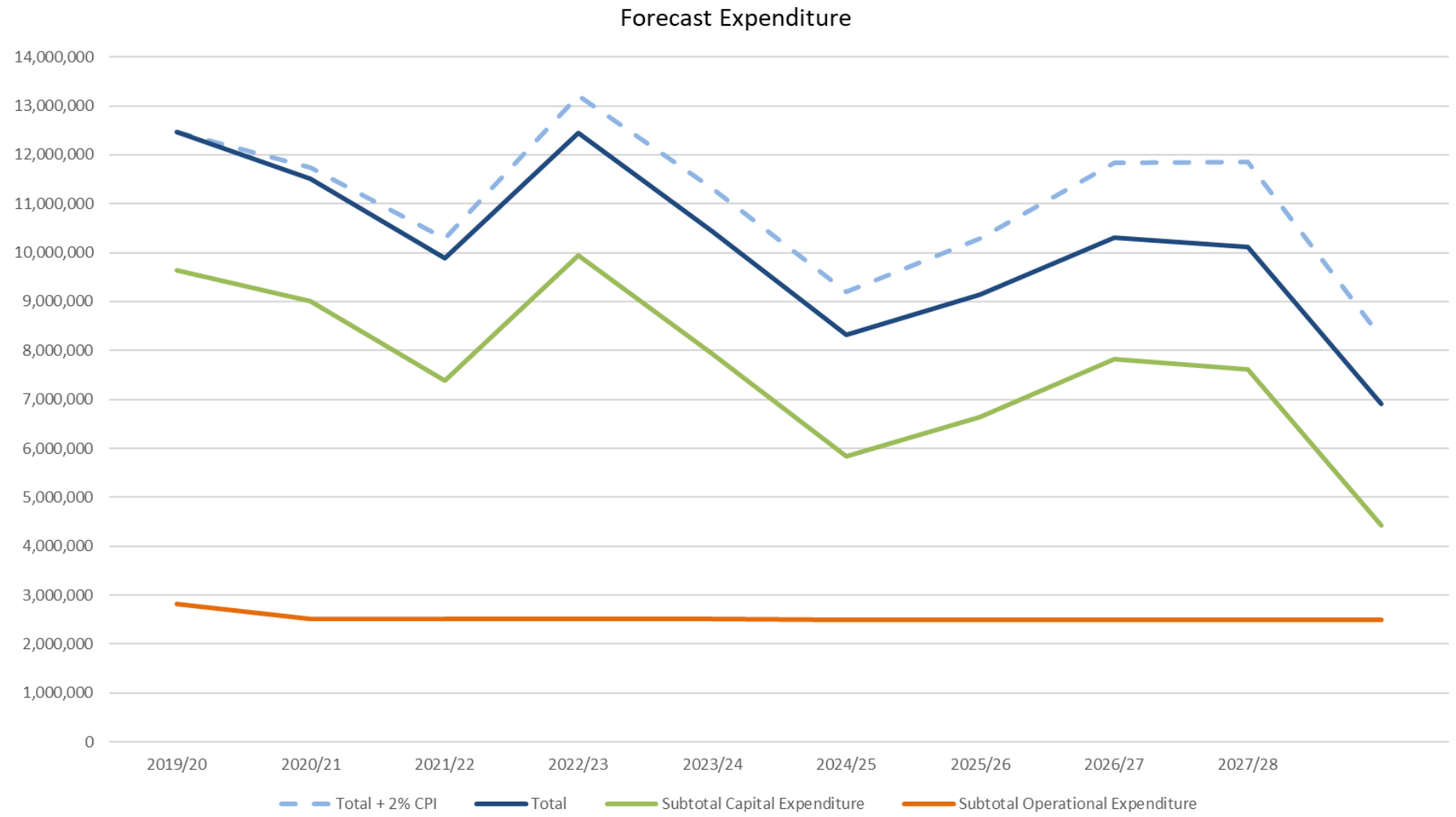

Figure 72- Summary of network expenditure forecast across planning period

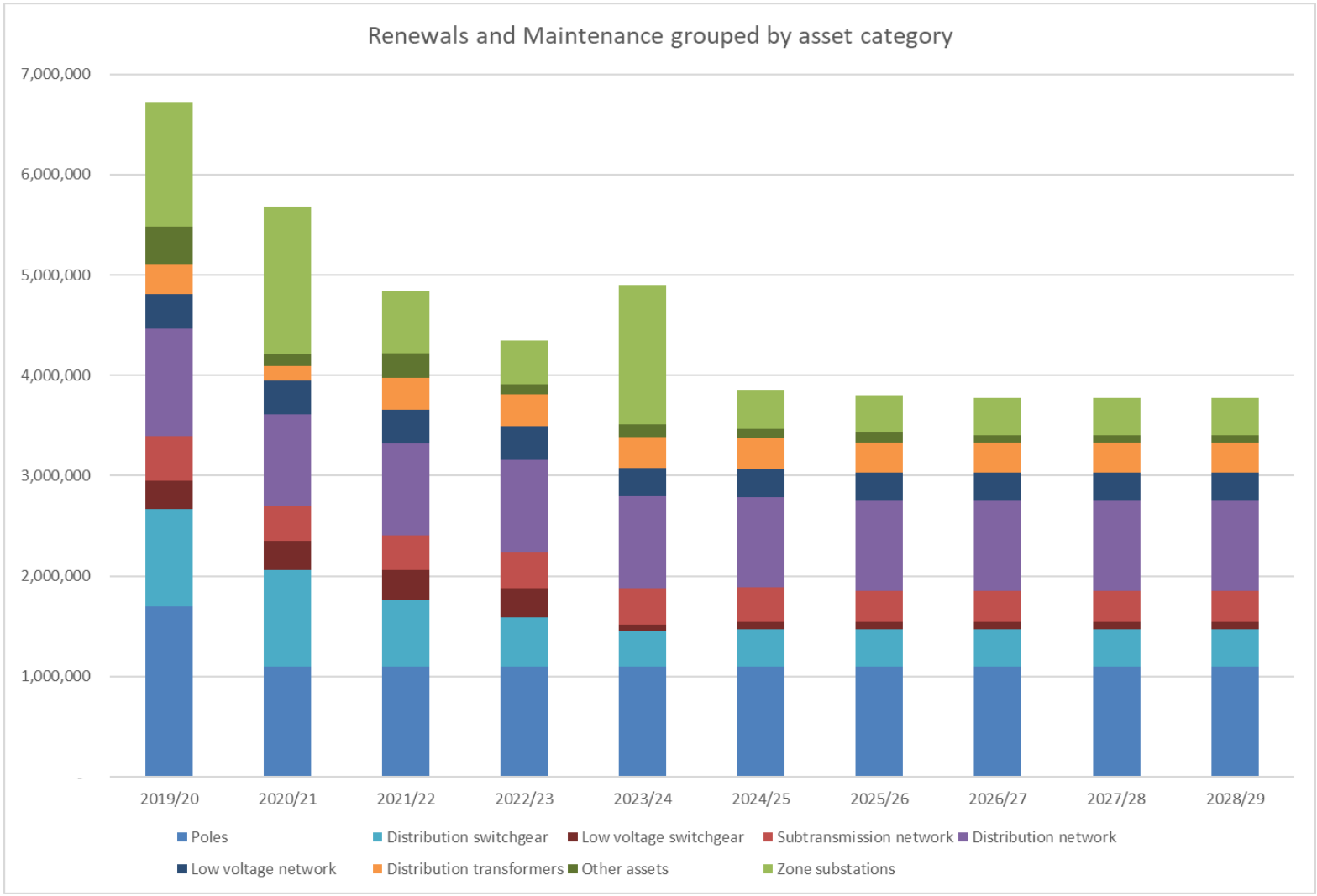

Figure 73 – Renewals and maintenance forecast expenditure by asset category (repeated from section 5.18)

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Appendices

09. Appendices

Appendix A - EDB Information Disclosure Requirements Schedule 13

Company Name	**Network Waitaki Ltd**
AMP Planning Period	**1 April 2019 – 31 March 2029**
Asset Management Standard Applied	**N/A**

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	Why	Who	Record/documented Information
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	2	We have an Asset Management policy approved by the CEO and reviewed by top management. It is available for staff in the policy section of the document library, and available to the public on the company website along with the AMP under the information disclosure section. Communication of the policy, and how it affects staff in their day to day work, is not as effective as it needs to be to warrant a score of 3.	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?	2	Key items in the Asset Management drivers are closely linked to stakeholder direction, such as the consumer surveys, and in some cases (such as the AMP) are subject to signoff from our board of directors. There is regular reporting on our asset management performance to stakeholders such as the board and the Consumer Trust. There is feedback through to modify the drivers where necessary, for example in 2017 the approach to consumer engagement and the content of the surveys was extensively overhauled with the intention of getting more actionable information. However, we cannot say that "all linkages are in place" to say that there is no missed opportunities to align internal strategies and policies with the asset management strategic focus, therefore cannot score 3 in this section.	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	There is a comprehensive range of planning, maintenance and inspection standards that reflect asset lives and characteristics. These are regularly updated according to the Document Control system. Recent work has shown that these are focussed on high risk and high value assets, and that there are gaps in coverage for "less important/less critical" assets.	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	The entry of new types of assets initiates the generation of policies and operating /maintenance documentation, based on industry practice and our specific circumstances. These plans reflect the expected lives, unique characteristics and recommended maintenance intervals for assets. However, there is still scope for the update and retroactive generation of this documentation for existing asset types.	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).

Company Name	**Network Waitaki Ltd**
AMP Planning Period	**1 April 2019 – 31 March 2029**
Asset Management Standard Applied	**N/A**

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.

Company Name	**Network Waitaki Ltd**
AMP Planning Period	**1 April 2019 – 31 March 2029**
Asset Management Standard Applied	**N/A**

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	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?	3	The AMP is available to the public, the wider staff, and the Consumer Trust on our website, or by calling into our offices. Many staff, including senior management and the CEO, as well as key contractor personnel are involved in the preparation and review of the AMP. Our Board approves our budgets and reviews and signs off on the AMP.	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?	3	The AMP is available to the public, the wider staff, and the Consumer Trust on our website, or by calling into our offices. Many staff and key contractor personnel are involved in the preparation and review of the AMP. Our Board approves our budgets and signs off on the AMP.	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.
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)	3	We are well resourced for our current Asset Management regime from an implementation point of view. Specific detail design and construction expertise will be contracted in as required. We monitor our workforce to identify gaps in training and competencies. We have been employing new trainees to build up staff levels to account for staff who are nearing retirement age. Resources are limited in the Asset Management and Network Planning areas of the business.	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	We have a comprehensive suite of Business Continuity Plans that cover asset failure, natural disasters and interruption to key processes. We review these plans at regular intervals, or when a specific event (such as the Christchurch earthquakes) causes concern. Our plans include working with external agencies such as the Police, Fire Service, and Civil Defence. Regular incidents such as cars hitting poles provide on-going training and opportunities to review plans. These plans have been developed as part of a wider risk management framework based on ISO 31000 that considers a range of mitigation measures.	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)

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.
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 (cont)

Question No.	Function	Question	Score	Evidence—Summary	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	Our management structure and company organisation are designed to remove silos and encourage cross talk between the different groups involved in the management of the network, from Engineering to FInance to Field services. The small size of the business and the culture of working together means that all members of the management team have involvement in asset management. Accountability for outcomes ranges from formal KPI's at an annual level, formal monthly management meetings after each Board meeting, to daily discussions of progress.	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	We discuss the ongoing works programme with our field staff in order to predict resource levels required for delivery of the plan. If resources are not available for a particular reason we will decide between contracting in extra resources, or rescheduling the work to fit around our existing workforce. We are actively recruiting trainees to safeguard succession as senior staff retire. Long term planning is still a challenge at times, and we are developing methods for improving this.	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.
42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	3	After each monthly Board meeting, our CEO presents the Board's feedback at a staff meeting. This meeting is supported by regular meetings amongst all staff to determine details of the works programs. Because we are a small company, communication is constant and managers work to remove any information barriers between staff.	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	We have a Contractor Approval Procedure, which allows to vet external contractors against our safety and skill requirements prior to them working on our assets. All external contractors are provided with all network Standards, Procedures etc, and their work is subject to inspections and completion audits. There is still opportunity to improve this area through the use of standardised contracts etc. to guarantee that all external interactions provide the highest levels of performance.	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)

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.
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	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)?	3	We are a small company and we have sought out staff with Asset management experience, and then provided further training. We are active in training staff, and engaging with other EDBs to find about best practice in the area of asset management.	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	NWL competence framework is detailed in document NC2004. This covers the field staff very well, but there is scope fir improving the coverage of other roles that are important to asset management. Induction, personal development/training and position descriptions are kept for all staff, and are reviewed for alignment with the requirements of the roles.	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?	3	We are a small company and our managers and senior personnel monitor the skillsets of their workers to help identify any training needs. Internal auditors compare the training records of staff against our requirements to keep on top of maintaining adequate numbers of staff with certain compentencies, and keeping up with training requirements. However, the outputs of the question above means that there is still room for improvement in this area to close gaps in the skillset of our staff.	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)

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 (cont)

Question No.	Function	Question	Score	Evidence—Summary	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?	3	We have put a lot of focus into providing work packs of a high standard to field services that are suitable for the safe and efficient delivery of our asset management tasks. We have an open door policy, whereby contracting staff are encouraged to dicsuss assigne3d tasks with engineering staff. This encourages the free flow of information from the field to the planners. However, there is evidence that there are still perceived to be barriers in effective communication between all levels of the business, and are working towards identifying ways to improve communication.	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	NWL has a comprehensive range of policies, standards and procedures that address all Asset Management activities. NWL also has a Safety management System in place, which requires a high level of document control. These documents are regularly revised and amended. Our understanding of best practice in asset management has revealed gaps which we were previously unaware of, and documentation is being developed to fill these, such as Asset Class Plans.	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.
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	We have focussed on upgrading our GIS and our works and asset management system to store useful asset information and to integrate and coordinate information, including external sources. The asset information that we capture into these systems is driven both by industry good practice (talking to peer EDBs, working from standards, using fit for purpose software platforms) and by local experience. We are developing methods to accurately capture field data direct to these systems, with several in test. The next major step is using the data in the systems for comprehensive, deep analysis of the lifecycle of our assets.	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	Our on-going inspections and pre-work site preparation provide confirmation that asset data is accurate. Field software is being adopted to maximise efficiency and reduce errors from the field.	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.
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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Asset Management Standard Applied	**N/A**

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	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	We have sized our asset management information systems to our foreseeable needs, based on industry good practice and by buying reputable products. We are still working with users to identify their ongoing needs, as developments continue.	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	Our risk management process is clearly documented in the AMP, and is based on the principles of ISO 31000. Operational risks are regularly reviewed. Compliance to regulatory requirements is reported to the Board each quarter. High focus risks are given special attention. Our PSMS, which includes asset risks, is audited to NZS7901 - we have consistently passed these audits. We are updating the PSMS to move from compliance to NZS 7901:2008 to NZS 7901:2014	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.
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?	3	Risk management is embedded in our day to day work , ranging from job safety analysis between stakeholders on a project to the "tail gates" and activities on site for a fault response. Feedback from these exercises can be directed either informally (via a conversation with an engineer) or formally (via meeting minutes, specific defects, or discussion at a management meeting).	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	We reference ENA & EEA newsletters, and notifications from the Commerce Commission and Electricity Authority. Each manager is formally made aware of their compliance obligations at monthly management meetings, and through the Complywith compliance software system that we have implemented in the last year. We have a culture of discussing potential non-compliances with the relevant authorities.	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.
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	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?	3	We have a comprehensive range of Policies, Standards and Procedures that address the entire asset life cycle from planning, design, construction, commissioning, operation, maintenance, renewal and removal. These policies are strictly controlled by a document management system, and are regularly reviewed.	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	We have a comprehensive range of Inspection and Maintenance Policies and Standards, programmes etc, to manage the implementation of asset management decisions. Complared to best practice we can improve the formal feedback loops that will verify that successful outcomes are consistently occurring. Business change is managed via a change management system.	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	We have clearly specified AM objectives, primarily Reliability and Safety, but also including other measures such as Works Programme progress and financial performance. These measures are continually assessed against targets by respective managers, with action taken to correct variances. These measures are informally reported to the CEO daily, and formally to the Board each month. We are developing improvements in how the capture and use of this data adds value to the asset management process.	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).
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	We use the Incident Cause Analysis Method (ICAM) to investige incidents where the potential for harm or major damage was high. We are developing Root Cause Analysis skills and practices to ensure that lessons can be captured from all incidents. Defects that are raised in our defect database are assigned an owner, who is responsible for managing the return of the asset to a compliant state. We are working towards ensuring that the lessons learned during the closeout of incidents are adequately processed through into all of our asset management systems and policies. Resource levels are holding back development	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)

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.
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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Asset Management Standard Applied	**N/A**

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	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))?	3	We have a document management system in place that specifies regular review and amendment of specific Policies, Standards, Procedures etc. The audit requirements for the Safety Management System overlapped some of the AM procedures. We subscribe to the PowerCo standards system, which provides extra expertise in certain technical areas.	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	Asset failure, or incipient failure from and inspection is recorded and communicated via our defects database. Defects are assigned owners who are responsible to return the asset to compliant state. We are working towards the discipline of Root Cause Analysis, and the improving the consistency of actions taken in response to an assert failure. While we can guarantee that all staff have safety first and foremost, closely followed by consumer supply issues, it is likely that in some cases we are missing opportunites to improve how we manage our assets due to lack of post incident feedback.	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
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?	3	We apply continuous improvement across all areas of the business. Our safety requirements and asset practices are regulalry updated to meet or surpass good industry practice. Maintenance and Inspection standards are written to ensure that the risk of in-service asset failure is minimised. We subscibe to the NEDERs equipment failure database, and incorporate information on failures into our practices. We track costs against various categories of work which allows the monitoring of performance against planning.	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	We activley monitor external sources of advice or comment such as the EEA and engage with other EDB's and suppliers and manufacturers on latest practice and equipment. We are actively using data from the NEDERs asset failure database to inform our asset management practice. Design staff are involved in industry forums in their area of expertise. We encourage staff to talk with colleagues in other companies and industries, and invite vendors to demonstrate and discuss new techniques and technologies. We actively trial new technologies to verify the utility for our operation. We engage with forums and businesses that are outside our traditional peers in the electrical industry, such as working with District Councils on our GIS project.	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)

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.
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.

Network Waitaki
Powering North Otago

SCHEDULE 17

Certification for Year-beginning Disclosures

Clause 2.9.1

We,

Christopher John Dennison,
Anthony James Wood,

being directors of Network Waitaki Limited certify that, having made all reasonable enquiry, to the best of our knowledge-

a. The following attached information of Network Waitaki Limited prepared for the purposes of clause 2.6.1, 2.6.3 and clause 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.

Christopher John Dennison

Anthony James Wood

DATED: 25 March 2019

Network Waitaki Limited
10 Chelmer Street
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