ASSET MANAGEMENT PLAN

For Period 1 April 2013 to 31 March 2023

27 MARCH 2013

This document has been prepared by WEL Networks Ltd to meet the information disclosure requirements under Part 4 of the Commerce Act for EDBs.

ASSET MANAGEMENT PLAN

WEL NETWORKS LTD

Planning Period: 1 April 2013 to 31 March 2023

Disclosure Date: 31 March 2013

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WEL BOARD OF GOVERNANCE STATEMENT FOR THE 2013-2023 ASSET MANAGEMENT PLAN (2013 AMP)

This document, which presents the Asset Management Plan (AMP), has been prepared for the following purposes:

- To enable WEL to provide the required level of services cost effectively through the creation, operation, maintenance, renewal and disposal of assets to meet the needs of existing and future customers.
- To provide a working document for use by WEL in conjunction with other detailed planning and implementation processes and activities as described herein.
- To provide stakeholders with the level of information required to make an informed judgement as to the extent that WEL's asset management processes meet Best Practice criteria.
- To satisfy the "Electricity Distribution Information Disclosure Determination under Part 4 of the Commerce Act for 1986".

This AMP was approved at the March 2013 Board Meeting by the WEL Board of Directors. It covers a period of 10 years from the financial year beginning 1 April 2013 until the year ending 31 March 2023.

John Spencer
Chairman

CHIEF EXECUTIVE'S STATEMENT

The primary purpose of WEL Networks Ltd (WEL) is to deliver customers in the Waikato a safe, reliable and cost effective supply of electricity. Our aim is to be responsive to our customers' needs, both for their current electricity supply and meeting their future requirements.

It is imperative that a detailed Asset Management Plan is in place given the long life nature of our assets. By listening to our customers, by benchmarking with other New Zealand lines companies and by learning about trends overseas, WEL has established a number of objectives for the management of our assets and these are detailed in the Plan.

At a high level the following points are important.

1. In compliance with the Disclosure Requirements this plan provides extensive information about WEL's asset planning and management.
2. In recent years we have had an ongoing programme of improving network-wide reliability (measured by SAIDI) and have made significant capital investment to drive our reliability towards a target of achieving a result within the top quartile of lines companies. This Plan recognises an ongoing and increased commitment to asset replacement expenditure on rural overhead lines, an ongoing programme of seismic upgrades of key substations and additional communication system upgrades to modernise and improve the resiliency of our control and protection systems.
3. A network-wide SAIDI target does not recognise challenges in parts of the network, particularly in some rural areas. We have introduced a new target to ensure that the repeat number of outages per customer is below prescribed levels.
4. This Plan recognises the importance of asset renewal and the methodologies to ensure that the optimal life is achieved from our existing assets with the introduction of condition based risk management analysis techniques.
5. This Plan adheres to a "top down" approach to network planning. This starts at the bulk transmission level. There have been capacity and quality upgrades at the Hamilton Grid Exit Point and a new GXP at Huntly. Continued enhancements include upgrades at the Te Kowhai and Hamilton GXPs. The 2013 AMP shows a strong emphasis on demand management and other commercial arrangements.
6. There is continuing economic growth in the Waikato which requires ongoing capital investment to maintain security of supply. We have a programme of meeting with and surveying customers, to ensure that their needs are best met going into the future. WEL is planning to spend $364m during the planning period on capital works which reflects a significant economic investment in the future of the Waikato.
7. This Plan includes WEL's commitment to the smart grid technology rollover programme including "Smart Boxes" being installed at customers' premises through the WEL Network area.

8 As is typical with long term plans looking out 10 years into the future, there are uncertainties around the projected spend. Cost estimates for the first two years of the plan are based on identified projects, costs will vary as scopes are defined and/or consent conditions prescribed. Overall the cost profile has an increasing level of variance. The first two years reflect certainty of scope and costs, towards the three year milestone there is an estimated variance of 10%. Over the latter part of the plan the defined projects are still subject to definition and a variance of 20% can be expected. This Plan therefore gives an indication of future spend requirements, but there are significant variables associated with the actual costs and timing of major projects.

We hope you find the Plan informative and we welcome your comments on it. Comments can be emailed to huazhuo.lin@wel.co.nz

Dr Julian Elder

Chief Executive

Photo 1 Te Uku Windfarm

WEL NETWORKS ASSET MANAGEMENT PLAN

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ASSET MANAGEMENT PLAN 2013

For period 1 Apr 2013 – 31 Mar 2023

Photo 2 Live Line Pole replacement 2012

1. EXECUTIVE SUMMARY

1.1. Background and Objectives

This Asset Management Plan (AMP) is prepared for the following purposes:

- To enable WEL to provide the required level of services cost effectively through the creation, operation, maintenance, renewal and disposal of assets to meet the needs of existing and future customers.
- To provide a working document for use by WEL in conjunction with other detailed planning and implementation processes and activities as described herein.
- To provide stakeholders with the level of information required to make an informed judgement as to the extent that WEL's asset management processes meet Best Practice criteria.
- To satisfy the "Electricity Distribution Information Disclosure Determination under Part 4 of the Commerce Act for 1986"

WEL seeks to apply international "Best Practice" asset management and planning processes integrated with strategic business plans and goals. The core business drivers for this are derived from WEL's Vision and Mission statements:

Providing high quality, reliable utility services valued by our customers whilst protecting and enabling our community.

Strap Line: Best in Service, Best in Safety.

Key Business Areas (Mission)	Objectives	Core Business KPIs
Security of Supply	Operate a safe and sustainable network	Acceptable company risk profile
		Health and Safety - Lost time injury accidents; zero public safety accidents
		Load Factor
Reliable network	Deliver reliability to meet or exceed customer expectations	SAIDI for urban and rural customers
		Urban Customer Repeated Interruptions
		Rural Customer Repeated Interruptions
Profitability	Grow the underlying profit and create value	Surplus After Tax
		ROI
Lower costs	Deliver costs in line with the top quartile of lines companies in NZ	Costs Per Customer
		Delivery Efficiency
Industry leader	Be progressive	Customer Services Satisfaction
		Capability and Employee Engagement Index

Table 1 WEL's Core Business Key Performance Indicators (KPIs)

Asset Management Systems and Processes

The relationship between Corporate Strategic Drivers and Asset Management is shown in Figure 1.

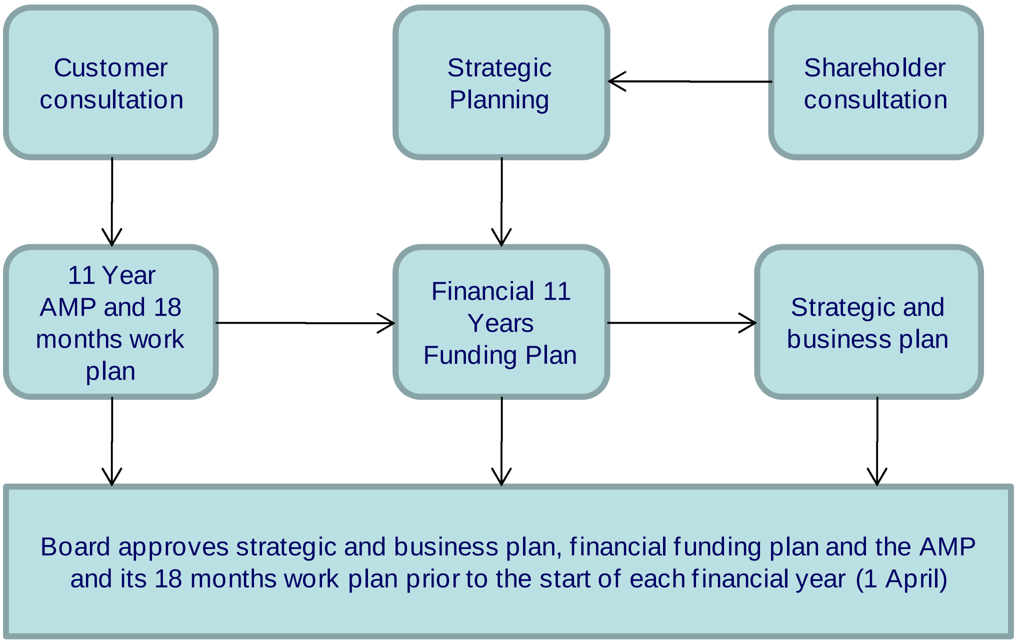


Figure 1. The link between Corporate Strategic Drivers and Asset Management

Key information systems include:

- GIS
- NMS with integrated SCADA and added load management system
- Outage Management System within NMS including Trouble Call System
- Smart box metering and asset management data (SSN Headend) service
- ICP Database
- Load Flow and Analysis Software tools
- Protection Database
- SAP Enterprise Resource Planning (ERP) system
- Vegetation Management Database

Systems are integrated to provide a cohesive asset management system.

1.2. Assets Covered

WEL Distribution Area Description

WEL supplies power to the North Waikato region which includes the population centres and surrounding rural areas of Hamilton City and the towns of Raglan, Gordonton, Horotiu, Ngaruawahia, Huntly, Te Kauwhata and Maramarua. The WEL supply area is predominantly agricultural in nature and the land is largely flat to rolling with areas of peat and some moderately steep country. Below is a map of the WEL Networks coverage area.

WEL also owns and operates subdivisions in the greater Auckland, Taupo, Wellington and Christchurch regions.

Figure 2. The WEL Networks area

1.3. Service Levels

WEL's goal is to provide a quality product to all consumers. WEL defines quality as "providing a network that is safe, reliable and fit for purpose". Quality is measured by the following safety and reliability indicators.

Customer Surveys

Regular summits are held with major industrial and commercial customers. Reliability and other issues are discussed, with a specific focus on the price quality trade-off. In addition to the summits, top energy consumers are contacted on a regular basis to ascertain their views on supply. The top 50 energy consumers are visited regularly and surveyed at least once a year.

Safety

WEL places primary importance on safety. As such, safety practices are chosen to be consistent with industry best practice.

- The Health and Safety performance of the organisation is measured by a combination of lead and lag indicators.
    - The lead indicators include:
        - the number of near misses reported;
        - the number of audits conducted by the field services manager and the supervisors; and,
        - the number of pre-qualified contractors in capital works projects.
    - The only lag indicator used in this scorecard is the number of days lost due to lost time injuries.
- In combination with the above, Lost Time Injury Frequency Rate (LTIFR), Total Injury Rate (TIR) and Average Time Lost Rate (ATLR) are also used as measures. The target is for all employees to go home every day safe.
- Key controls are:
    - Design Standards;
    - Restricted access to dangerous equipment;
    - Field staff and contractors using safe work practices; and
    - Adequate electrical protection systems to cut the power to potentially dangerous situations

Reliability

Reliability is an essential performance indicator. Appropriate levels of reliability are determined by combining customer survey results with benchmarking studies and by taking implementation costs into account.

Reliability can be measured in a number of ways. WEL uses the following indicators to measure reliability performance:

- Number of Faults per 100km of circuit
- System Average Interruption Duration Index (SAIDI)
- System Average Interruption Duration Index (SAIDI) for urban customers
- System Average Interruption Duration Index (SAIDI) for rural customers
- System Average Interruption Frequency Index (SAIFI)
- Customer Average Interruption Duration Index (CAIDI)
- Maximum outage duration for each outage

- Number of interruptions
- Customer Repeated Interruptions

The strategic targets to March 2018 of 70 SAIDI minutes and 1.30 SAIFI meet customer expectations, as derived from customer surveys while focusing on improvement for rural area customers.

Operating Efficiency – Cost per Customer

Cost per customer (CPC) is applied as the operating efficiency measure. WEL's strategic goal is to deliver costs in line with the best quartile of lines companies in New Zealand. The target for the 2013/14 financial year for CPC is $253. WEL has significantly improved the maintenance programme in the last few years. SAP now records condition assessments, inspection results and maintenance records. This significantly reduces our compliance risks, but has added to our operating spend through increased levels of granularity of asset data.

Delivery Efficiency – Billability and Productivity

WEL has introduced measures of "billability" and "productivity" to ensure that our workforce is effectively and efficiently delivering the approved capital and maintenance programme.

"Billability" is defined as the hours charged to jobs divided by the hours paid to the field staff. Only time spent working on the job is chargeable with non-working time such as annual leave, sick leave, training, meeting attendance and waiting in the yard being excluded.

"Productivity" is defined as the planned labour costs divided by the actual labour costs (including subcontractors' costs).

The target for the 2013/14 financial year for billability and productivity is 80% and 95% respectively. The strategic targets for 2017/18 are 80% and 95% respectively.

Asset Efficiency – Load Factor and Asset Utilisation

WEL faces two emerging risks to the business:

- Investment Return Risk

  The return achieved for the large investment in the network could be compromised if certain changes occur within the network. An example of this would be increased use of distributed generation which could significantly change the energy and load flows around the network.

- Risk of a Shrinking Business

  Several trends threaten to divert revenue from us which would reduce income and could strand some assets.

Traditional network planning is based on system peak demand. However, the line revenue is mainly from total energy consumption. Load factor is a measure of the relationship between peak demand and energy used and is an indication of asset utilisation efficiency.

WEL's long term objective is to achieve a load factor above 60%.

Asset utilisation is defined as the ratio of peak load divided by the installed capacity of the asset and is a measure of effective investment. For example, for a transformer the asset efficiency is the peak load as a percentage of the installed transformer capacity. All assets must be able to carry the transient, daily, weekly and seasonal peak loads therefore asset utilisation will always be less than 100%. This measure is known as "capacity utilisation". WEL's long term goal is to deliver asset utilisation to be within the best three lines companies in New Zealand. WEL has set a capacity utilisation target to maintain or exceed 38.1%.

Low Voltage Complaints

WEL records all low voltage complaints (LVCs). The total number of LVCs and the details of each are monitored to determine the quality of supply. A process has been put in place to identify the root cause of each LVC. WEL's aim is to reduce the number of LVCs that WEL is responsible for and to respond to all customer requests promptly. Initiatives include the installation of Smart Boxes and load monitoring devices on distribution transformers, which will assist in identifying power quality issues before they reach unacceptable levels.

1.4. Network Development Planning

WEL is committing to a high level of Capital Expenditure (CAPEX) to meet growth, maintain security levels and quality of supply and regulatory requirements.

Our network development projects recorded in this document are extensive and include:

- Capacity upgrade at the Transpower Hamilton GXP
- Integration of the Transpower 33kV and 11kV supplied networks
- Capacity upgrade at the Transpower Te Kowhai GXP
- Extensive new 33kV sub-transmission and existing sub-transmission network upgrade
- Northern network development
- Two new zone substations
- Extensive distribution 11kV cabling
- Extensive zone substation upgrade programme (with transformer shifts between them)
- POS and zone substation security
- Smart networks
- Safety, LVC, and relocation compliance issues
- 11kV and LV cable augmentation and interconnections
- 900 sections of subdivision reticulation and 240 new infill connections per annum
- Undergrounding
- Extensive asset replacement programme
- Protection and communication upgrades and development

Demand forecasting, demand-side management, generation and load management form part of the process to develop appropriate network solutions. The deployment of smart grid technology on an advanced metering platform will be central to our plans to defer investment in a new GXP. This opportunity was identified in 2010; the benefits of deferred investment have been captured in this Plan along with further refinement of the GXP solution (to the extent that a new GXP will not be necessary until well beyond the end of this planning period).

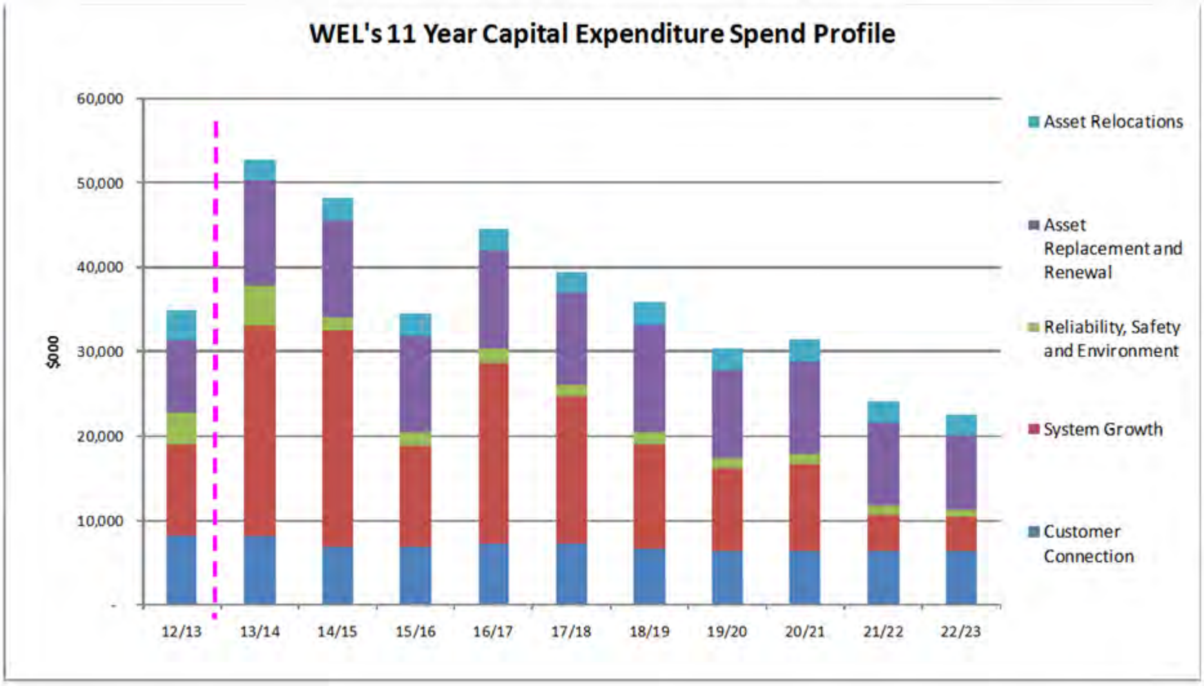


Figure 3. Capital Expenditure Projection for AMP Period.

1.5. Life-Cycle Asset Management Planning

WEL's maintenance and renewal expenditure over the next 10 years will ensure the asset base meets customer security requirements and WEL's business objectives.

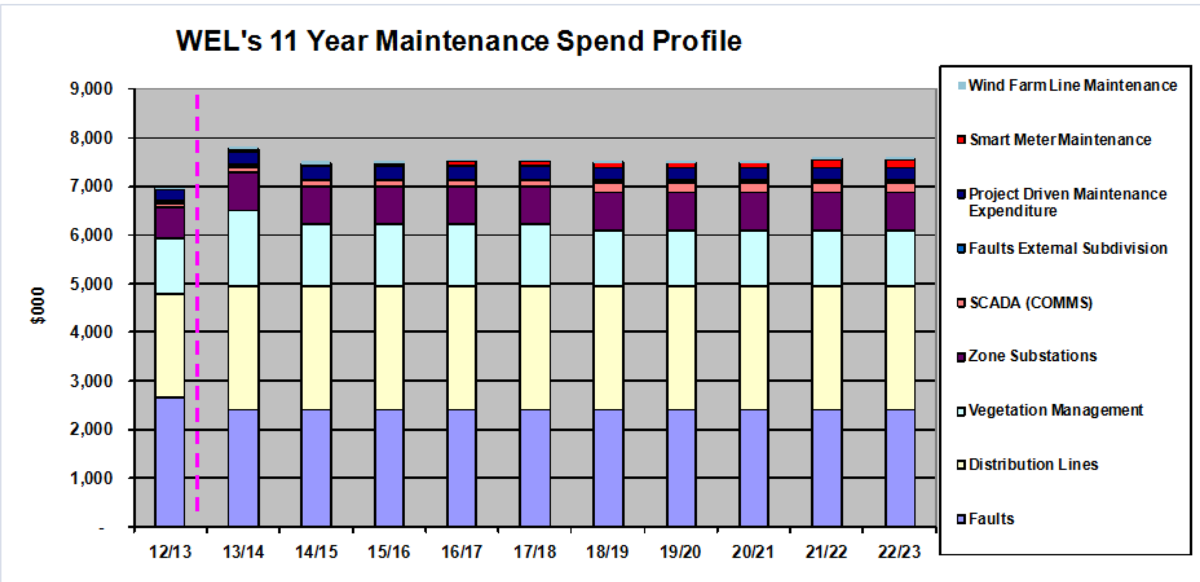


Figure 4. Maintenance Expenditure Projection for AMP period.

Maintenance techniques employed include Root Cause Analysis (RCA) and Failure Mode Effects and Criticality Analysis (FMECA).

A long term asset renewal strategy has been established with increasing attention being paid to asset replacement management. An asset renewal plan has been developed to ensure the continued high performance of in-service network assets, in particular older assets, through refurbishment and replacement strategies for each class of asset. The programme identifies the need to continue to renew assets to allow service levels and customer expectations to be met. WEL has initiated the development of Condition Based Risk Management (CBRM) starting from Ring Main Unit (RMU) and 11kV overhead conductors including its associated poles and crossarms.

The decision to undertake replacement of an asset is based on age as well as the following factors:

- Performance evaluation
- Asset condition monitoring
- Level of refurbishment, maintenance and operating cost
- Historical failure statistics
- A risk assessment associated with deferring asset replacement expenditures
- Smooth out costs in consideration of availability of resource
- Optimising the asset replacement spend profile in consideration of overall capital spend profile

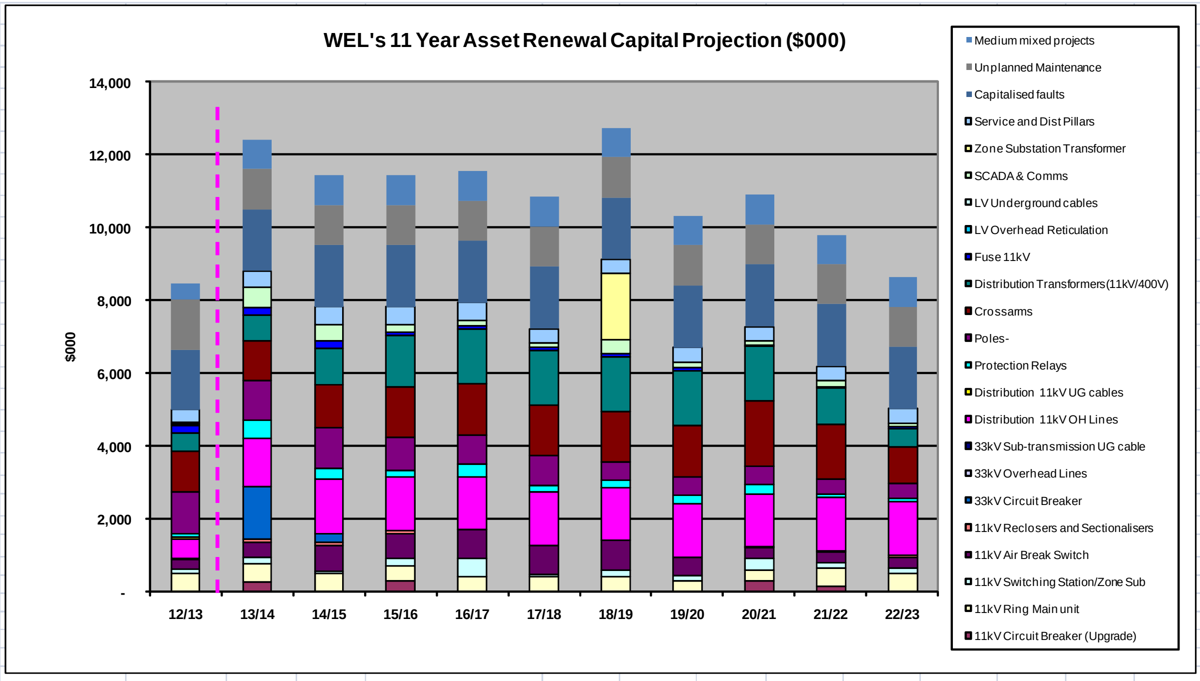


Figure 5. Asset Renewal Expenditure Projection for AMP Period

1.6. Demand Management

In assessing load growth WEL has made the following assumptions about demand management:

- Progressive impact from introduction of network intelligence
- Future electricity pricing is likely to be structured to influence customer management of demand
- Home efficiency initiatives by central government are likely but the impact will be incremental over many years
- Technology will be used increasingly to manage demand (e.g. Smart Boxes) and also to make plant, equipment, appliances and living space more efficient, for example the increased use of heat pumps.

WEL has initiated a project to introduce Smart Boxes. These Smart Boxes provide customers with better information about power consumption and appliance running costs and are expected to gradually bring about modifications to customer behaviour by:

- Encouraging lower power consumption choices
- Encouraging the purchase of more efficient appliances
- Enabling increased utilisation of time-of-use tariffs

The impact of these factors is assumed to be gradual and the demand forecasts have been adjusted, taking into account a newly introduced target to reduce peak demand growth by 10% through the introduction of Smart Boxes. This reduction will be achieved through development of time-of-use tariff charges within a year and through incentives to capture additional load control participation.

1.7. Risk Management

WEL has a clearly defined Risk Management Policy, which is published on the company intranet. This Policy and supporting procedure identifies risk management as a core management responsibility and outlines in broad terms the emphasis given to this in both the day-to-day and longer-term facets of managing the assets and overall business. A detailed description of how WEL manages risk is provided in Section 7.

1.8. Performance Evaluation

WEL monitors performance through a variety of measures which include:

- Overall actual Capital Expenditure matched against AMP forecast
- Maintenance Expenditure matched against budgeted forecast
- The gap between Network Development Programme targets and delivery
- Service Levels and Asset Performance for safety, reliability and other performance measures
- Low Voltage Complaints received and the number proven for comparison

Performance gap analysis and improvement initiatives have been put in place.

1.9. Best Practice

WEL's asset management practices are aligned with the following industry best practice standards:

- PAS 55 Publicly Available Specification for the Optimised Management of Physical Assets and Infrastructure
- International Infrastructure Management Manual 2006 (IIMM)

2. BACKGROUND AND OBJECTIVE

2.1. Purpose of The Plan

This Policy is based on WEL Networks Ltd (WEL) Vision and Mission Statements.

The primary purpose of WEL Networks Ltd (WEL) is to meet the needs of existing and future customers by providing a safe, reliable and acceptably priced supply of electricity by means of the creation, operation, maintenance, renewal and disposal of assets. The following are the WEL Asset Management Policy objectives that relate to WEL's primary purpose:

- *The installation, operation, and maintenance of network, plant and other assets with the aim of achieving best practice levels of reliability, resiliency and safety and the efficient long-term utilisation of assets;*
- *The development of the network structure to meet current and future performance expectations;*
- *The establishment of appropriate asset management systems and processes to advance the strategic needs of the Company; and*
- *The generation of sufficient asset based revenue to support the long-term operation of the business.*

The Asset Management Policy requires that WEL assets should be planned, designed, constructed, operated, maintained, renewed and disposed of in an efficient manner which:

- *Complies with regulatory and statutory requirements;*
- *Meets current and future reliability and quality performance expectations cost effectively;*
- *Maintains and renews WEL assets and adopts appropriate methodologies to ensure that optimal benefit continues to be derived from existing assets;*
- *Achieves appropriate financial returns on assets;*
- *Supports Waikato economic growth while still maintaining WEL security standards;*
- *Supports the infrastructure development of the Waikato area by sharing costs with other entities;*
- *Accords with the risk management framework adopted by WEL; and*
- *Bases asset management decisions on the full evaluation of all alternatives - evaluation that takes into account full life cycle costs as well as safety, resiliency, environmental, sustainability, social and economic benefits and risks.*

This Policy has my full support, as well as that of the Board of Directors.

All WEL staff, suppliers and contractors have a role to play in effectively implementing the WEL Asset Management Policy. WEL expects that all staff will give the policy their full support.

Dr J M Elder

Chief Executive

November 2012

2.2. The Period Covered by The Plan

This AMP was approved at the March 2013 Board Meeting by the WEL Board of Directors. It covers a period of 10 years from the financial year beginning 1 April 2013 until the year ending 31 March 2023.

The AMP provides the capital and maintenance expenditure projections for the next 10 years from 1 April 2013. The projects and costs in year 0 (current financial year) have been modified to reflect the up to date forecast. The projects and costs in year 1 and year 2 are very certain, year 3 to year 6 are reasonably certain, whilst years 7 to 10 have a high degree of uncertainty due to unpredicted external factors, particularly new technologies such as embedded generation and smart networks.

2.3. Corporate Planning Interaction

WEL's Vision and Mission

Providing high quality, reliable utility services valued by our customers whilst protecting and enabling our community.

Strap Line: Best in Service, Best in Safety

WEL's Focus

Our focus is on:

- Secure Supply - operating a safe and sustainable network
- Reliable Network – delivering reliability and quality to meet or exceed customer expectations
- Profitability – growing the underlying profit and creating value
- Lower Costs - delivering costs in line with the best quartile of New Zealand lines companies
- Recognition as an industry leader – being progressive

Best practice asset management and planning processes are integrated with strategic business plans and goals. Refer to Section 2.7 for a discussion of Best Practice.

The following core business drivers are derived from WEL's Vision/Mission statement.

WEL's Core Business Performance Drivers

WEL's asset management practices are consistent with the company Vision/Mission statement and are aligned with Public Available Specification (PAS 55) and other best practices. Our aim is to provide the required levels of service at least cost.

WEL seeks to:

- Provide a network that will meet future demands safely and reliably through understanding of; electricity volumes, energy demands, asset lifetime requirements, new technology, commercial arrangements, optimal maintenance and replacement programmes, assessment of risk and reliability, safety of network operation, capital improvement, use of skilled labour and appropriate materials, and ensuring an ongoing commercial return
- Continually improve reliability through a segmented customer approach by understanding and educating customers on the price/quality trade-off, delivery of reliability expectations and targeting the worst performing network components
- Deliver efficiency and performance through improving processes, operating a performance based organisation and aligning with industry benchmarks
- Improve customer service

Photo 3 Otorohaea Repeater January 2012 (new mast)

Photo 4

Key Business Areas (Mission)	Objectives	Core Business KPIs
Secure Supply	Operate a safe and sustainable network	Acceptable company risk profile
		Health and Safety - Lost time injury accidents; zero public safety accidents
		Load Factor
Reliable network	Deliver reliability to meet or exceed customer expectations	SAIDI, SAIDI for urban and rural customers
		Urban Customer Repeated Interruptions
		Rural Customer Repeated Interruptions
Profitability	Growing the underlying profit and creating value	Surplus After Tax
		ROI
Lower costs	Deliver costs in line with the top quartile of lines companies in NZ	Costs Per Customer
		Delivery Efficiency
Industry leader	Be progressive	Customer Services Satisfaction
		Employee capability and engagement index

Table 2 WEL's Core Business Performance Drivers

Relationship between Corporate Strategic Drivers and Asset Management

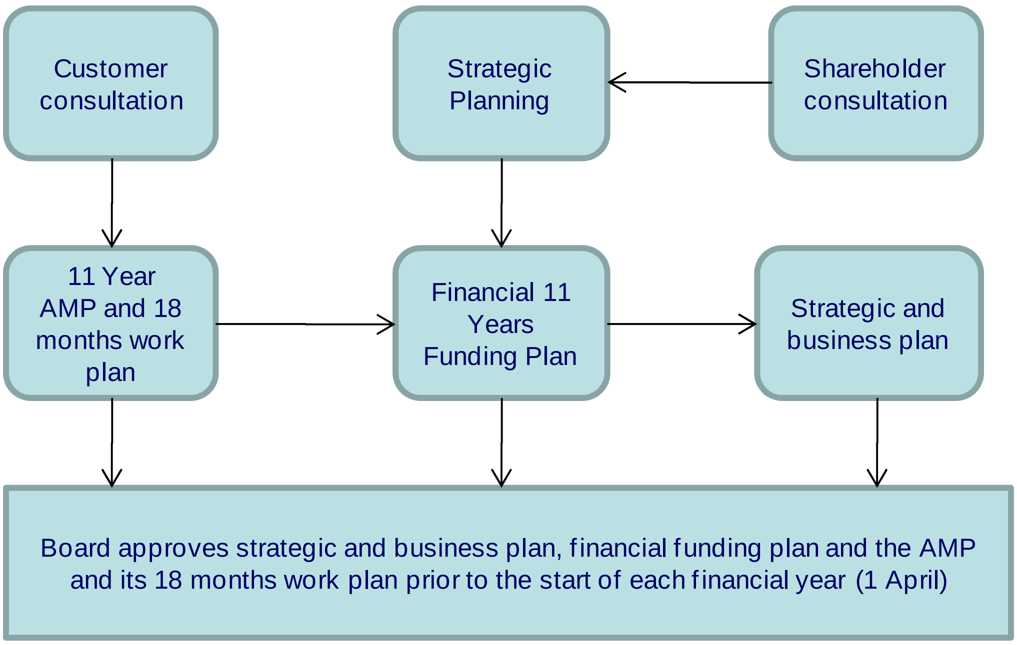


Figure 6. The link between Corporate Strategic Drivers and Asset Management.

- Our Asset Management Planning is a key component of WEL's strategic planning process to ensure that the level of service required by consumers is provided by us at the lowest life cycle cost
- The objective of asset management strategies and practices is to optimise asset management decisions through a full evaluation of all alternatives - evaluation that takes into account full life cycle costs as well as environmental, sustainability, social and economic benefits and risks while considering "do-nothing" and non-network options
- Optimised and prioritised asset management decisions are captured in the AMP to set long term network development and maintenance objectives
- Optimisation requires quality information recorded in effective management systems and appropriate processes to interpret and act on the information in order to make sound decisions
- The AMP provides the capital and maintenance expenditure projections for the next 10 years. The AMP is a critical input into the Strategic and Business Planning process; the 18 month work plan is produced from this
- Our AMP spending profile forms a core part of funding requirements to be considered during the strategic planning process
- The Company's strategic planning process interacts with the development of asset management strategies and objectives
- The governance activity and approvals occur prior to implementation and operation
- Business performance is reported back to the Board each month

Photo 5 Preparing a pole mount transformer for installation

2.4. Stakeholder Interests

WEL is owned by a community trust, the WEL Energy Trust. The WEL Energy Trust has a 100% shareholding, on behalf of the community, in WEL Networks Ltd.

The Trust was formed in 1993 and continues until 2073, unless terminated sooner if its purpose is completed. It is a consumer elected body (currently with seven Trustees) and elections are held every three years. The next election will be in June 2014.

The Trust appoints the Board of Directors, who in turn appoints the Chief Executive. Stakeholders and their requirements are formally identified during the annual strategic planning process.

The Trust agrees strategic KPIs with WEL, which include measures around asset management.

Strategic Stakeholder Requirements by 2017/18				
SHAREHOLDER	**CUSTOMER**	**BOARD/MANAGEMENT**	**COMMUNITY**	**STAFF**
▪ Enterprise value ▪ Price increases to be in line with inflation ▪ "Keep the lights on" for customers ▪ Long term sustainability of the business ▪ Ensure the company has a good reputation and is seen in a superior light by the community ▪ Invest in growth opportunities and seek increased value ▪ No regulatory breaches ▪ Engage with consumers on discount	▪ Quality and reliability ▪ Customer service ▪ Fair pricing ▪ Price/quality to manage customer expectations	▪ "Keep the lights on" ▪ Increase profit by growth and improving efficiencies ▪ Manage business risk by seeking unregulated opportunities ▪ Minimising regulatory constraints ▪ Efficient operation ▪ Operate within financial capacity ▪ Maintain the integrity of the network with prudent investment ▪ Productive staff ▪ Safe working environment ▪ Adopt appropriate advances in technology ▪ No regulatory breaches ▪ Influence on the regulatory reset ▪ NPAT	▪ Operate our business with due care for the environment ▪ Maintain health and safety of the public ▪ Understand and help meet the needs of the community	▪ Good place to work ▪ Fairly rewarded ▪ Development opportunities ▪ Safe working environment ▪ Seeking to add value

Table 3 Stakeholder Interests

In addition to the stakeholders identified above, WEL works closely with other industry participants, namely Transpower and Electricity Retailers, particularly in relation to planning and network development and to ensure quality supply is delivered to customers. WEL also works with local bodies and governmental agencies to meet regulatory requirements.

Stakeholder interests are accommodated by applying the following key tenets to Asset Management:

- Maintaining a clear focus on providing a safe and high quality service to customers
- Achieving levels of reliability which meet customer expectations on reliability and price derived from customer consultation process
- Balancing the needs of Shareholders, Customers, Retailers and Users
- Effectively managing risk
- Achieving excellent returns by improving operating efficiency and optimising investment decisions
- Making WEL the place staff want to be a part of

Prioritisation of Interest between Stakeholders

WEL has a clear hierarchy of stakeholder requirements which is embedded in various policy, planning, corporate and contractual documents. This hierarchy provides clarity in managing conflicts of interest.

WEL has clear policies and procedures in line with legislative requirements. WEL recognises the importance of public safety as well as staff safety. Safety is not negotiable and all other interests are secondary.

Consumer Requirements

WEL invests considerable effort in establishing what interested parties require in terms of price and quality. Major customers have direct access for any issues or questions they may have, whether this is concerning price versus quality or if they wish to increase their load.

For the “Mass Market”, WEL conducts annual customer surveys to assess views on the trade-off between price and quality by the following market segments:

- Urban Residential
- Urban Commercial
- Rural Dairy and Business
- Rural Residential / Lifestyle

The following list prioritises our response to competing and potentially conflicting demands for lower prices while maintaining (or in some cases improving) reliability in this area:

1. Deed of Trust (shareholder requirements) – the requirements of this document provide for the long term protection of the asset for the ultimate beneficiaries and ensuring staff and public safety
2. Contractual requirements – we abide by the terms of contracts we have entered into
3. Consumer requirements for price and quality – we aim to meet our published service levels
4. Company requirements for investment

Where a conflict arises that is not related to safety, the management team will review the factors and present options to the Board.

Where a conflict cannot easily be resolved, expert opinion will be sought and a conflict resolution process entered into.

2.5. Asset Management Accountabilities and Responsibilities

Responsibility for asset management occurs on several key levels: governance by the Board of Directors, executive management, planning and field services implementation.

Governance is provided by the Board of Directors through:

- Annual review of the five yearly strategic plan
- Annual review and approval of the AMP and 18 month work plan
- Annual review and approval of the business plan and budgets
- Individual project approval
- Monthly review and decision-making on required actions that vary from original plans

In addition the Board receives the following information as appropriate at Board meetings:

- A capital project progress report with an overview and detailed information on individual major capital projects
- Project close-out reports
- A detailed reliability report with an explanation of outages that incur more than 0.5 SAIDI minutes
- A report on Transpower peak demand achieved versus budget
- A report on customer complaints
- A report on voltage complaints
- A report on the performance framework for reliability and a corrective action plan for improvement

All reports are produced by management. WEL has structured its business with the five divisions of Corporate Services, Asset Management, Operations and Customer Delivery, Commercial Management and Human Resources shown in Figure 7 - Executive and Functional chart.

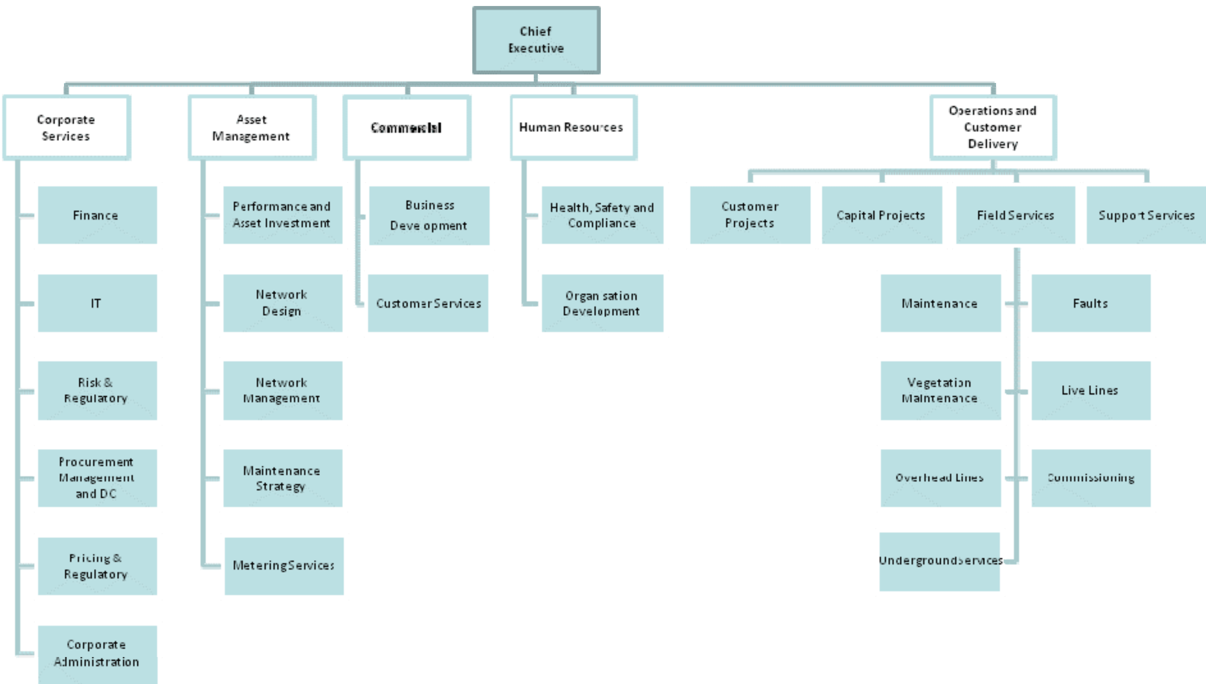


Figure 7. WEL's Executive and Functions

The Asset Management team has overall responsibility for management of the network assets. This includes ensuring that the assets are developed, renewed, maintained, operated and used on a long term sustainable basis to meet the needs of all stakeholders. Within the Asset Management division there are five teams. Their key responsibilities are summarised below:

Managers	Key Asset Management Outcomes
Performance and Asset Investment	• Optimised WEL asset management plan and annual work plan • Works programme management • Ensure overall delivery of asset performance outcomes • Direct asset valuation and maximise utilisation of assets • Ensure business management systems are in place including process, system and information
Network Management	• Long term network development to meet network safety, security and reliability standards, including long term load forecast • SCADA/NMS, network automation, Smart Grid and communications • Manages the successful operation of WEL Control Centre • Consenting and Resource Management
Network Design	• Design management to provide a central design service for internal and external customers • Approve designs for design works provided by external contractors • Prioritise the options and provide recommendations to ensure optimal asset investment decision
Maintenance Strategy	• Optimise maintenance strategy, develop and implement maintenance standards, policies and procedures and produce maintenance programs • Optimise asset replacement spend profile and associated works programme
Metering Services	• Optimise the potential benefits arising from the WEL Smart Boxes deployment by leading the development of a competitive and technically sound consumer premises metering data service business function

The Operations and Customer Delivery team has overall responsibility for the delivery of the approved capital and maintenance work plan while meeting the following requirements:

- Meeting safety standards to ensure public and staff safety
- Meeting WEL's adopted quality standards including the Maintenance Standard and the Design and Construction Manual
- Meeting programme timeframe requirements
- Delivering cost effectiveness and efficiency
- Collecting asset data in a timely and accurate manner

Within the Operations and Customer Delivery division there are four teams. The main objectives for service delivery are:

Managers	Key Asset Management Outcomes
Customer Projects	• Ensure quality customer services
Field Services	• Effective and efficient fault response and repairs to minimise outage duration • Delivery of the approved maintenance programme, asset replacement programme and customer driven projects • Delivery of agreed capital projects
Capital Project Management including construction services	• Delivery of the approved capital programme and major customer driven projects
Support Services	• Ensure planning and delivery effectiveness and efficiency • Ensure timely and quality data collection

The approved annual capital and maintenance programmes are used to maintain a work plan for field operations.

The aim of the work plan is to provide enough work volume in advance (ideally three to six months) to ensure resources are used effectively and projects delivered efficiently to time, budget and quality. Materials are supplied by the WEL Distribution Centre. Supply chain management principles have been applied for the selection of material suppliers, materials purchase and Distribution Centre operations.

Detailed design packages and estimated costs are produced using WEL's Comparable Unit Estimation (CUE) tool. Monthly cross–functional reviews monitor performance against the plan.

WEL is now set up as a largely self sufficient business with in-house consenting and project management and delivery. Maintenance, faults and capital asset replacement works are delivered by WEL's own Field Services staff. Major capital projects and specialised communications work continue to be largely carried out by external contractors. Specialist services such as complex design and architectural services are contracted out as required.

2.6. Asset Management Systems and Processes

WEL Master Process Architecture

WEL uses a number of management systems and processes for complete management of the asset. The relationship between Corporate Strategic Drivers and Asset Management is shown in Figure 6.

WEL has been focussed on continuous improvement with a process re-design project starting in 2003, with the following objectives:

- Improved effectiveness and efficiency
- Informed decisions regarding organisation structure
- Formalisation of ad hoc arrangements
- The development of a common understanding on how WEL works
- The identification of specific gaps and bottlenecks in key processes
- Consistency throughout the organisation

The result of this project was the establishment of WEL Networks Master Processes – a series of high level processes that describe WEL as a business. The re-design created eleven master processes. The following master processes have been defined:

- Asset Investment Strategy
- Business Development
- Business Support
- Contract Strategy and Management
- Corporate Governance
- Operate and Restore
- Performance Management
- Revenue Management
- Strategy and Business Planning
- Staff Development
- Works Delivery

The overall architecture of the WEL master processes is shown in Figure 8. WEL is currently reviewing the architecture of the master processes. It is potentially to add end to end Customer Services Management as an additional master process to enhance customer services.

Each master process is described by a hierarchy of three levels. It has a set of inputs, and a process, which generates a set of outputs. It is demonstrated in Figure 9 and Figure 10 below:

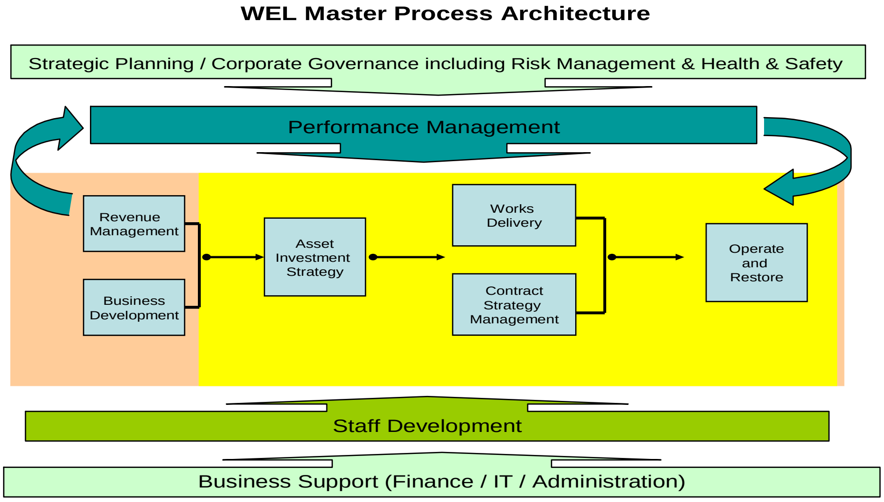


Figure 8. The Master Process Architecture

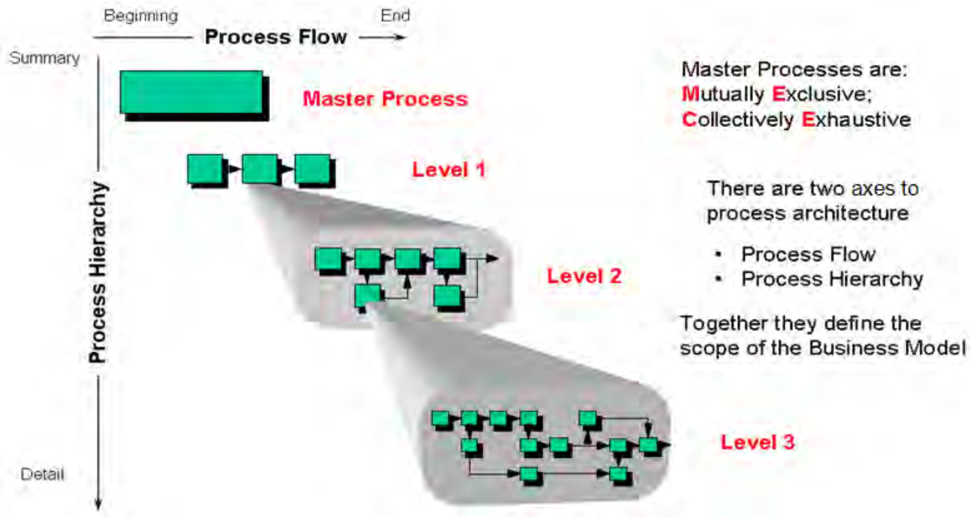
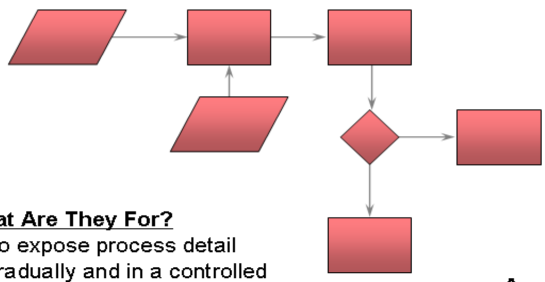


Figure 9. Master Process explanatory diagram



What are They?
Process maps are graphical representations of processes, showing the sequence of process steps, developed for a specific purpose and from a selected viewpoint

What Are They For?
- To expose process detail gradually and in a controlled manner.
- To encourage conciseness and accuracy in describing the process.
- To focus attention on process interfaces/hand-offs.
- To provide a powerful process analysis and consistent design vocabulary

Are They Necessary?
Process maps are essential tools for understanding, analysing, and ultimately improving processes. They provide a graphical representation that bounds a process and translates its flow into a common medium/language that everyone can follow

Figure 10. The Master Process Level 1, 2 & 3 Demonstration

High Level Asset Management Planning Process Interaction

The Asset Investment Strategy Process is used for asset management planning. The relationships between the high level processes within the Asset Investment Strategy Process are shown in the following diagram:

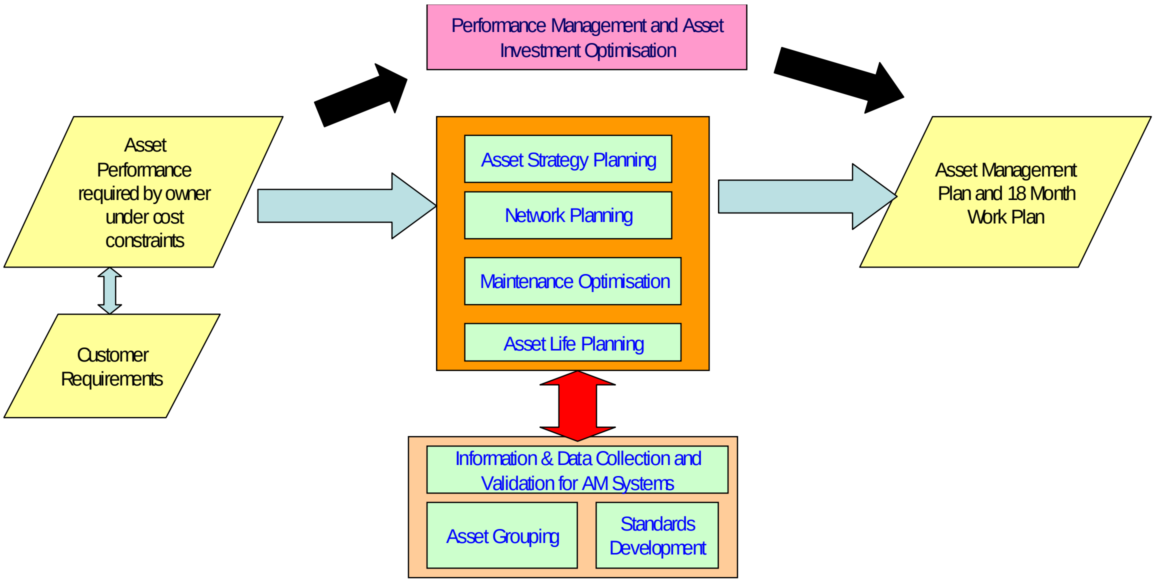


Figure 11. Interaction between high level asset management planning processes

A description of the main sub-processes shown in Figure 11 is given below:

Asset Strategy Planning

This process generates and evaluates high-level investment and maintenance strategies, and confirms these strategies with the Asset Owner.

Network Planning

This process develops project plans and optimises them with consideration of cost, performance and risk, to produce both the Asset Management Plan and Work Plan.

Maintenance Optimisation

This process develops maintenance plans and optimises them with consideration to cost, performance and risk, to produce both the Asset Management Plan and Work Plan.

Asset Life Planning

This process pulls asset data together into cohesive plans for the life of a given asset or group of assets, considers the Opex/Capex trade-off and combines these into an overall Asset Life Plan.

Information and Data Collection and Validation for AM Systems

This describes the process, rules and conventions regarding the definition, capture, storage and validation of asset data.

Asset Grouping

This describes the process, rules and conventions regarding the creation and manipulation of assets into groups for efficiency and other purposes.

Standards Development

This describes the process, rules and conventions regarding the standards required to manage the network.

Asset Strategy Planning, Network Planning, Maintenance Optimisation and Asset Life Planning form the core decision making components of Asset Investment Strategy. They reflect the planning process by starting at high level strategies and long-term projections that develop through the planning process to specific detailed plans for short-term activities (example Work Plan) and the long term plan (AMP). The Asset Life Plans form the backbone of the planning process.

Asset Grouping, Standards Development and Information and Data Collection and Validation support sub-processes to this planning loop by providing rules and conventions around the asset data and network standards.

Alignment between performance requirements is required to optimise the overall Asset Management Plan and 18 month work plan.

Asset Inspections and Network Maintenance

The maintenance strategy for each class of equipment comes from the Maintenance Optimisation process. This process uses RCM techniques and other sources of information to develop possible maintenance strategies. The costs and benefits are evaluated to choose the optimal strategy for the particular class of equipment. The maintenance strategies for all the equipment classes are consolidated and an assessment is made on whether this will deliver the desired level of network performance and reduction of risk.

Periodic Maintenance and Condition Assessments

Periodic maintenance activities and condition assessments are developed into Job Plans within WEL's Computerised Maintenance Management System (CMMS). These job plans specify the maintenance tasks and provide estimates of the cost and resource requirements. The Job Plans are linked in CMMS with individual items of equipment and set the plan execution period for Preventative Maintenance (PM). Work orders are generated at required intervals to perform the maintenance activity. Once the work has been completed the actual costs and condition assessments are recorded back in the system against the jobs.

All of these PM tasks in total form the routine maintenance works plan.

Faults

Faults are managed within CMMS in a similar way to routine maintenance. Work orders are created automatically from a fault call. A more detailed work order structure may be developed in larger fault situations where multiple items of equipment require repair or replacement. Actual costs are recorded against each equipment item and failure codes are recorded.

Root Cause Analysis (RCA)

RCA is used as a reactive (continuous improvement) technique to follow up on all incidents. RCA is compulsory for all faults which have a SAIDI impact of more than 0.3 minutes, any Transpower faults which cause a loss of supply to WEL, any 33kV faults, any defective equipment, or any events due to human error.

A team reviews all incidents regularly (generally weekly) and the root causes are identified. The team will investigate the fault and recommend repair work for the immediate problems and also recommend an approach to minimise the class of fault in the future. A risk impact assessment is used to determine the urgency of action. The required actions are set up as work orders in the CMMS against the individual items of equipment and scheduled as required. The work performed and actual costs are recorded against the equipment item.

Network Development Projects

The routine monitoring and investigation activities performed by Network Planning staff serve to identify areas of improvement on the network. Those performing the real time operations role and those working in the field are again a good source of ideas for network improvement. WEL has implemented SAP, a software application which allows these and other parties to record new network development opportunities.

Ideas for new capital or maintenance projects are entered into SAP where all technical options, benefits and costs can be analysed.

Projects are ranked according to score. Given the ranking and the importance of each project an assessment is made on which projects should proceed in the next financial year. Those projects are included in the preliminary capital works budget and presented to the Board for approval. For projects that receive final Board approval a detailed project definition document is produced by the Network Design Manager. The project is then handed over to the Capital Projects or Field Services Project Managers to implement the project.

Network Performance Measurement

Network reliability affects customers more than any other network performance indicator. WEL has developed an internal process called "Data Collection & Validation Process for Reliability Performance Data". This process ensures quality and integrity of data used to calculate HV outage performance figures such as SAIDI, SAIFI and CAIDI and its sub-measures.

Key Asset Management Systems

WEL strives to excel in the management of its assets. A number of computer based systems support this endeavour, the most significant of which are described below.

Refer to APPENDIX 1 Glossary of Terms for a definition of acronyms.

Geographic Information System (GIS)

The assets managed by WEL are distributed over a large geographical area, so at the most basic level WEL needs to know the geographical location of each asset. The Geographic Information System (GIS) contains this spatial information as well as asset specifications, which is known as attribute data. The GIS also contains data describing the electrical attributes of assets, connectivity, land-base data (which includes property boundaries and owner details), topological maps and aerial photography. Some of this data is transferred to other systems including the ICP Registry, SAP and SINCAL (the network planning tool).

The GIS aims to leverage existing data and present it in a way that decision makers can easily comprehend. One of the strategic focuses for the GIS is to increase the degree to which it leverages existing company data for the benefit of decision makers at all levels.

WEL recognises that the information derived is only as good as the source data it depends upon. Thus a number of data cleansing projects have been completed in the past and a number are in progress. A data collection programme verifying the conductor size has been completed. Attributes of major equipment items such as transformers, circuit breakers, RMUs and other switches have been verified in the field. Suspected connectivity errors within the low voltage network and street lights are being progressively corrected.

As part of developing an information framework the consistency between the GIS and other systems is improving. The purchase of aerial photography provides cost savings across the company and also is a means of improving the data quality. Other recent data enhancement initiatives include the criticality project, addition of easements, and conversion from NZMG to NZTM and communication features. The criticality project leverages the GIS data to optimise asset replacement decisions. The addition of easements is particularly important for managing the associated legal risks and responsibilities. Most recently the GIS was extended to model and record the new fibre network. The upgrade from a relational model to a full spatial has enabled improved efficiencies is compliance reporting.

The data enhancements planned for the future include improvements in connectivity, inclusion of photographs, faster transfers from the GIS to SINCAL, more aerial photography, electronic capture of field data and utilisation of the linear referencing functionality to provide advanced reporting and greater system integration. It also needs to be extended to record the location of distributed generation. A recent risk review meeting decided to include the absolute altitude of cables on a trial basis as well as the configuration within the trench.

Network Management System

WEL continues to use the PowerOn Fusion Network Management System. This consists of subsystems including SCADA (Supervisory Control And Data Acquisition), OMS (Outage Management System), Trouble Call and Dispatch and Distribution Management. The primary functions of the NMS are to provide a real time operator, call, and dispatch interface for the safe management of the network, efficient customer service and to ensure security, reliability and management of system utilisation.

Access to NMS functionality is controlled in a secure authorisation hierarchy. System Management, System Administration, Operator, Call Taker, Dispatcher, Engineering, Report Access or View Only provide different levels of system access. Access can be via a full client installed on a workstation or through a web browser.

Another part of the NMS is load management. Load management is used to minimise WEL's exposure to Transpower peak demand charges as well as assisting in management of network utilisation and improvement in load factor. WEL uses a standalone load management package which interfaces through NMS to provide load control commands to the network.

All data collected from the field and other operational data is presented to the operator in a clear and concise manner providing critical information and control to the 24 hour manned control room. The operator is alerted audibly and visually to events important to the operation of the network.

Specific functions performed using NMS include automatic and manual load control, network switching, fault restoration, real-time system monitoring, retrieval of historic load information for planning and, retrieval of relay flag information for fault determination and analysis. The TrendSCADA module provides long term storage, retrieval and trending of analogue data for engineering use.

The NMS keeps permanent records of all significant events and selected parameters and provides auditable reports to meet regulatory requirements and performance indicators. Data held includes real-time and historic voltages, currents and power levels for significant items of equipment, system configuration information, alarms, operator action logs, equipment ratings and operating instructions.

DMS (Distribution Management System)

The DMS provides an integration of the Control Centre operational procedures and processes providing one view of SCADA and the OMS analysis and reporting functions sharing one database. The DMS also allows for operators, dispatchers, reliability analysts and managers to each have access to the same pool of real time and historical information.

All switching management steps (preparation, validation and execution) are performed within the NMS system without the use of printed material and making use of the in-built safely logic through all stages.

The DMS provides real time state information to the OMS to allow for the capture and recording of reliability data.

The DMS maintains a connectivity model of the network, but does not include enough information to perform network calculations.

OMS (Outage Management System)

The OMS is an application designed to aid in the management, prioritisation and administration of outages on the network and individual customers.

OMS automatically associates customer call taker calls and clusters of calls to the one incident and to the respective devices supplying them. To do this OMS relies on the ICP to transformer relationship of the ICP database and the connectivity of the DMS.

The customer calls are automatically updated into the trouble call system which, along with real time events from SCADA, allow for logical prediction or confirmation of the outage area and fault location.

OMS is also used for the capture and recording of reliability data such as SAIDI and is used to assess network performance.

With the introduction of Smart Boxes to the field, an interface has been created between the Smart Box head end system and the OMS. 'Last Gasp' events from boxes that lose power are transferred to the OMS as customer calls and assist with the identification and prediction of outages. Restoration messages are used to confirm power restoration.

Trouble Call Management System

WEL Networks contracts its call taking and after hours dispatch activities to a remotely located call centre. The call taker function provided in NMS records all incoming customer calls and makes them available to the trouble call system for dispatch of field staff and OMS grouping and fault prediction functions. The call taker and trouble call systems are provided though web browser access to the call centre providing constant updates on outage progress.

Call Taker, through OMS, can be interfaced with an Interactive Voice Recorder (IVR) to automatically update customers with known outage information and predicted restoration

Load Management System

WEL's load management system provides centralised intelligence to monitor regional and network peak demands, calculating and forecasting the half hourly demands, and managing control of interruptible load within service levels to ensure demand does not exceed targets. RCPD (Regional Coincident Peak Demand) functionality is used to coordinate WEL's load control with regional demand. Other controls provided by the load management system include street lighting and meter tariff rate control. The load management system provides its output to NMS which provides the monitoring and load control interface with the network.

NMS Development Planning

Below are listed some of the future developments planned for the system over the next few years:

- Distribution automation support providing for automated switching sequences
- Continued report development. This is primarily focussed on providing information to support analysis for improvement to CAIDI and SAIDI
- A new release upgrade is anticipated to be performed in the 2012-13 year to provide enhanced functionality related to switching management, correct bugs and ensure compatibility with more recent versions of Linux OS, Windows software and Oracle
- Support for Transpower's implementation of secure ICCP (Inter-Control Centre Communications Protocol)
- Perform a further upgrade in the 2014/15 year which will incorporate hardware replacement

Installation Control Point (ICP) Database

The ICP database contains all relevant information on all of WEL's ICPs. The DMS ICP to Transformer connectivity will be for the calculation of reliability performance figures. The ICP database is used directly by the NMS and call centre applications for their operation.

Data stored within the ICP database comes from a variety of sources including the customer, WEL GIS, retailers and electrical inspectors. Much of the data transfer between the parties relies on manual processes. There are therefore checks in place to ensure data integrity. WEL has staff dedicated to identifying, investigating and correcting suspect data. This is an ongoing process.

Silver Spring Smart Box Head End

The Silver Spring Network head end hosts a suite of applications that support the Smart Box implementation. The head end itself is hosted in the United States and operates as Software as a Service (SaaS). The application is accessed in the WEL office via a web interface. Data traffic from devices and other application traffic flows from the WEL office to the head end via an Internet VPN. The major functional modules are listed below.

Advanced Meter Management (AMM) **–** This is the main application and is used for managing devices (meters, relays, access points) and for setting up schedules, reports and exports. The number of devices in various life cycle states can be monitored along with events and alarms from devices. On demand interrogation and control of devices in the field can be performed.

Smart box meter readings and events are obtained at scheduled intervals.

Network Element Manager (NEM) – This application is used for monitoring and analysing performance on the mesh radio network. Faulty devices can be identified and the characteristics of communication paths within the mesh displayed. Various diagnostic tests can be performed.

Firmware Upgrader (FWU) – This application is used to push out firmware upgrades to meters or network interface modules.

Meter Program Configurator (MPC) – This application pushes out new meter programs to selected devices.

Outage Detection System (ODS) – This application allows for the configuration of the last gasp outage and restoration events that are returned from Smart Boxes when power is lost and restored and determines how these events are used when interfaced to other systems.

PSS SINCAL (Power Analysis Tool)

PSS SINCAL is an application that uses physical attribute information from GIS to create an electrical model of the network. Load flow calculations can be used by system control staff to assess the feasibility of proposed actions, and by network planning staff in assessing the suitability of proposed asset investments. PSS SINCAL also calculates fault levels used in determining protection settings.

Data held within the application includes construction dictionary information and geographical, physical and electrical information relating to the network. The quality of the network information relates to the quality of data stored within the GIS. Fault levels have been validated using actual fault levels recorded in the field by protection relays. The quality of dictionary information relies on new conductor types being added to the dictionary whenever they are installed on the network.

Protection Databases

Modern numerical relays require a large number of parameters to be specified for each relay. The sets of applied parameters are collectively known as the relay “settings”. At WEL these detailed settings are stored in the proprietary setting software packages and are supplied by the vendors for each make or model of relay. The following vendor supplied databases are in service:

- SEL 5010 and AcSELerator for SEL relays
- TELUS for the Noja Reclosers
- WSOS for the Nu-lec Reclosers
- Coopers Form 5 & Form 6 database
- Siemens relay database
- Reg D database

Settings for which there is no vendor software, are recorded in the following WEL developed data bases stored in WIRE:

- VIP relay database
- WEL Protection settings miscellaneous database for all other relays
- SCADA Schedules Database

In addition, WEL has a developed a “summary setting” Excel spreadsheet database held in Content Manager (WEL’s document management system) where the key operational parameters, including trip and alarm values, for each relay are recorded. The integrity of the protection data is ensured by the strict adherence to a detailed master process.

All databases are password protected but at present not all are yet server based. This limits universal access and also leads to limited automatic back up of data. Migration to server based systems is under investigation.

SAP Enterprise Resource Planning (ERP) System

SAP was implemented to allow for full systems integration between the functional areas of finance, asset management, maintenance, capital works and procurement, with the additional functionality of the Prometheus system for works and resource scheduling.

The plant maintenance module in SAP provides a primary database of network equipment and locations where equipment is installed. It is used to manage all maintenance and capital work on the network through the work orders application and further application modules are used for inventory management and purchasing.

For preventative maintenance, a maintenance task is assigned to each equipment item and these then create work orders for the performance of that work at defined intervals. The condition measurements for each item of equipment and the actual costs of the maintenance task are captured.

Faults and corrective maintenance tasks generate work orders, and costs, activity and failure codes are recorded against equipment.

Capital works involve work orders being created for the construction of each new equipment item with costs being captured against these.

The system is deployed throughout the company and selected contractors. Comparison of data against other systems and checking by field inspection is continuing to improve the quality and completeness of data. Each asset is assigned a unique number which is used to track an asset when it is moved from one location to another. Where practical these numbers are physically attached to new equipment.

Future enhancements will be developed in a number of areas. These include:

- Business Intelligence – A Business Intelligence (BI) Steering Committee has been established to ensure optimal development of this powerful data reporting tool in support of business and operational decision making
- Mobility – This is a means of providing the appropriate information remotely to users
- CRM – To enhance the customer relationship information to improve service to the end customers

Vegetation Management Database (VMD)

This application was commissioned by WEL in order to better manage the tracking of vegetation removal. It has a graphical interface which is derived from a landbase and GIS extract. All vegetation is recorded in the system and registered against a span or sub-span of line. Information includes the priority, owner, species, previous work, previous notifications and other notes as required.

Job cards are created from the system and direct field work. Periodic field patrols are done to update information into the system.

The interface allows tree issues to be visually observed in a spatial mapping environment.

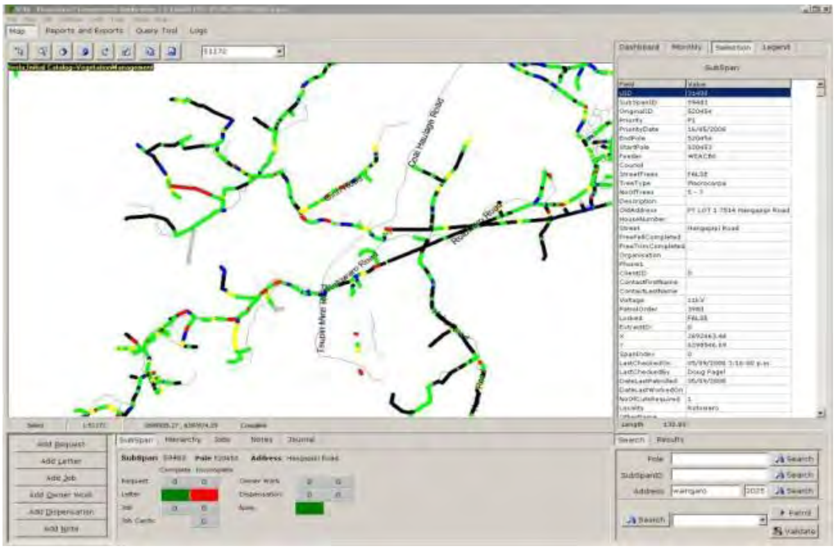


Figure 12. Screen Shot of Vegetation Management Database

Asset Information System (AIS)

The AIS is designed to provide an accurate, consistent and repeatable source of reporting data. The initial focus is to satisfy the regulatory financial reporting requirements. It is also intended to support ad hoc queries regarding such things as line lengths, classified in a variety of ways. The other important role of the AIS is to provide base data for the pricing model and age profile for the asset replacement economic model.

The AIS is a data warehouse application, which typically requires consistent data across a number of systems. Much effort was devoted to the establishment of a sound set of base data to support the AIS. As part of the implementation continuous data checking is being implemented to identify any new errors that are detected once the system is operational.

Data Integrity Checking System

Pervasive Data Profiler was purchased to provide a data integrity check between systems. The initial focus was to satisfy the successful implementation of the Asset Information System (AIS) last year. In addition to the data cross check between the GIS and SAP, the system has been used to ensure data integrity between GIS and ICP, GIS and SCADA, etc. Another copy of the product may be purchased to support the business processes around data quality control.

Systems Data Flow

The flow of data between the applications described above is shown in Figure 13. Dotted line between SaaS and NMS represents potential integration between systems. Dotted line between PSS SINCAL and the Protection Database represents data integrity alignment but not system integration.

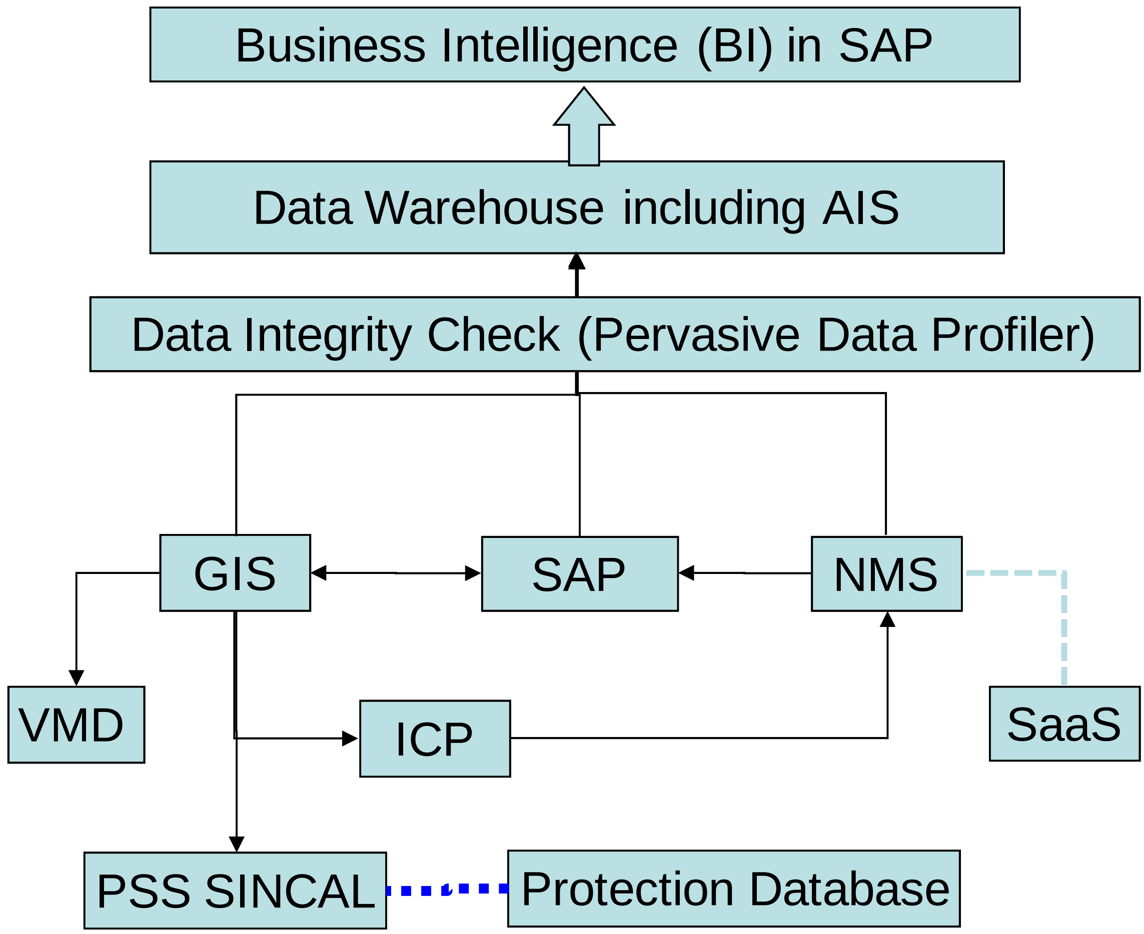


Figure 13. Data flow between applications.

Refer to APPENDIX 1 Glossary of Terms for an explanation of acronyms used.

System and Data Ownership

As part of the SAP implementation programme clear ownership of data has been defined. This was done to clearly differentiate between the management of the Information Technology (IT) and associated software, which is a service provided by the IT department, and the ownership of the data which is vested with the primary users of the data and system functionality.

A review of the company's IT and IS strategy has been completed by PricewaterhouseCoopers (PwC). This has resulted in a clearer definition of data ownership and IT/IS accountabilities. Resourcing for ensuring appropriate staffing levels to provide excellent service has also been addressed, including a better focus on service delivery through the implementation of a Help Desk function.

WEL has adopted a policy of allocating Business Process Owners representing the primary users of the system supported by the IT department. The process owners are responsible for the accuracy and timeliness of collection of the data.

Information Framework and Integrity Assurance

Seven years ago a specialist data quality position was created within WEL and since then that role has driven a process of continual data quality improvement. The role has now expanded to cover all asset information across the company. The position is responsible for the overall data quality standards and delivery of quality data.

Recently WEL conducted a data quality assessment across the whole company. This measures the current level of data quality within the company and a framework, which guides systematic, continuous improvement.

WEL adopted an information framework that is shown below:

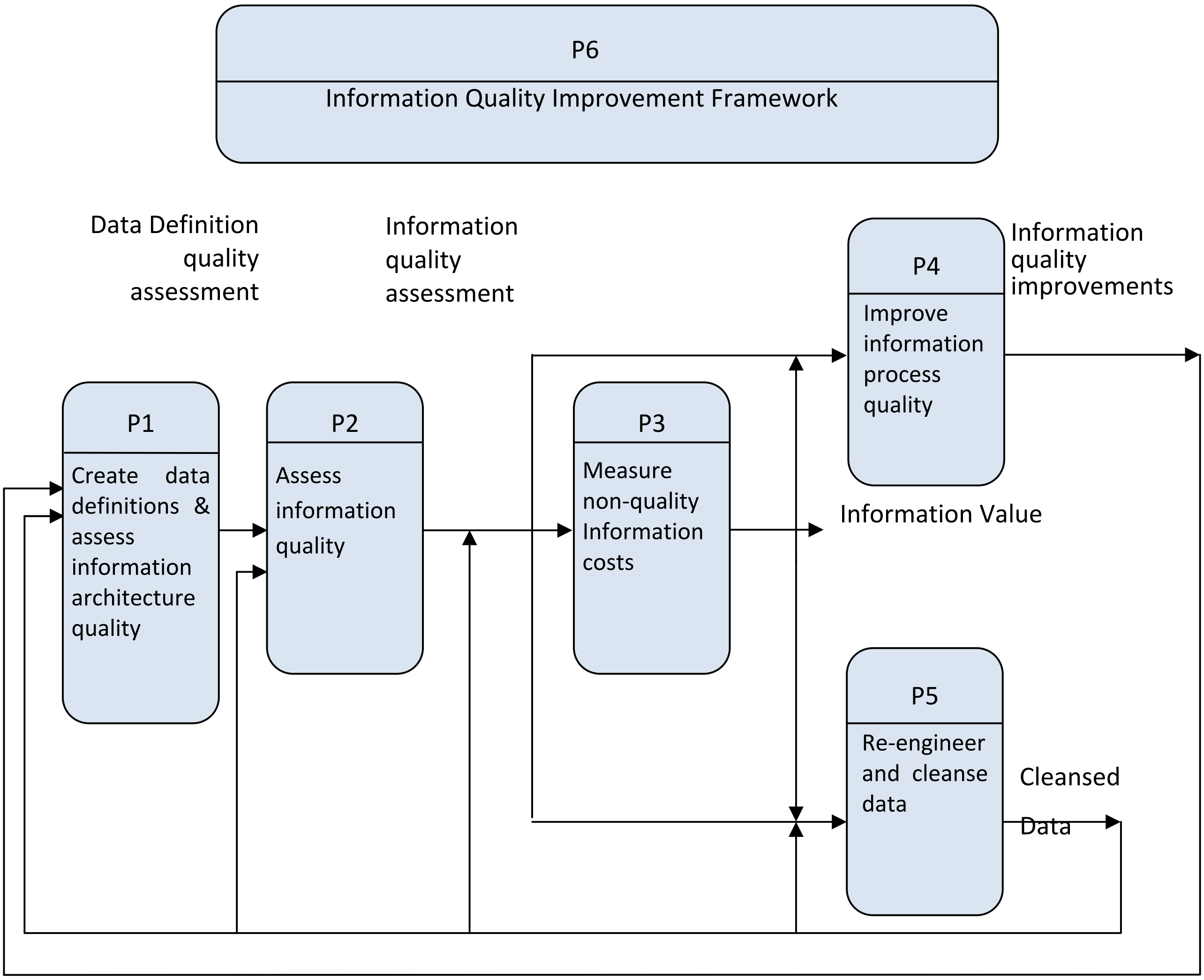


Figure 14. Generic Information Framework

2.7. Best Practice

WEL's asset management practices are aligned with the following industry best practice:

- PAS 55 Publicly Available Specification for the Optimised Management of Physical Assets and Infrastructure
- International Infrastructure Management Manual 2006 (IIMM)

PAS 55 was developed by the Institute of Asset Management (IAM) in the United Kingdom as a standard for carrying out asset management. It is made up of two parts; the first (PAS 55-1) provides the specification for optimised management of physical infrastructure assets, while the second (PAS 55-2) provides guidelines for the application of PAS 55-1.

It is based on the business cycle of continuous improvement and covers the following major areas:

- Asset management system
- Policy and strategy
- Asset management information, risk assessment and planning
- Implementation and operation
- Checking and corrective action
- Management review

WEL's asset management practice was independently reviewed by Sinclair Knight Merz (SKM) against PAS 55 in February 2008. The review was completed through an iterative process of identifying the requirements of the various sections in the standard in order to select appropriate WEL documents on processes, followed by discussions leading to the provision of further supporting data as appropriate.

SKM's view on the wider issue of meeting the requirements of PAS 55-1 is that the present processes and practices adopted by WEL substantially meet the requirements, are clearly focussed to achieve the stated objective of good asset management and are generally in line with good industry practices.

As a result of The Commerce Commission's new disclosure requirement, every lines company is now required to complete an Asset Management Maturity Self Assessment (AMMSA). The results are summarised below:

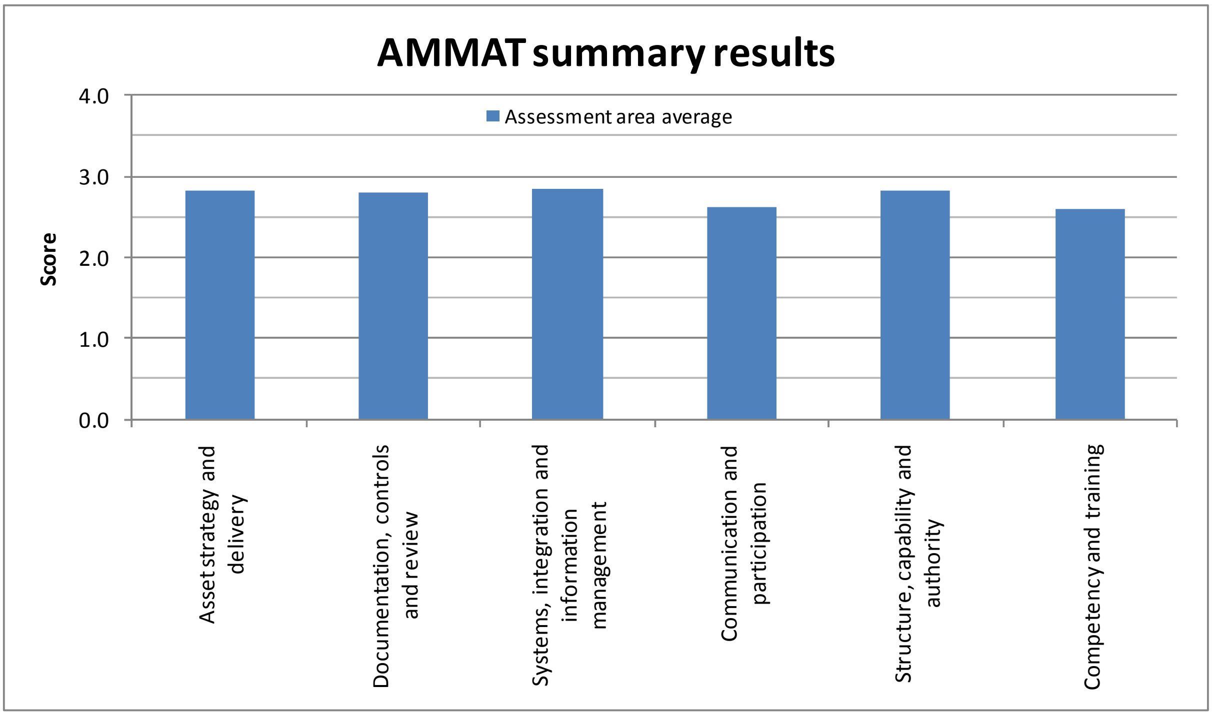


Figure 15. AMMAT summary results

Key improvement opportunities were identified and responsibilities for actions were assigned as a result of this process. More detailed analysis is attached in the schedule 13 of Appendix 9.

WEL uses regular benchmarking exercises to identify gaps for improvement.

Photo 6 **New 33kV indoor switchgear at Te Kauwhata Substation**

3. ASSETS COVERED

3.1. A High Level Description of the Distribution Area

3.1.1. WEL Distribution Area Description

WEL supplies power to the North Waikato region, which includes the population centres and surrounding rural areas of Hamilton City and the towns of Raglan, Gordonton, Horotiu, Ngaruawahia, Huntly, Te Kauwhata and Maramarua. The WEL supply area is predominantly agricultural in nature and the land is largely flat to rolling with areas of peat and some moderately steep country. Below is a map of the WEL Networks coverage area.

Figure 16. A map of the WEL Networks coverage area

The following Figures outline the areas WEL supplies. The full name for each acronym along with zone substation capacities, capacity utilisation, and number of customers supplied and security class by each zone substation are provided in Appendix 3.

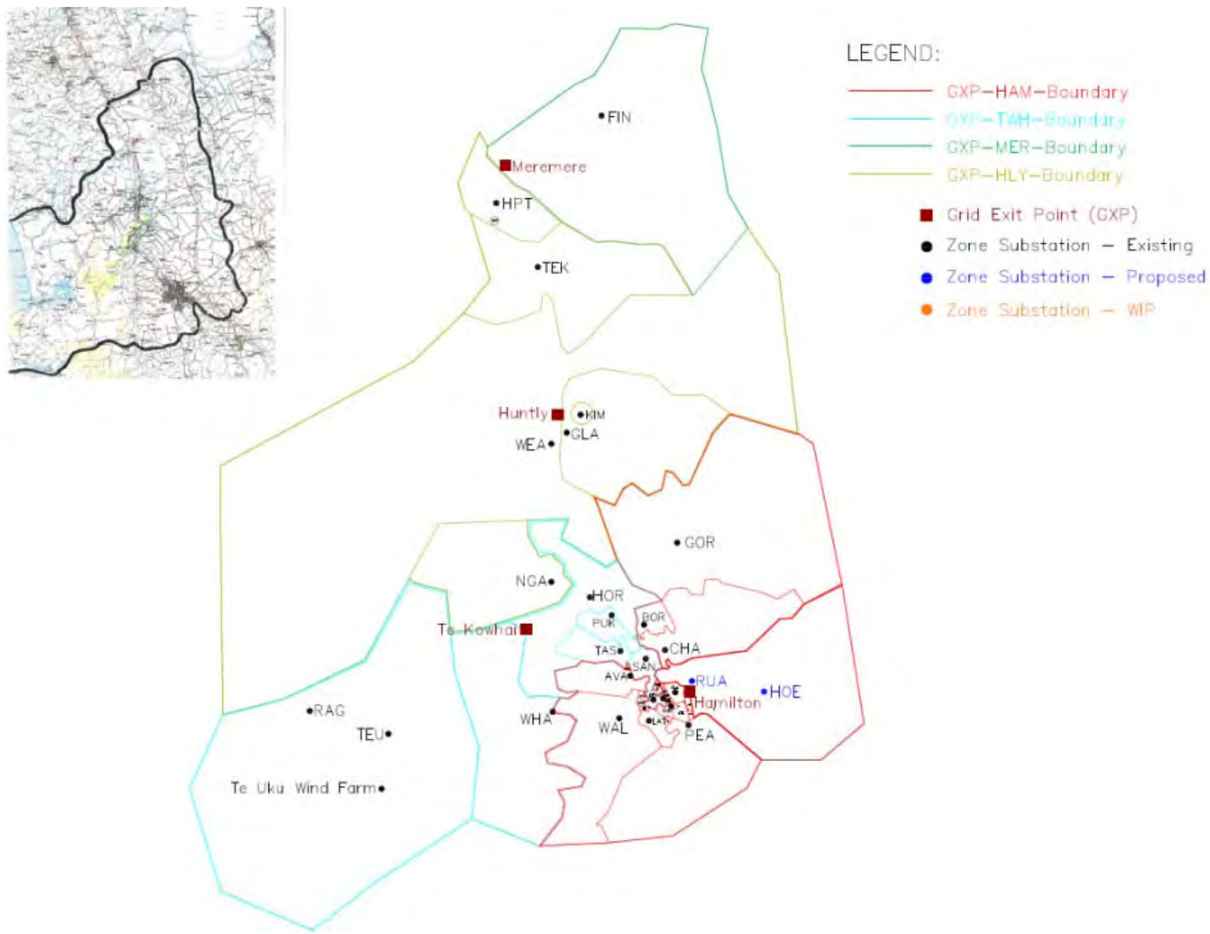


Figure 17. Points of Supply, existing zone substations, associated supply zones and proposed zone substations.

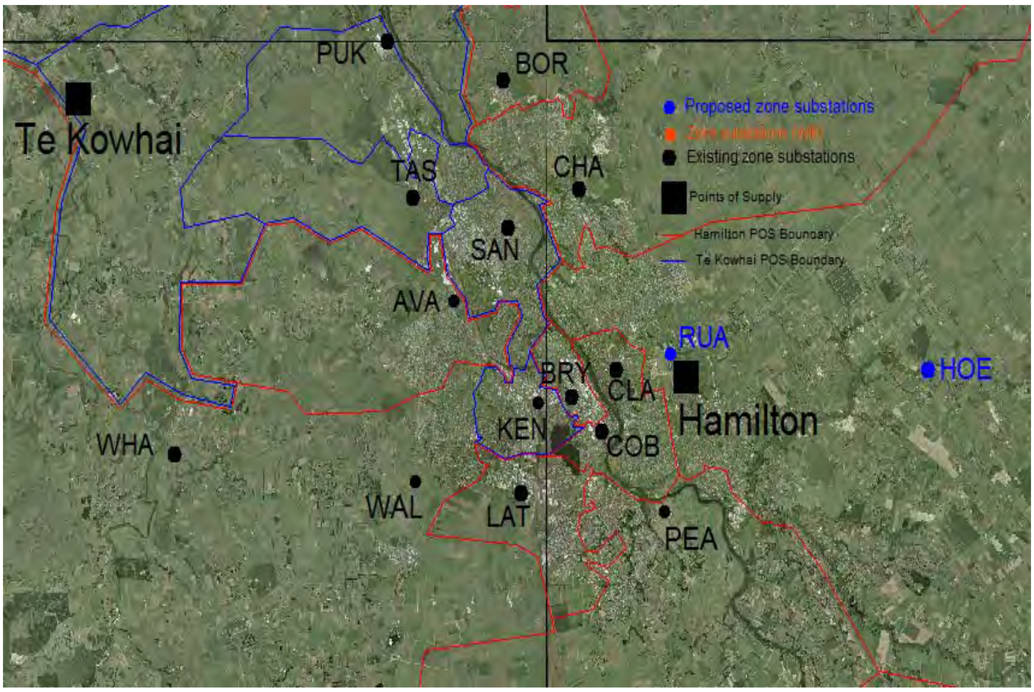


Figure 18. Hamilton City zone substations and associated supply zones.

Figure 19. North Waikato Area 33kV Sub-transmission Network

Figure 20. Huntly Area 33kV Sub-transmission Network.

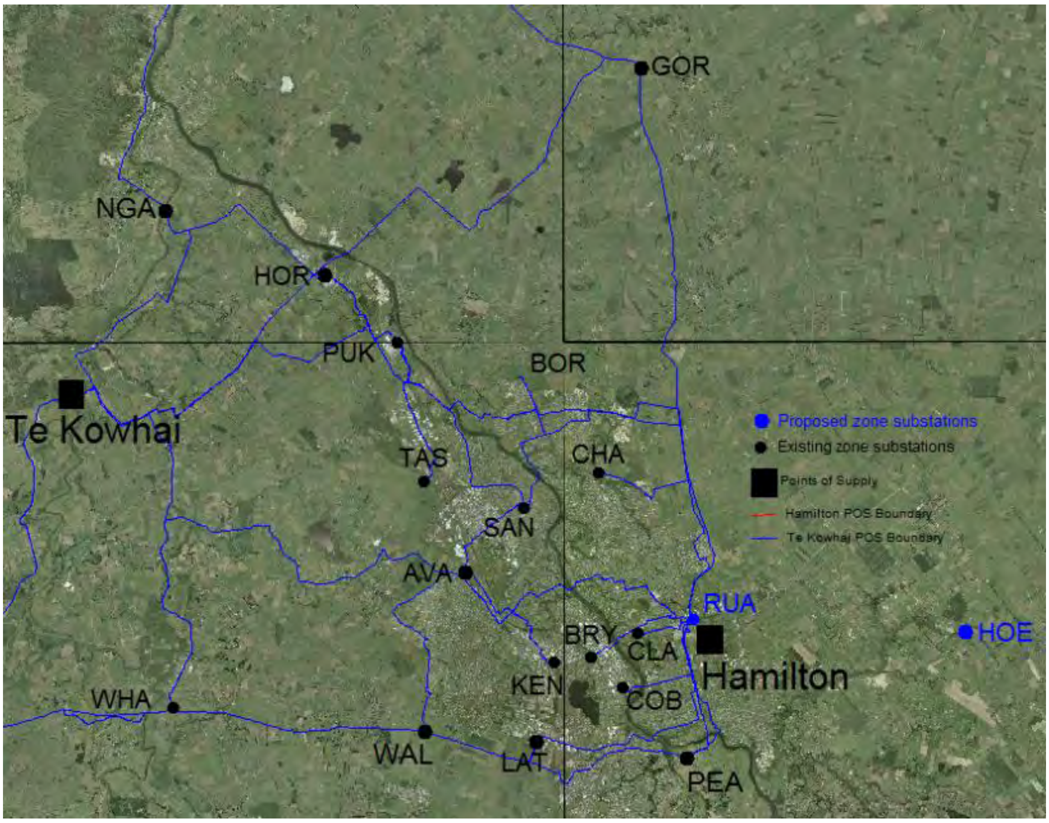


Figure 21. Central Waikato 33kV Sub-transmission Network

Large Customers

WEL's mass market customer base (residential and small commercial customers) represents 99% of the connections, but takes 60% of total volume conveyed through the network. WEL's top 50 customers represent 20% (approx.) of volume conveyed.

The 600 (approx.) large commercial and industrial customers are time of use metered and a demand based line charge is applied. The line charge includes a monthly peak demand based price signal, which loosely represents a congestion related price signal.

WEL's annual asset planning programme includes a number of initiatives aimed at understanding customer needs and building these into the price/quality trade-off that ensures service levels continue to meet expectations. The interaction also aims to derive growth trends and increases in, or new, point loads around our network.

Initiatives undertaken through the year include:

- Supporting specific customer enquiries and assisting regional economic growth initiatives to encourage connections where there is sufficient inherent network capacity to supply
- Facilitating access to WEL project staff for load growth investments
- Undertaking surveys to better understand the needs of major customers; including future load needs, price versus quality and how this might differ from residential consumers, as well as reliability of supply issues and requirements
- Regular meetings/visits/phone or email conversations to keep major customers abreast of electricity industry changes, WEL strategic directions etc
- Staging major customer summit(s) each year, to help maintain a close relationship and to inform key customers of trends, industry issues and demand management related initiatives

Over the next few years WEL aims to introduce a number of commercial arrangements with the intent being to improve the network load factor and hence asset utilisation. Opportunities will be investigated in consultation with our larger customers, and the introduction of our smart grid initiatives will help source demand-side responses from mass market customer connections.

Network Load Characteristics

The charts in Appendix 3 and Table 4 for zone substations show the customer types supplied by each zone substation. There is a clear relationship between customer type and load characteristic. As such it is possible to establish general load characteristics for different parts of WEL's network.

Analysis of the charts reveals that all zones are made up of a high proportion of residential customers. Bryce Street and Finlayson Road have the lowest proportion of residential customers with around 50-60 percent.

Zones with the most agricultural, forestry and mining customers are Weavers, Hamilton 11kV, Gordonton, Wallace Road and Finlayson Road, in that order. Commercial customer categories such as Retail Trade, Accommodation, Cafes and Restaurants, Property and Business Services and Financial and Insurance are most prevalent in Bryce Street and Claudelands. This makes sense as these zone substations supply the Hamilton CBD.

The manufacturing sector is best represented in Kent Street, Latham Court, Sandwich Road and Tasman Road.

Peak Load and Total Electricity Delivered

The highest peak demand over the 2011/2012 financial year for WEL's network was 247MW. The coincident system peak demand with RCPD was 231MW. The highest peak demand so far for the 2012/13 financial year is 240MW.

These figures are derived by summing the total demands incurred at the Transpower Grid Exit Points plus any embedded network generation export. As such, the figures stated represent the peak power consumed by WEL's customers plus WEL's network losses.

The total amount of energy supplied by WEL over the 2011/2012 financial year was 1255GWh. This figure was derived by summing the energy supplied through Transpower Grid Exit Points plus the energy supplied from embedded network generation export. The figure therefore includes WEL's network losses.

3.2. Description of Network Configuration

Grid Exit Points and Embedded Generation

WEL takes supply from Transpower Grid Exit Points (GXPs) at Hamilton, Meremere, Huntly and Te Kowhai as well as from embedded generation. Contact operates an embedded 50MVA co-generation plant at Fonterra which connects to the Pukete zone substation. Meridian owns the 65MW generation at the Te Uku wind farm. Embedded generation is not factored into WEL's firm capacity levels.

Grid Exit Point Capacities

Grid Exit Point	Transformers	Installed Capacity	Firm Capacity N-1	Post Contingent Limits	Connections
Hamilton 33kV	100+120 MVA	220 MVA	100 MVA	132 MVA	42,577
Hamilton 11kV	2 x 40 MVA	80 MVA	40 MVA	40 MVA	12,018
Te Kowhai 33kV[1]	2 x 100 MVA	200 MVA	100 MVA	109 MVA*	21,013
Meremere 33kV	Nil	14 MVA	4.5 MVA	4.5 MVA	1,095
Huntly 33kV	2 x 60 MVA	120 MVA	60 MVA	82 MVA	7,637

Note 1: Planned to be upgraded to 137MVA.

Hamilton GXP supplies power to WEL at both 33kV and 11kV while Meremere, Huntly and Te Kowhai supply power at 33kV only. With the completion of the installation of 33kV cables from Huntly to Te Kauwhata, all of WEL's GXPs are now interconnected through WEL's 33kV sub-transmission network. The northern-most area of our network is no longer reliant on a single Transpower 33kV line from Bombay substation. The Meremere GXP is now only supplying Finlayson Rd zone substation and its longer term use will be reviewed after 2016.

Schematic diagrams of the GXPs and the WEL 33kV sub-transmission system are included in Appendix 4.

Sub-Transmission System

The supply to the Hamilton CBD is by underground 33kV feeder-transformer circuits with all underground distribution at 11kV.

The 33kV supply to the suburban areas of Hamilton is by a closed 33kV mesh connected system which enhances delivery and reliability and also provides (N-1) security. All zone substations located in Hamilton have dual transformer banks and the 11kV distribution is a radial system with interconnection points.

In rural areas 33kV sub-transmission is primarily radial with limited interconnection capability through the 11kV system.

Both the 33kV sub-transmission and 11kV distribution systems are typically more of overhead construction, except where they traverse the residential areas of Hamilton.

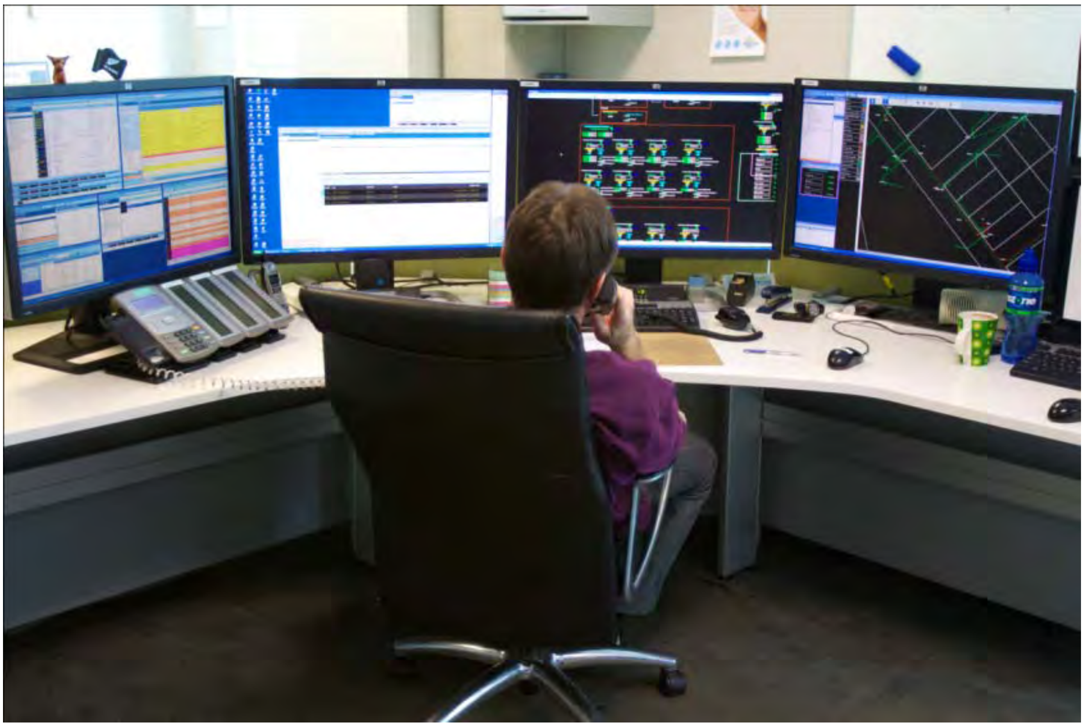


Photo 7 WEL Control Centre

Key Information for Zone Substations

Code	Full Name	Installed Capacity (MVA)	Firm Capacity (MVA)	Emergency Capacity 4 hours (MVA)	Capacity Utilisation (2012 Winter)	Customers Supplied	Customer load Type	Security Class required	Security class achieved - 1st interruption
AVA	Avalon Drive	46	23	28	39%	5428	Industrial, Commercial and Residential	C2	C2
BOR	Borman	46	23	28	20%	2933	Residential & light commercial	C3	C3
BRY	Bryce St	46	23	23	33%	2170	Central Business District	C2	C2
CHA	Chartwell	46	23	28	43%	7051	Residential & light commercial	C3	C3
CLA	Claudelands	46	23	28	38%	5503	Residential, light commercial & Central Business District	C2	C2
COB	Cobham	46	23	28	33%	2520	Central Business District and Residential	C2	C2
FIN	Finlayson Road	7.5	7.5	7.5	66%	1093	Residential & light commercial	B2	B3
GLA	Glasgow Street	10	10	15	81%	2500	Residential and commercial	B1	B1
GOR	Gordonton	10	5	7.5	67%	1524	Rural and Residential	B1	B2
HAM 11	Hamilton 11kV	80	40	40	46%	13068	Residential & light commercial	D	D
HOR	Horotiu	36	18	18	32%	2949	Industrial and Rural	B1	C3
HPT	Hampton Downs	10	10	15	17%	331	Rural and commercial	B3	B2
KEN	Kent Street	46	23	23	37%	4286	Industrial, commercial & residential	C2	C2
KIM	Kimihia	10	1.5	1.5	37%	1	Industrial	B2	B1
LAT	Latham Court	46	23	30	39%	4517	Industrial and commercial	C3	C3
NGA	Ngaruawahia	15	7.5	7.5	37%	1842	Residential & light commercial	B1	C3*
PEA	Peacockes Road	20	10	15	75%	4541	Residential & light commercial	C3	C3
PUK	Pukete 11	30	15	15	26%	1501	Residential & light commercial	C3	C3
SAN	Sandwich Road	46	23	28	24%	2588	Residential & light commercial	C3	C3
RAG	Raglan	23	20.8	20.8	24%	2588	Rural	B1	B2
TAS	Tasman Road	46	23	28	47%	5412	Commercial and industrial	C3	C3

Code	Full Name	Installed Capacity (MVA)	Firm Capacity (MVA)	Emergency Capacity 4 hours (MVA)	Capacity Utilisation (2012 Winter)	Customers Supplied	Customer load Type	Security Class required	Security class achieved - 1st interruption
TEK	Te Kauwhata	10	5	7.5	40%	923	Residential & light commercial	B1	B3
TEU	Te Uku	10	10	15	17%	505	Rural	B1	A
WAL	Wallace Road	20	10	15	77%	5253	Residential & light commercial	C3	C3
WEA	Weavers	15	7.5	11.25	62%	3449	Residential & light commercial	B1	C3
WHA	Whatawhata	23	23	28	12%	1022	Residential & light commercial	B2	B2

Table 4 Key information for Zone Substations as at 31 August 2012

Note 1: *A brief interruption is necessary to perform switching ("switched" N-1 security)

Note 2: Refer to Table 9 for the meaning of security class from A-D.

To meet the "N-1" security criteria peak load must not exceed emergency rating of remaining banks (Emergency Capacity). Plans have been put in place to address the issues identified. Refer to the Network Development Programme in Section 5.10 for details. In the case of Glasgow Street there is a robust 11kV backup supply of 10 MVA available from Weavers. For Finlayson Road future installation of cooling fans could raise the continuous capacity of the transformer to 10 MVA if needed with load growth.

11kV Distribution Network

The Hamilton CBD 11kV distribution system is a radial system with 11kV trunk feeders interconnecting and meshing the central zone substations ensuring (N-1) system security. There is redundancy on the 11kV networks, as is typical of high reliability underground networks serving CBD areas.

The general 11kV distribution systems are mostly of overhead construction except where they traverse the residential areas of Hamilton, which are underground cabling networks. All new subdivisions, whether they are rural or urban, are reticulated with underground cables in accordance with District Plan Requirements.

Distribution substations are of four main types consisting of industrial/commercial, residential berm, pole mounted and rural.

Industrial and commercial distribution substations are enclosed, ground mounted transformers with integrated high voltage switchgear enclosed or adjacent to the unit and are site specific or distributed to a small number of customers. Low voltage distribution to the customer from these units is from either fuses or circuit breakers with the unit.

Residential berm type substations are enclosed ground mounted transformers with integrated high voltage switchgear enclosed or adjacent to the unit and with low voltage distribution to the customer from these units via fuses to generally underground cable distribution networks.

Residential pole type substations are mounted on poles with high voltage fuses adjacent to the unit and with low voltage distribution to the customer from these units via fuses to generally overhead distribution networks.

Rural pole type substations are mounted on poles with high voltage fuses adjacent to the unit and with low voltage distribution to a small number of customers or a single customer from these units via fuses into an overhead distribution network.

LV Network

Approximately 50% of the overall low voltage network is reticulated via overhead lines (approximately 90% of the rural and 40% of the urban low voltage network is overhead). All new residential subdivisions, whether they are rural or urban, are reticulated with underground cables.

Underground cables are designed to meet the expected loading with growth and are based on optimised industry standard cabling sizes. The overriding design factors in low voltage networks are to ensure voltage management within the statutory limits and to ensure optimal customers per circuit.

Overview of Secondary Assets

Hot water and streetlight load control is managed with 283Hz and 500Hz mains borne ripple signals. Most of WEL's customers have ripple control relays while a small proportion of customers in some parts of the city are controlled via hard-wired pilot cables.

Pilot cables are generally either overhead or underground in accordance with the LV reticulation or protection element requirements.

Protection signalling, SCADA, and remote control communications are transmitted via a comprehensive radio network; this is being progressively extended to improve communication dependability by a fibre optic cable network. There is a copper pilot network still in use in the CBD.

Smart metering devices and associated mesh radio communications infrastructure are currently being installed across the whole network. Integrated ripple devices within the deployed Smart Boxes are progressively replacing old separate ripple relays.

3.3. Age Profiles and Condition Assessments

Age profiles and conditions for each asset category are summarised below. Information is collected through field surveys and is stored in the computerised maintenance management system (SAP). The asset inspection, maintenance and renewal programme for each asset category is detailed in section 6.

3.3.1. Assets Owned by WEL at the Points of Supply (GXP)

At the Hamilton 33kV and 11kV points of supply, and at Te Kowhai, the switchgear is owned by Transpower but WEL owns some protection equipment including ancillary equipment consisting of check meters, power supplies, ripple plants, SCADA and communications equipment. Transpower has upgraded the Hamilton 33kV outdoor switchgear to an indoor GIS board.

At the Huntly point of supply WEL owns all the equipment on site including the 33kV switchgear and protection equipment. WEL also owns some ancillary equipment consisting of check meters, power supplies, SCADA and communications equipment.

At Transpower Bombay WEL maintains a Remote Terminal Unit that provides breaker status and check metering. (The Bombay substation connects the Meremere GXP).

The equipment at all sites is in good serviceable condition.

3.3.2. 33kV Sub-Transmission Underground Cables

Status

The 33kV sub-transmission circuits in the Hamilton city area are all underground cables. No weaknesses have been reported with these cables. The sub-transmission system was modelled using the PCORP software from which maximum allowable current flows were determined. For future projects, use will be made of the more sophisticated ETAP software.

WEL has standardised the use of XLPE insulated single core aluminium conductor cables with copper wire screens. In the mid 1990s some XLPE cables with aluminium screens were installed and these cables are now subject to failure due to water ingress from corroded screens beneath a damaged external sheath. These cables are being monitored more closely.

Actions

Due to a number of 33kV cable joint failures, a selected number of circuits will be subjected to routine partial discharge testing to increase reliability and to gain an early indication of any problems. Results from these tests will be used for condition monitoring analysis.

The age profile below consists of both PILC and XLPE cables each having a nominal life of 70 and 45 years respectively.

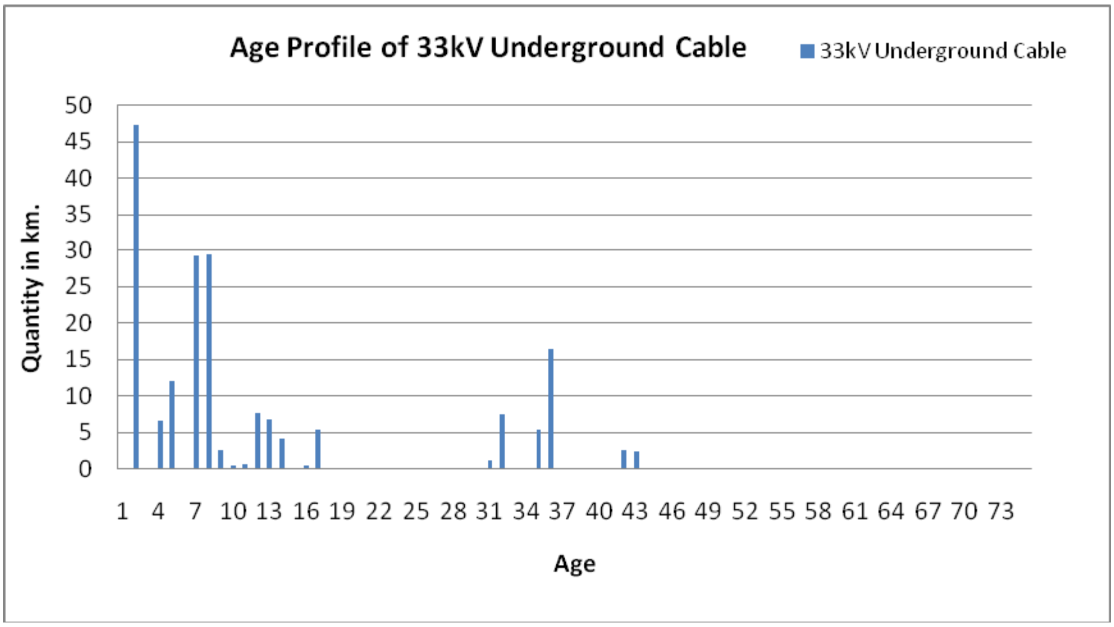


Figure 22. 33kV Sub-transmission Underground Cable – Age Profile

3.3.3. 33kV Overhead Lines

Status

The outer parts of the city and in the outlying areas served by WEL the sub-transmission circuits that were built prior to the last three years are predominantly overhead lines.

Most conductors of this type are still below its nominal life as indicated by the orange line in Figure 23. Inspections indicate that the condition of the conductor is generally good and better than expected for its age.

Actions

In some sections where there are high rates of insulator failures, the porcelain insulators are being replaced with polymers to improve reliability.

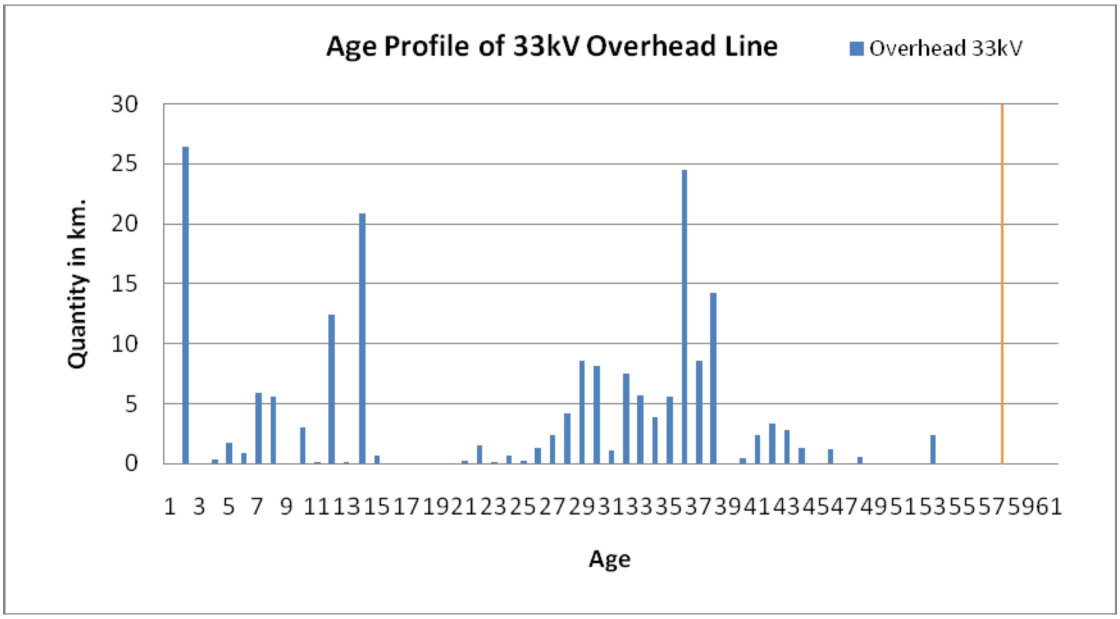


Figure 23. 33kV Overhead Conductors – Age Profile

3.3.4. 33kV Circuit Breakers

Status

WEL's 33kV circuit breakers are a combination of indoor and outdoor equipment. All 33kV circuit breakers are regularly maintained in accordance with recognised maintenance practices and are in acceptable condition. Figure 24 shows the age profile against the quantities of both indoor and outdoor circuit breakers installed on the network. Most 33kV circuit breakers installed over the last 10 years were indoor SF_6 and GIS type and have a "standard life" of 60 years. The older outdoor 33kV circuit breakers having a "standard life" of 45 years are closely monitored through condition monitoring regimes.

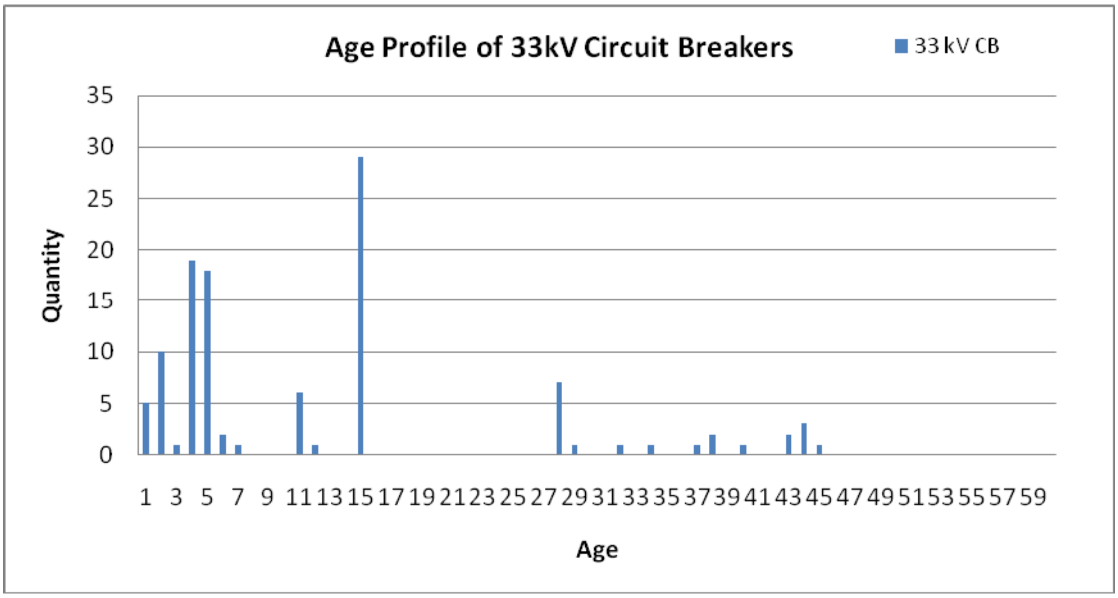


Figure 24. 33kV Indoor/Outdoor Circuit Breaker – Age Profile

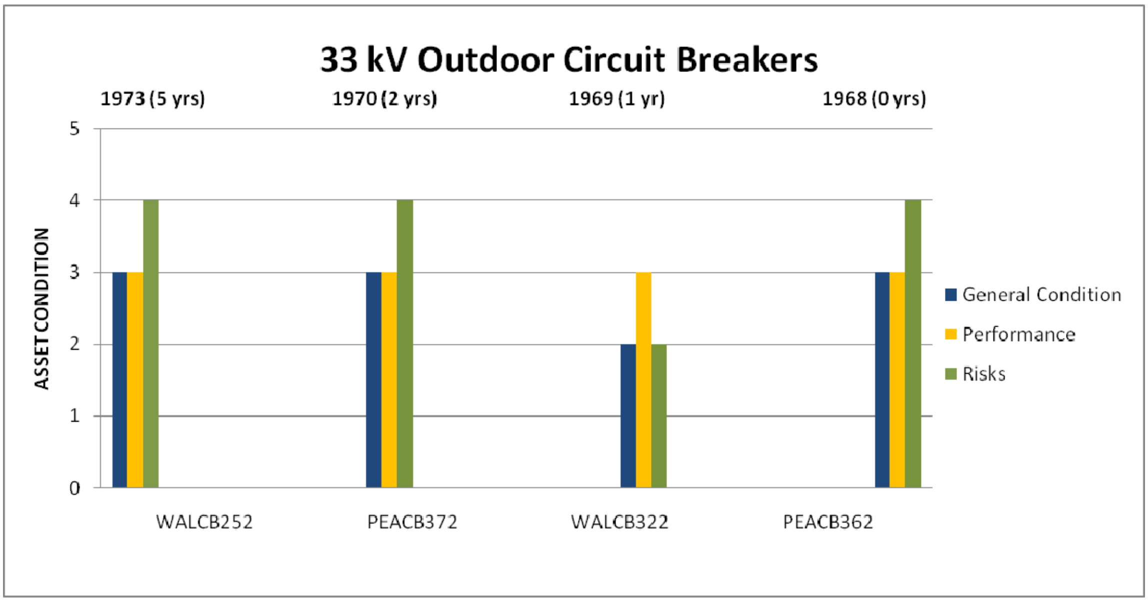


Figure 25. 33kV Outdoor Circuit Breaker – Age Profile less than 10 years of "Standard life"

Actions

Figure 25 shows a subset of 33kV circuit breakers' (outdoor) with an age profile less than or equal to its "standard life". The graph shows the ratings that were identified based on their general condition, performance and risk assessments. These 33kV circuit breakers are now on the 10 year replacement plan and will be replaced with indoor SF_6 or GIS type switchgear which has a lower maintenance requirement and a longer asset life.

3.3.5. Zone Substations

Status

Zone substations include the buildings, outdoor structures, foundations, fences, oil interception equipment and auxiliary equipment such as low voltage AC and DC power supplies, that make up the site, but exclude major items of equipment within the zone substation, such as zone transformers and HV circuit breakers which have their own asset categories.

Zone substations are used to transform power from the 33kV sub-transmission voltage to the 11kV distribution voltage. There are 26 zone substations with construction dates ranging from the 1950s to 2012. Nine out of 26 zone substations have outdoor switchyard which comprises of mostly 33kV circuit breakers, outdoor instrument transformers, switches, insulators and busbars. The zone substations are of varying construction types that reflect the design standards at the time of their construction.

Buildings have been well maintained and are in reasonable condition with some repairs of leaks and painting required.

Photo 8 Bryce St. Zone Substation – 2012

Actions

Risk assessments with respect to public health and safety are undertaken on these assets according to WEL's Public Safety Management System (PSMS). Security fences and other civil works are progressively being upgraded. Seismic strengthening has been completed at Sandwich Rd and Bryce St substations. Further substations are being evaluated and corrective work will be proposed in the plan.

All equipment is suitable for its purpose and in a state that is generally aligned to its age.

Lawn on most of the existing outdoor switchyard will be replaced with latest material used for outdoor switchyard construction (e.g. gravel). Scheduled replacement will be mostly in conjunction with the transformer bunding program and other development projects in the AMP within 2013-2023 financial years. The program aims to standardise the design and construction of WEL outdoor switchyards. It will also reduce the current maintenance cost for these sites in the long run.

Zone Substation	with Lawns	Estimated Cost $000	Financial Year on AMP
*GLA	**	5	18/19
*GOR	***	25	17/18
TEU	***	25	15/16
CLA	***	25	17/18
*WEA	***	25	17/18
*PEA	***	25	14/15
BOR	**	5	18/19
HOR	**	5	18/19
LAT	***	25	15/16
*MAS	***	25	15/16
TOTAL	**10**	**190**	

**Note: In conjunction with the development of capital projects*
***Note: small area with lawns*
****Note: Large area with lawns (Outdoor Switchyard)*

Figure 26. Lawn Replacement Program

3.3.6. Zone Substation Transformers

Status

Zone substation transformers are generally in good working condition. Annual Dissolved Gas Analysis (DGA) has allowed the internal condition of the transformers to be monitored and periodic furans analysis gives an indication of remaining paper life. This has shown that the transformers are in a condition appropriate to their age and there is no evidence of accelerated insulation ageing or deterioration. Most of the zone transformers which need to be replaced were neither due to age nor condition but because of significant risks such as operational limits and capacity requirements.

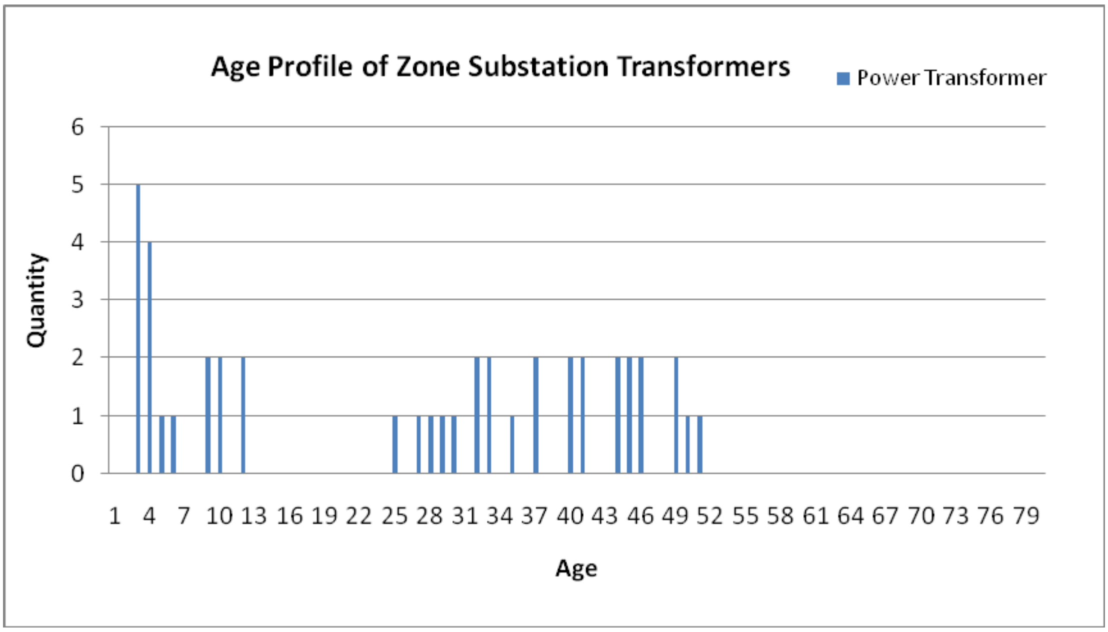


Figure 27. Zone Substation Transformers – Age Profile

Action

Transformer mid life refurbishment is being undertaken where economically feasible.

3.3.7. 11kV Circuit Breakers

Status

The circuit breakers (CBs) on WEL's network range from new to over 45 years of age. The CBs consist of a mix of technologies corresponding to the relative age of the equipment. The oil-filled circuit breakers are the oldest on the network followed by SF_6 and vacuum type.

Routine condition monitoring so far indicates no significant maintenance problems. Since service operation has been well below operational limits, life expectancy is expected to exceed the standard life of 45 years for oil type CBs and 55 years for SF_6 and Vacuum type. Circuit breakers currently being installed are typically of the vacuum and SF_6 type and have low maintenance requirements. Note that the CB type as mentioned here refers to the arc quenching technology incorporated and not the insulation medium which can be compound, oil, air or SF_6 gas.

The older switchgear units are of solid construction and remain serviceable. Older items in particular are kept under review through condition monitoring regimes.

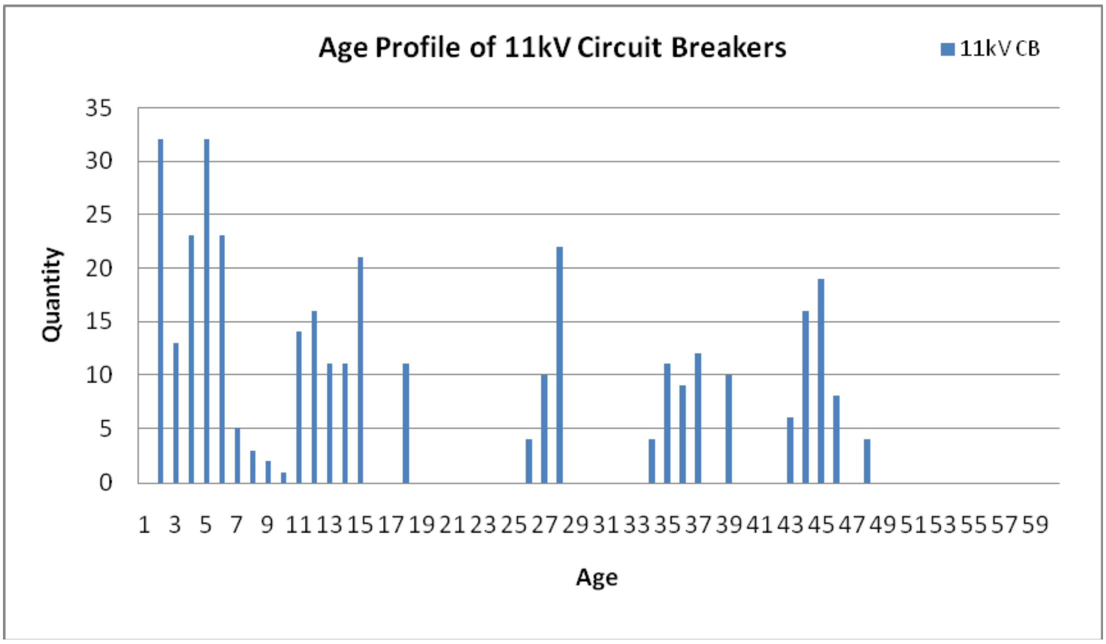


Figure 28. 11kV Circuit Breaker – Age Profile

In general, 11kV switchboards supplied before the 1970s incorporate compound-insulated busbars and heavy oil-insulated current transformer chambers and cable boxes. This generation of switchboard typically includes withdrawable bulk oil circuit breakers. There are increasing maintenance difficulties with some of this equipment including the lack of spares. In this case, all the 11kV circuit breakers with age profile reaching the "standard life" of 45 years *(35 years to 45 years and above)* were closely monitored and assessed based on the actual condition, taking into consideration the risks *(safety, reliability, fault capability, operational limits, etc.)* and asset performance *(peak demand, average demand, etc.)*.

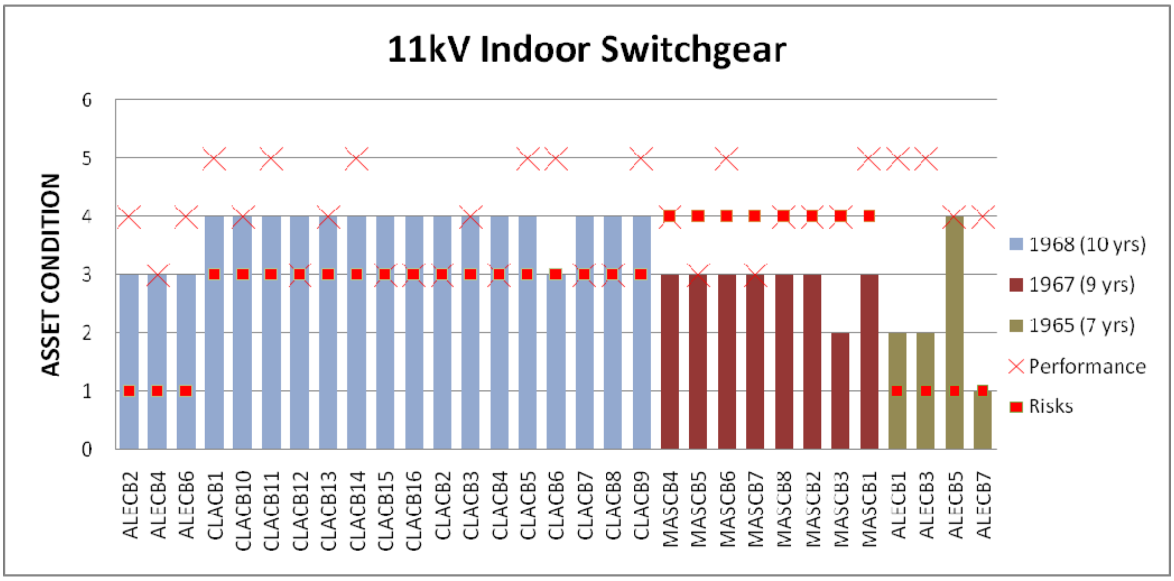


Figure 29. 11kV Switchgear – Condition Monitoring

Actions

Figure 29 shows a subset of switchgear assets, with installed dates revealing less than 10 years remaining life and showing condition, performance and risk assessment ratings. Condition monitoring analysis performed on the 11kV switchgear and circuit breakers suggests that most of the CBs aged 35 years and above have significant issues in terms of condition, operational limit and fault capability requirements. Switchgear and/or circuit breaker replacement will be arranged on the identified sites based on the criticality of the asset's overall condition. Protection and SCADA/Communication upgrades will be undertaken in conjunction with the switchgear renewal and replacement programmes.

3.3.8. Protection Relays

Status

Most electromechanical relays have been proven in service to last more than 30 years; the next generation of relays manufactured using discrete semiconductor components are likely to have lives averaging 20 years.

A number of electromechanical relays are still operational and most of them have already exceeded their “standard life” which was anticipated during the planning period. These electromechanical relays are well maintained and deemed to still be in good working condition. However, the integration of these assets to complex schemes and technology now becomes an issue as well as the cost of maintaining them.

Numerical protection relays normally have a standard life of 20 years or more depending on the relay’s physical condition (internal circuitry, external condition, etc.), software and communication requirements, availability of spare parts and replacements. Unlike electromechanical and solid state relays, numerical relays’ service life can be extended by upgrading the firmware.

Action

An asset renewal and replacement programme for these assets was put in place to address electromechanical relay replacement within the 2013-2023 financial years. Some in conjunction with development projects and switchgear/circuit breaker installations as outlined in Section 6.4.5.

The prioritisation of replacement will be on criticality, condition, risk, compliance and performance. The main focus will be on the Hamilton CBD area where a substantial number of electromechanical relays are still operational on critical zone substations. Some of these assets were “re-used” when the corresponding switchgear/circuit breaker were upgraded in the past. Relay firmware’s service life is normally the same as the relays’ “standard life”, however, when the relay fails several times and is no longer compatible with newer technology, it is recommended to upgrade the firmware. Once the “old” firmware is upgraded, it will become compatible with the latest technology and can be considered as “good as new”. Ageing numerical relays on critical sites were identified and included in the relay firmware upgrade programme for the next three financial years. Firmware upgrades will be in conjunction with the scheduled circuit breaker maintenance on those sites to manage costs.

Substation	Voltage Level	No. of Relays
SAN	33KV	5
	11KV	6
AVA	33KV	5
	11KV	0
CHA	33KV	2
	11KV	8
WAL	33KV	3
	11KV	0
BRY	33KV	0
	11KV	6
LAT	33KV	2
	11KV	0
HOR	33KV	4
	11KV	0
PUK	33KV	4
	11KV	7
TOTAL		**52**

Figure 30. SEL Protection relays – Firmware Upgrade Programme

3.3.9. Distribution 11kV Underground Cables

Status

All of the 11kV cable installed prior to 1976 was PILC. These PILC cables have a nominal / standard life of 70 years and XLPE has a nominal life of 45 years. Between 1976 and 1990 XLPE cable was installed in the Hamilton CBD area with predominantly PILC installed in other areas. Since 1990 most cable installations have been XLPE. Though difficult to assess, condition is generally considered to be good.

Actions

Most 11kV underground cable faults have occurred at joints and where possible, cable sections are taken for closer examination.

The following figure shows the age profile of all the underground 11kV cables in the network.

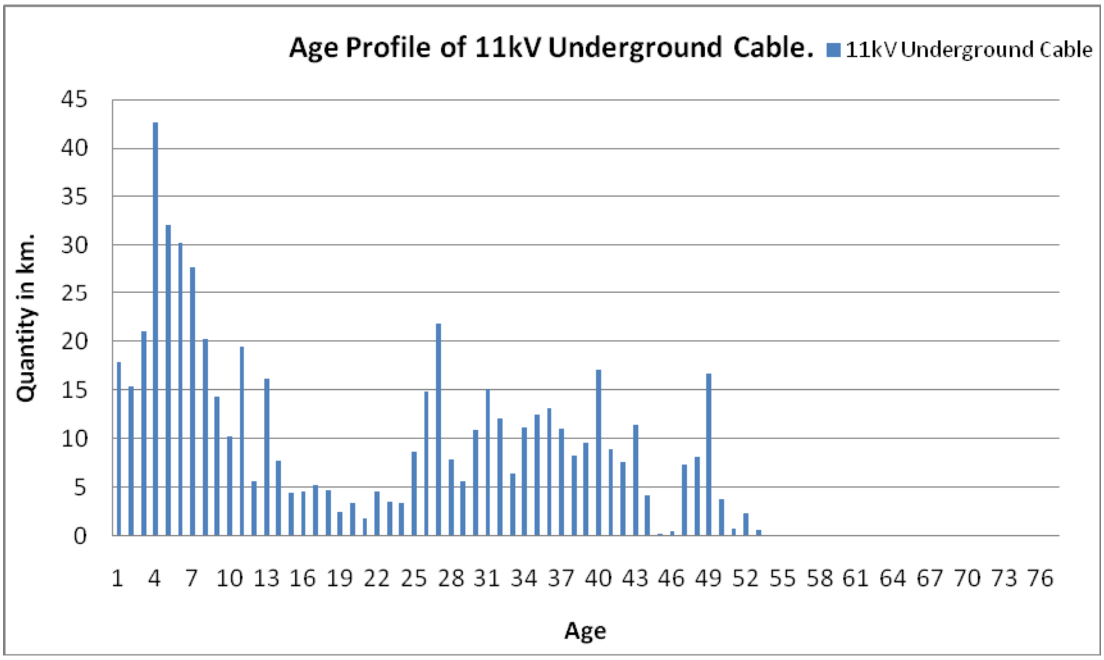


Figure 31. Distribution 11kV Underground Cables – Age Profile

3.3.10. 11kV Overhead Distribution Lines

Status

There are 1,932km of 11kV overhead distribution lines.

The 11kV overhead lines are generally in satisfactory condition, apart from a number of sections of the older 16mm square copper conductor which is failing due to corrosion. These sections have been identified and an earlier replacement programme will be undertaken.

Actions

Where practical, any refurbishment is coordinated with the undergrounding plans to avoid unnecessary replacement of overhead lines. The following figure shows the age profile of the overhead lines while the orange line depicts the nominal life of the 11kV overhead lines (58 years).

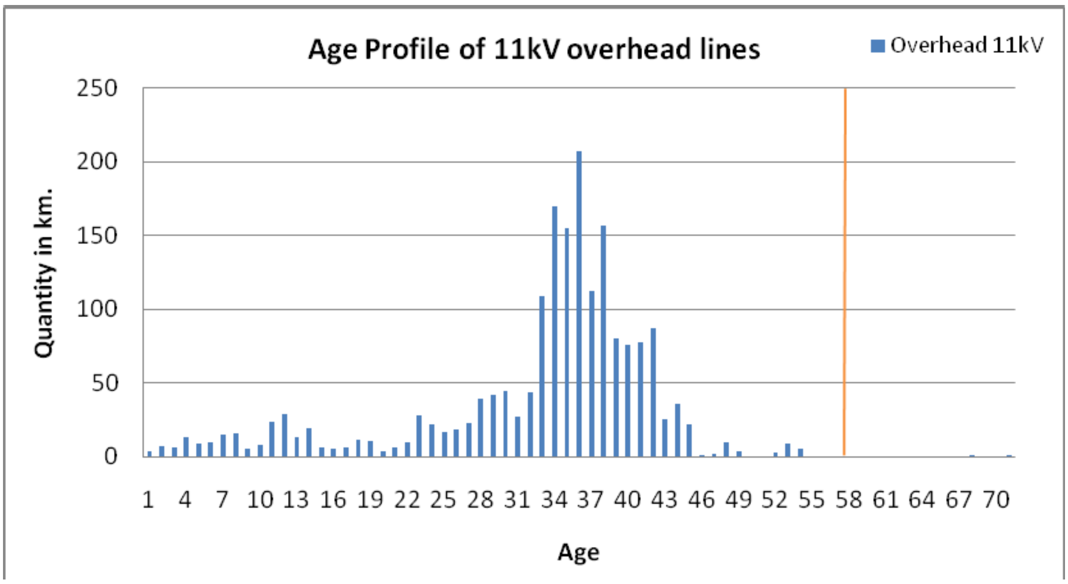


Figure 32. Distribution 11kV Overhead Conductors – Age Profile

Photo 9 Pole Mount Transformer installation 2012

3.3.11. Wooden Poles

Status

Given that WEL has approximately 1,200 hardwood poles, most of which will need to be replaced in the 10 year planning period, it had been decided to assess the condition and prioritise the replacement through the use of a radiation backscatter density measurement. All these assessments were completed in the 2011/12 year. Each pole now has a condition rating. Poles found to be in poor condition were programmed for urgent immediate replacement.

The condition data for the wooden poles for the last 5 years was examined. The data examined provided a sizable sample of wooden poles throughout the network. This data was then extrapolated into the age profile to provide a condition profile that would give a holistic view of the status of the wooden poles in the network. The condition of each asset was identified by a number between 0 to 5, with 0 being 'the most critical' and 5 being 'in good condition'.

Actions

Condition assessments, so far, suggest remaining asset life is less than initially expected and likely to need replacing before reaching the nominal lifespan. The plan has been updated to reflect this change. The age profile below indicates the nominal life of the wooden poles to be 45 years.

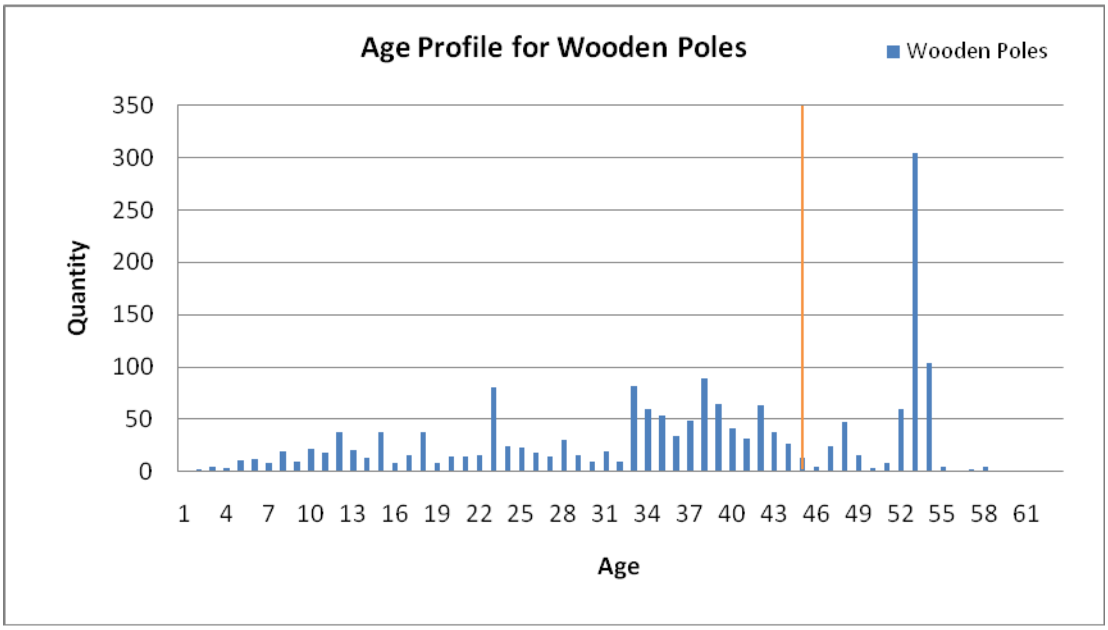


Figure 33. Wooden Poles – Age Profile

In order to further analyse the asset age and condition, the age profile was then overlaid with the condition ratings as can be seen in Figure 34. The assets with conditions 1, 2 and 3 were then identified and the most critical assets grouped into feeders and plotted according to their respective feeders as shown in Figure 35. These results have now enabled the worst areas to be targeted in the replacement program.

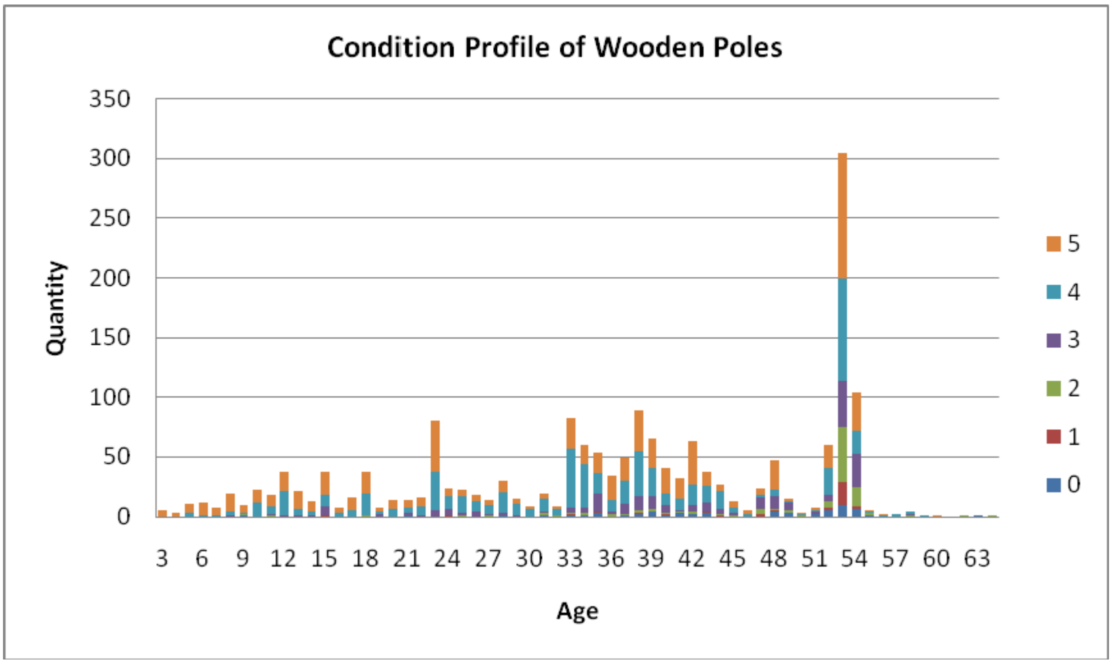


Figure 34. Wooden Poles – Condition Profile

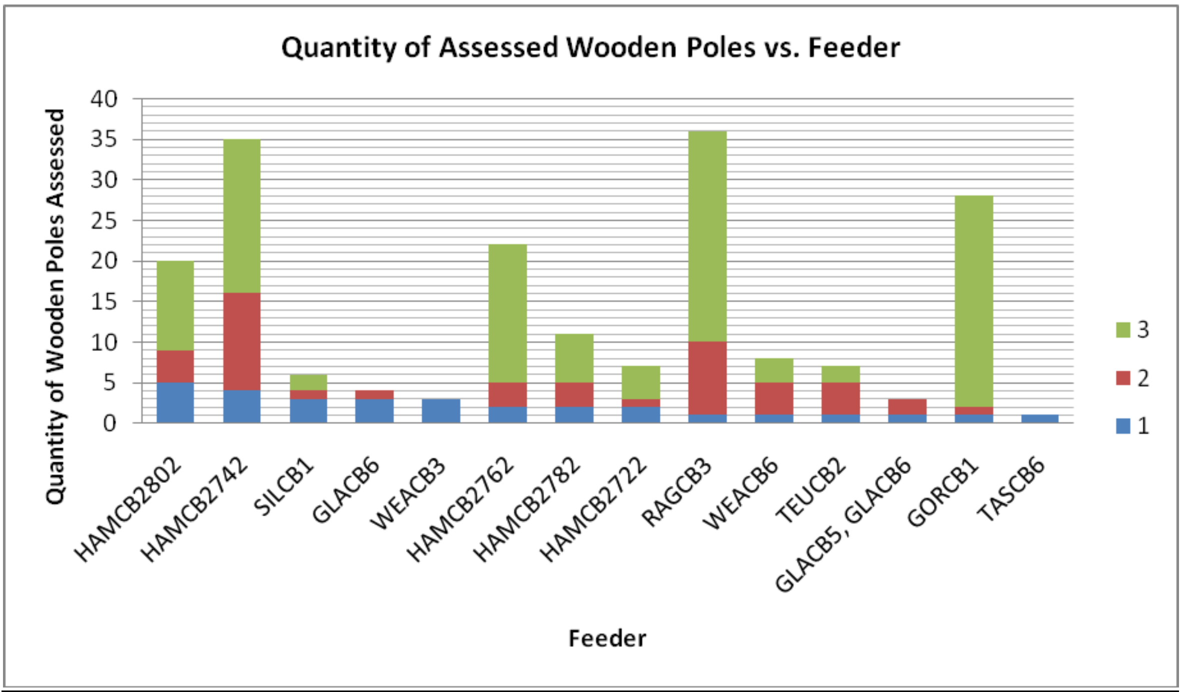


Figure 35. Wooden Poles - Critical Feeders

3.3.12. Concrete Poles

Status

Concrete poles are generally in good condition and the projected spend on this asset class is minimal over the 10 year planning period. There are however particular types that are more susceptible to concrete spalding and these are being replaced as identified by condition assessment. The age profile indicates the nominal age of concrete poles as 70 years.

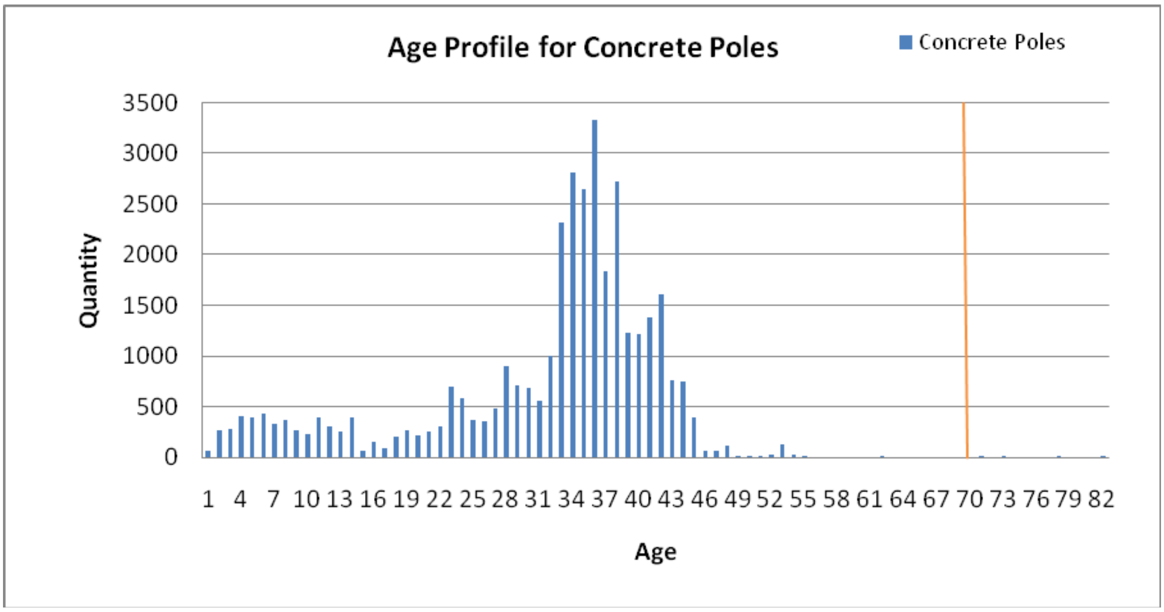


Figure 36. Concrete Poles – Age Profile

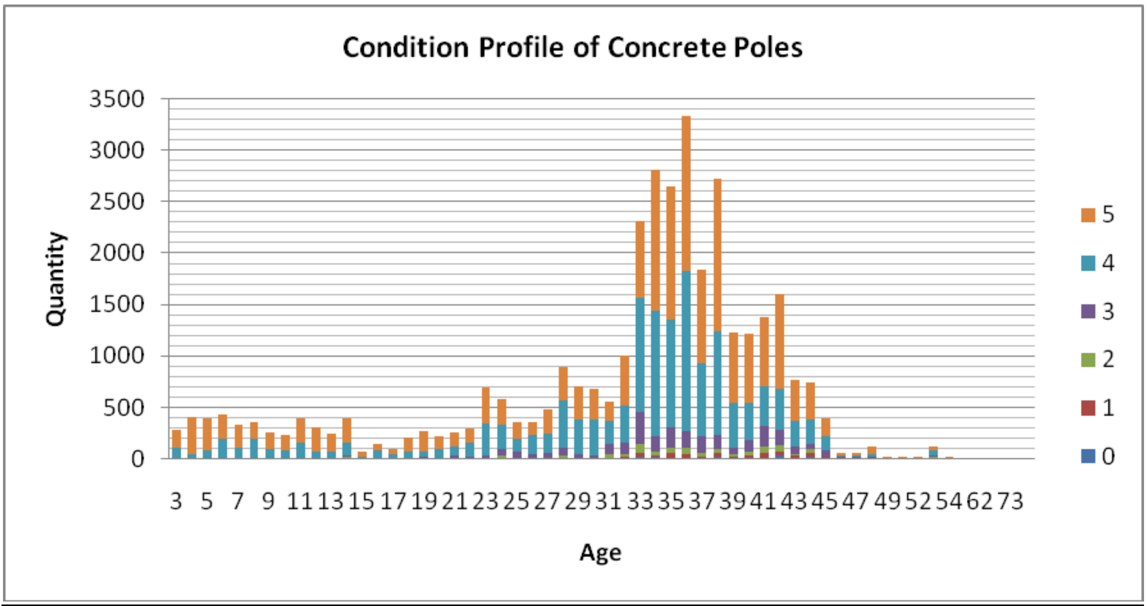


Figure 37. Concrete Poles – Condition Profiles

In order to further analyse the asset age and condition, the age profile was then overlaid with the condition ratings as can be seen in Figure 37 above. The condition data for concrete poles for the last 5 years was examined. The data examined provided a sizable sample of concrete poles throughout the network. This data was then extrapolated into the age profile to provide a condition profile that would give a holistic view of the status of the concrete poles in the network. The condition of each asset was identified by a number between 0 to 5, with 0 being 'the most critical' and 5 being 'in good condition'.

Actions

The assets with conditions 1, 2 and 3 were then identified and the most critical assets were grouped into feeders and plotted according to their respective feeders as shown in Figure 38.

It should be noted that the condition information does not represent the entire network but does cater to a big enough sample so as to provide an indication of the asset health in the network.

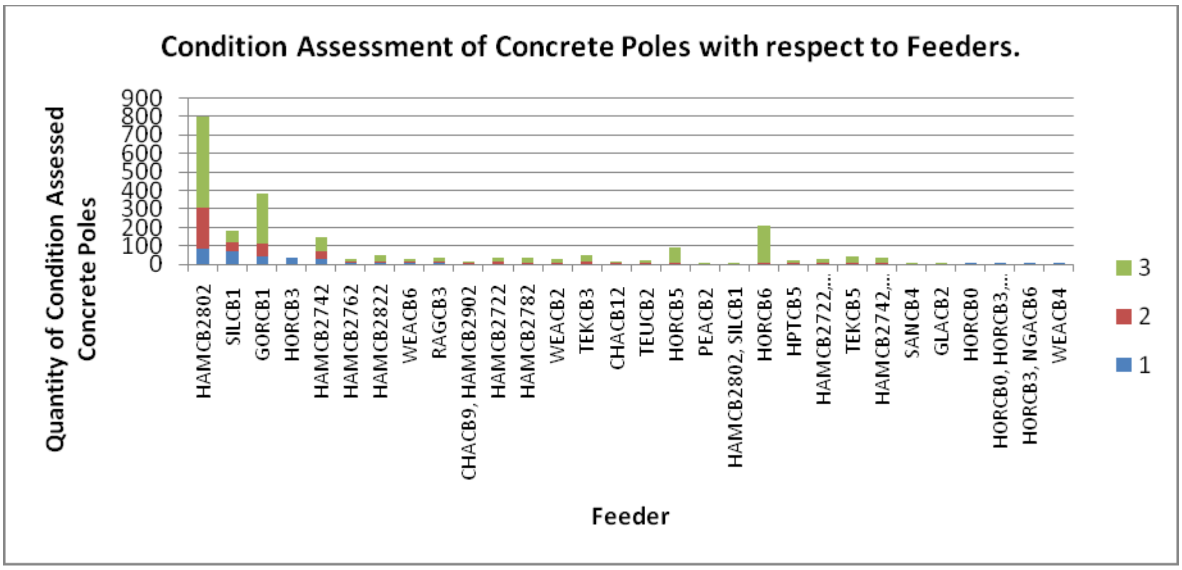


Figure 38. 33kV Concrete Poles – Critical Feeders.

3.3.13. Crossarms

Crossarms are visually inspected as part of the five yearly condition assessments of overhead assets. Notifications are raised in SAP for those given a poor assessment and scheduled for replacement in the following period's capital programme. Particular insulator types (for example Kidney) are noted and are being progressively replaced. Current inspection information suggests crossarm conditions may be slightly better than originally expected.

Status

The condition data for the crossarms for the last 5 years was examined. This data was then overlaid onto the age profile to provide a condition profile that would give a holistic view of the status of the crossarms in the network (Figure 40). The condition of each asset was identified by a number between 0 to 5, with 0 being 'the most critical' and 5 being 'in good condition'.

Actions

In order to further analyse the condition profile it was decided that the focus should be on assets with the conditions of 1, 2 and 3. The assets were identified and the most critical assets were grouped into feeders and plotted according to their respective feeders as shown in Figure 41. It should be noted that the condition information does not represent the entire network.

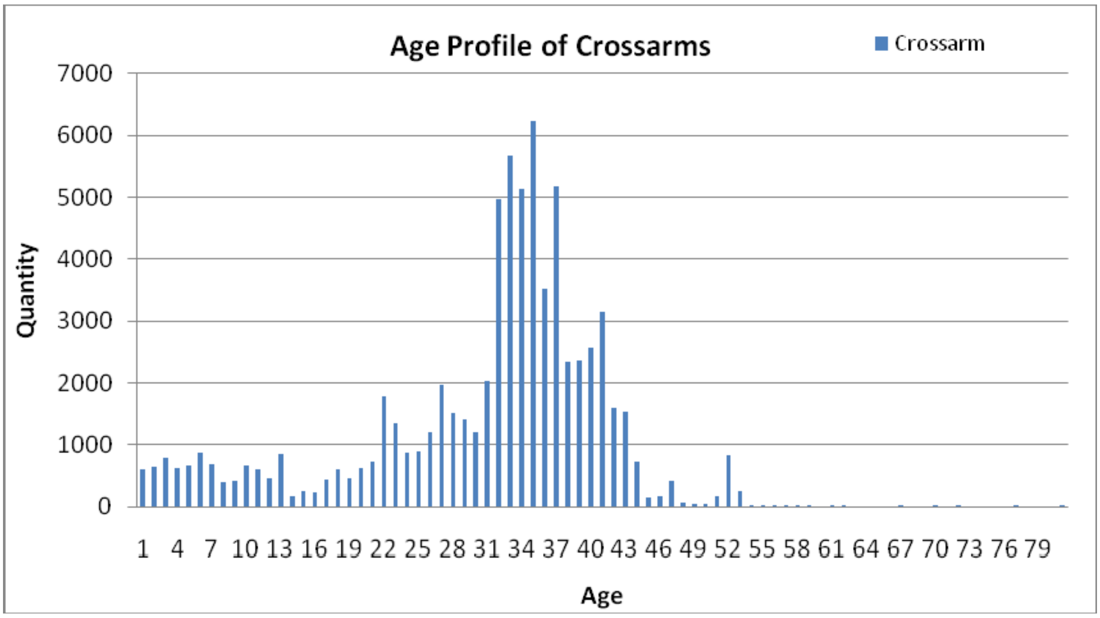


Figure 39. Crossarms – Age Profile

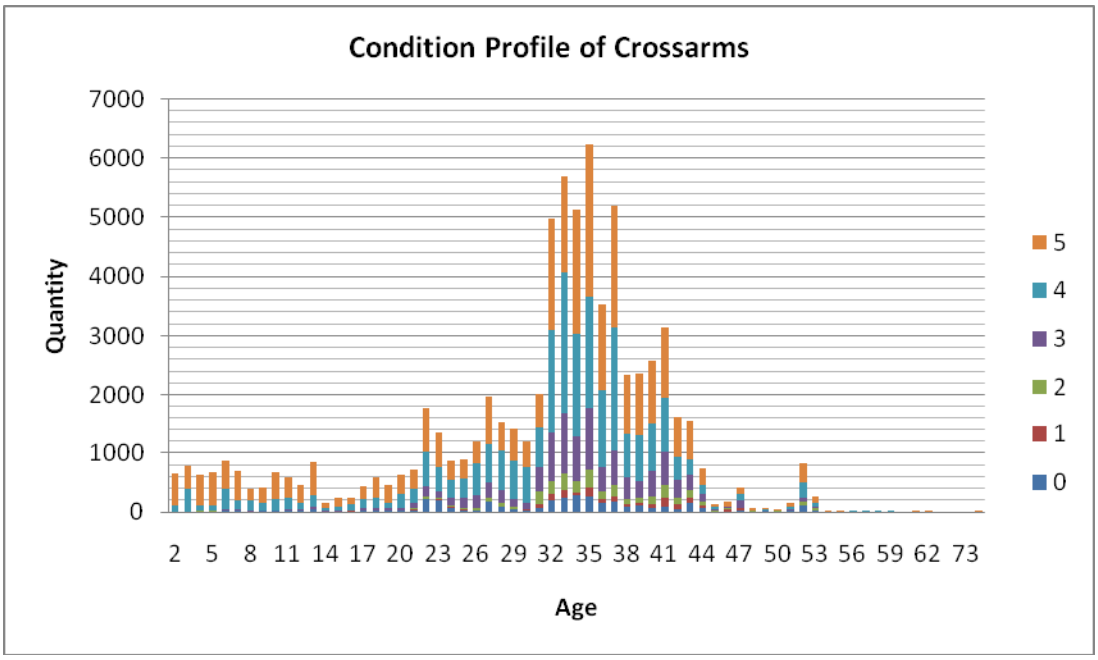


Figure 40. Crossarms – Condition Profile

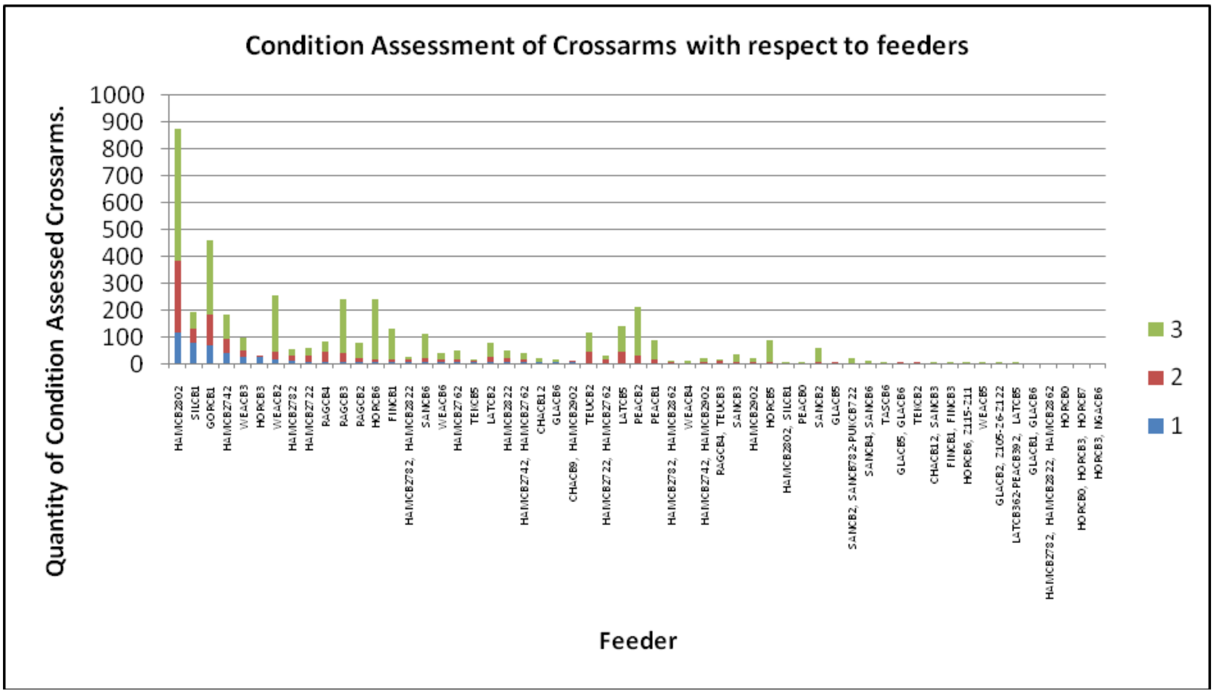


Figure 41. Crossarms – Critical Feeders

3.3.14. 11kV Switching Stations

Status

There are 17 11kV switching station installations which are deemed to be in good condition based on the maintenance inspection regimes on these sites.

Actions

Condition monitoring is carried out as part of the RCM philosophy. Condition monitoring indicates no major electrical or structural problems.

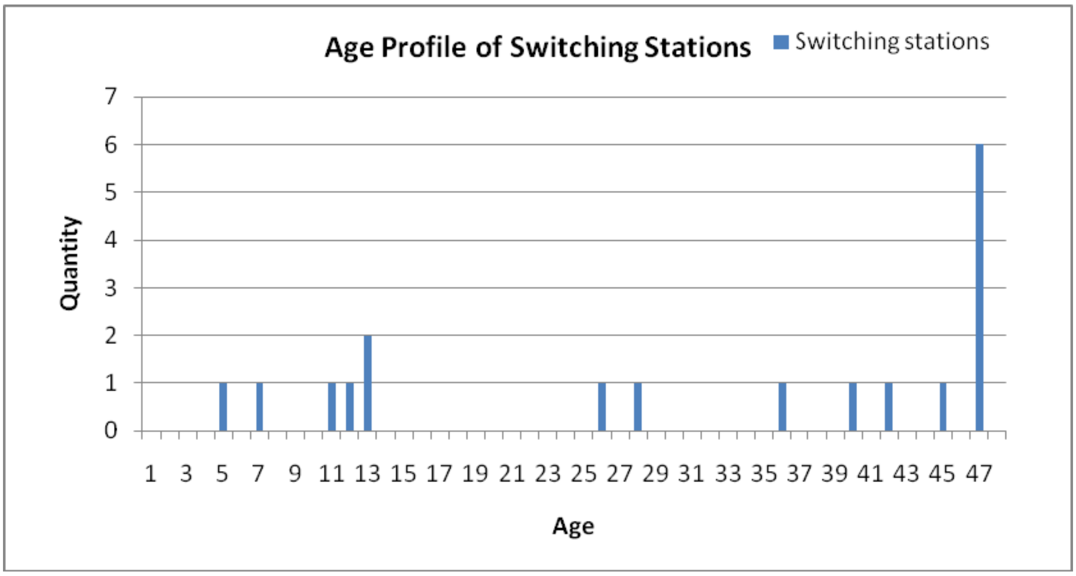


Figure 42. 11kV Switching Stations – Age Profile

3.3.15. 11kV Ring Main Units (RMUs)

Status

All new installations are of the SF_6 gas-insulated type because of problems experienced with oil insulated units. There have been a number of instances where oil filled ring mains have failed due to incorrect adjustment of internal contact travel, contact bounce and contact damage. Issues have been identified with Andelect ring mains and particular attention has been paid to the internal inspection of these. Where appropriate they are being replaced. Due to problems encountered with particular models of oil filled ring mains, all oil filled RMUs have been internally inspected and have had the oil changed. This programme was completed at the end of the 2011 financial year. The age profile consists of gas and oil filled switches/fuses which have nominal life of 40 and 55 years respectively.

The condition data for RMUs for the last 5 years was examined. The data examined provided a sizable sample of RMUs throughout the network. This data was then overlaid onto the age profile to provide a condition profile that would give a holistic view of the status of the RMUs in the network Figure 43. The condition of each asset was identified by a number between 0 to 5, with 0 being 'the most critical' and 5 being 'in good condition'.

Actions

In order to further analyse the condition profile it was decided that the focus should be on assets with the conditions of 1, 2 and 3. The assets were then identified and the most critical assets were grouped into feeders and plotted according to their respective feeders as shown in Figure 45.

Our program aims to replace units based on poor condition and age.

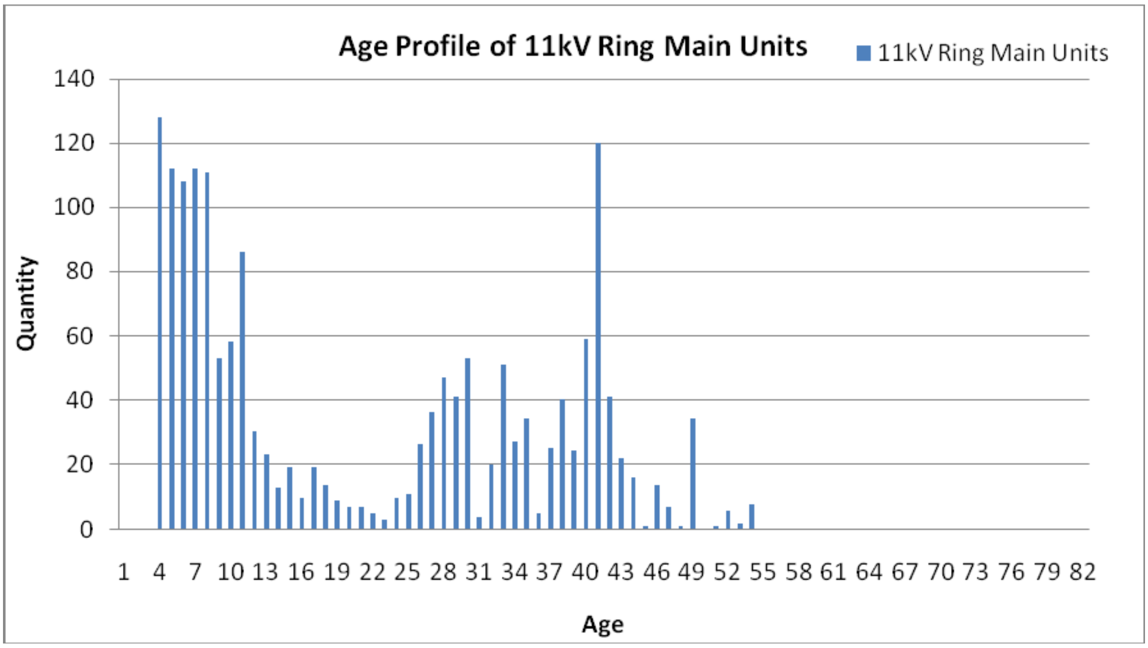


Figure 43. 11kV Ring Main Units – Age Profile

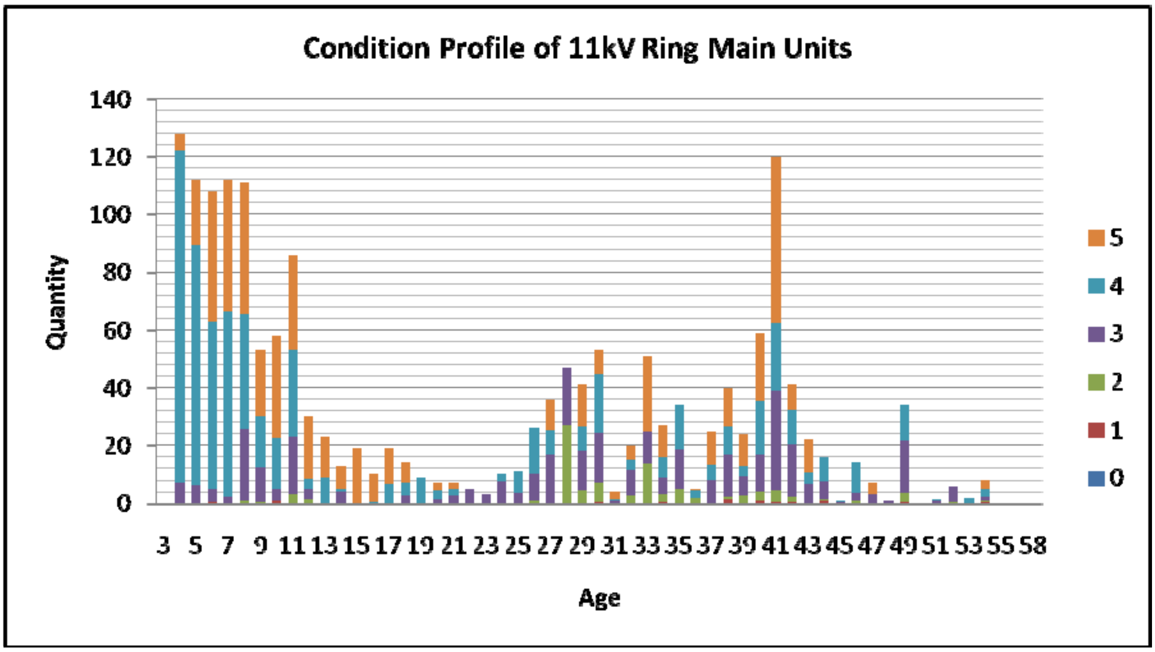


Figure 44. 11kV Ring Main Units – Condition Profile

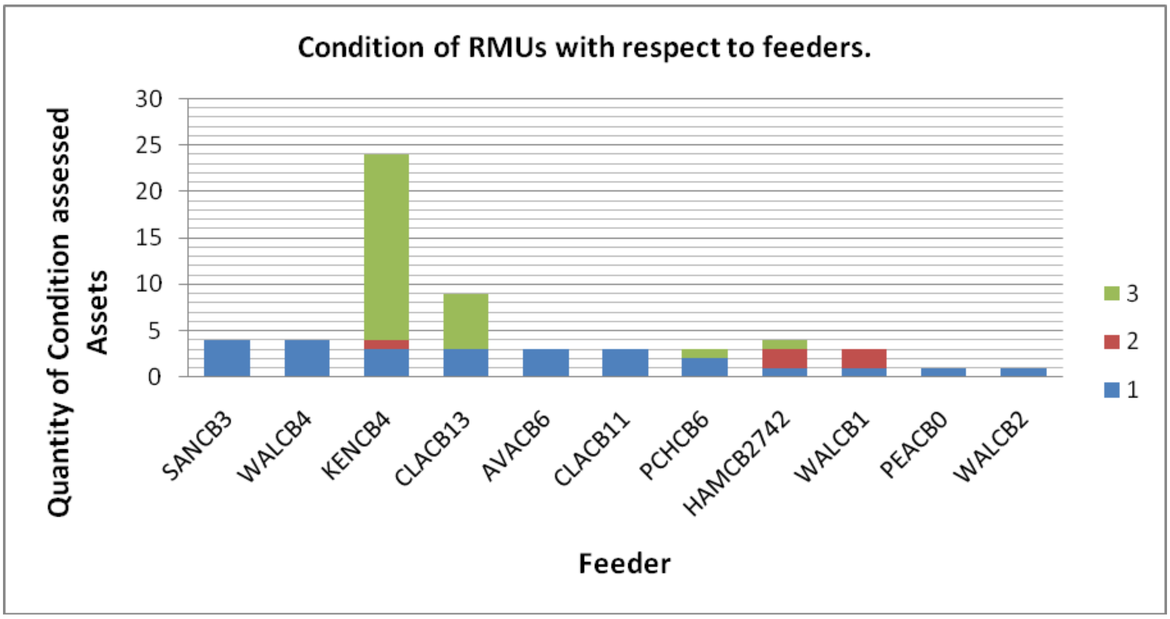


Figure 45. 11kV Ring Main Units – Critical Feeders

3.3.16. 11kV Air Break Switches (ABS)

Status

The age profile indicates a growing number of switches reaching end of life and requiring replacement. The majority of these are non load break switches for isolation on overhead transformer structures. The condition of these is generally poor. Load break line switches are in better condition but are being replaced with sealed gas insulated units.

With appropriate maintenance most of the units are expected to be used to the end of their nominal life, except where their fault level rating is insufficient to meet the growing system fault level.

The age profile illustrates the nominal age of the ABS as 35 years.

The condition data for the ABS for the last 5 years was examined. This data was then overlaid onto the age profile to provide a condition profile that would give a holistic view of status of the ABS in the network Figure 46. The condition of each asset was identified by a number between 0 to 5, with 0 being 'the most critical' and 5 being 'in good condition'.

Actions

In order to further analyse the condition profile it was decided that the focus should be on assets with the conditions of 1, 2 and 3. The assets were thus identified and the most critical assets were grouped into feeders and plotted according to their respective feeders as shown in Figure 48.

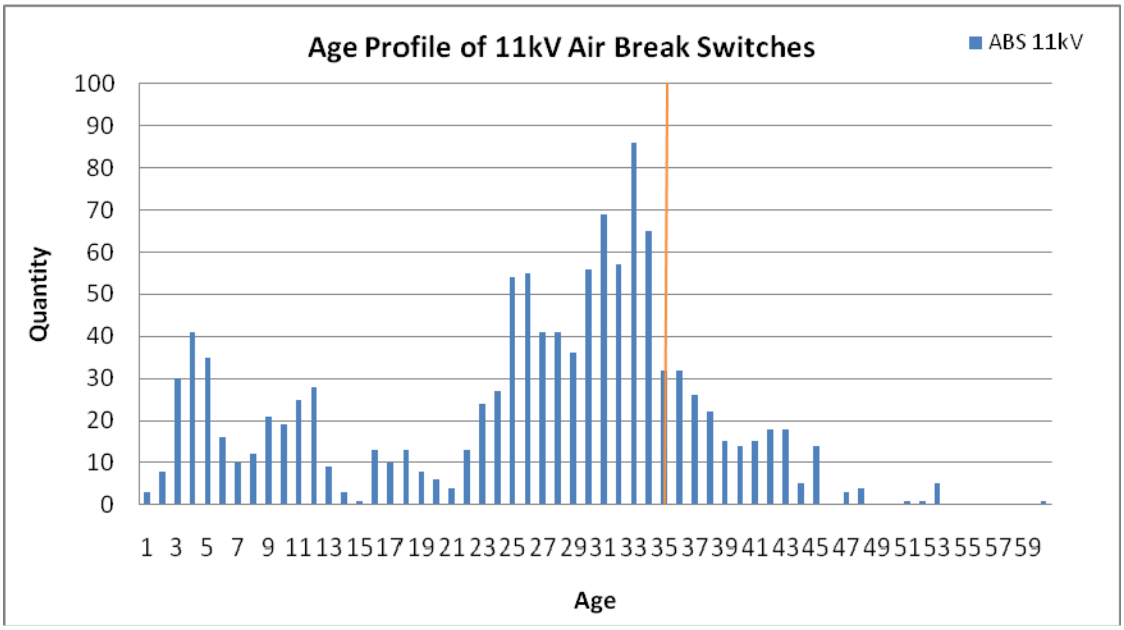


Figure 46. 11kV Air Break Switches (ABS) – Age Profile

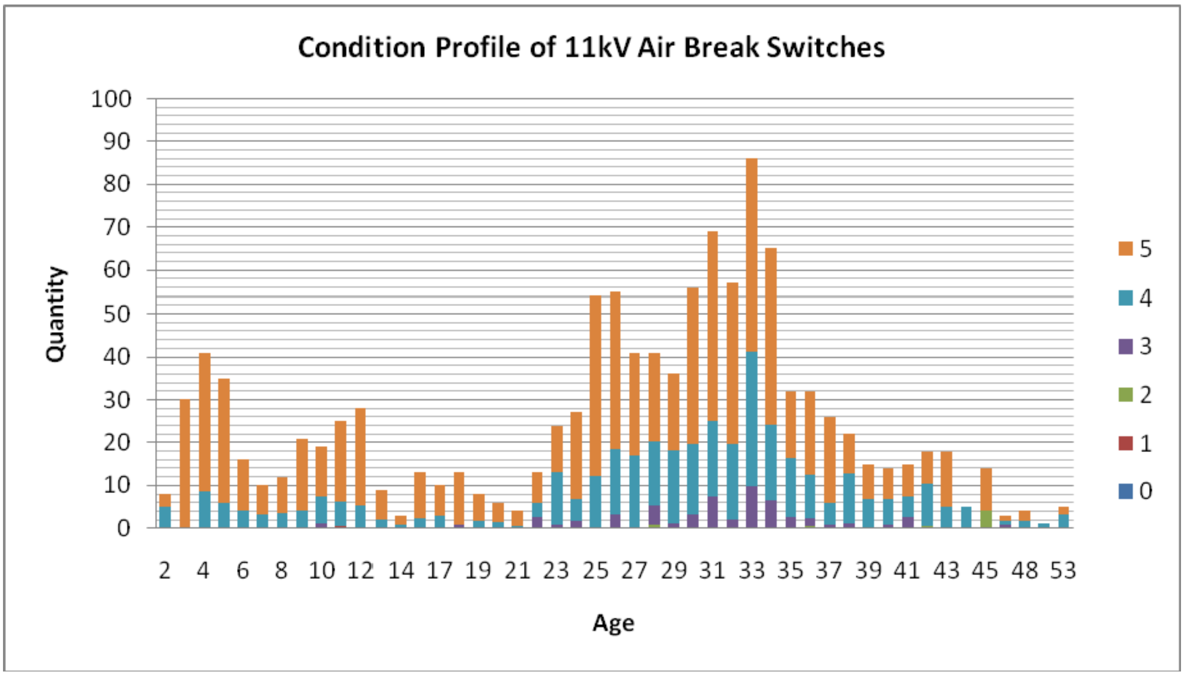


Figure 47. 11kV Air Break Switches (ABS) – Condition Profile

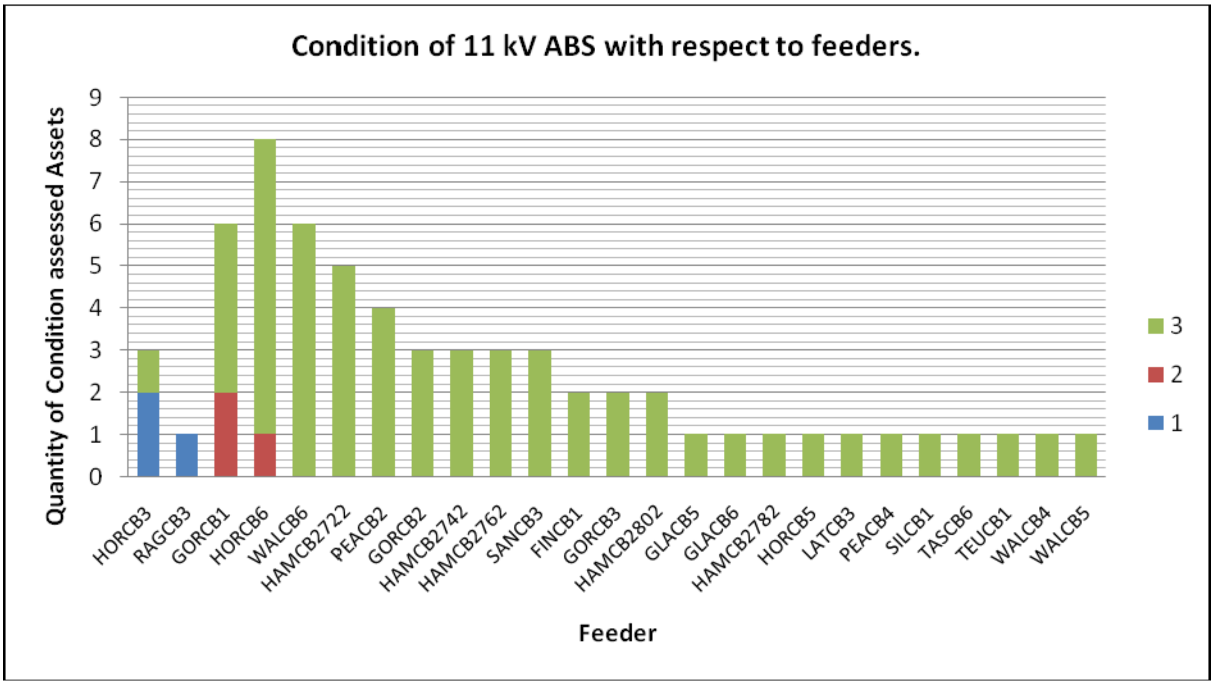


Figure 48. 11kV Air Break Switches (ABS) – Critical Feeders

3.3.17. 11kV Reclosers and Sectionalisers

Status

A large number of units were installed in 2004 and 2005 to achieve reduced SAIDI minutes. Since then the discrepancy in maintenance costs between the older and newer units has become apparent. A life cycle cost analysis has been carried out and as a result the remaining older units will be progressively replaced.

Many of the sectionalisers on the network are old and routine testing has been found to have a detrimental effect on the reliability of their operation. Therefore testing will only be done when there is an indication from SCADA data that an incorrect operation has occurred.

All reclosers are automated, with remote SCADA operation and monitoring.

Actions

In recent years there have been a number of electronic failures of the more recently installed units. These failures aren't confined to any particular make, and are expensive to repair.

Problems have been experienced with drop-out sectionalisers that were installed in 2004-2005. These do not always operate when expected and moves to correct these problems through maintenance actions have been unsuccessful. Alternatives to the units are being evaluated and the expectation is that these units will be replaced over the following five years of the plan.

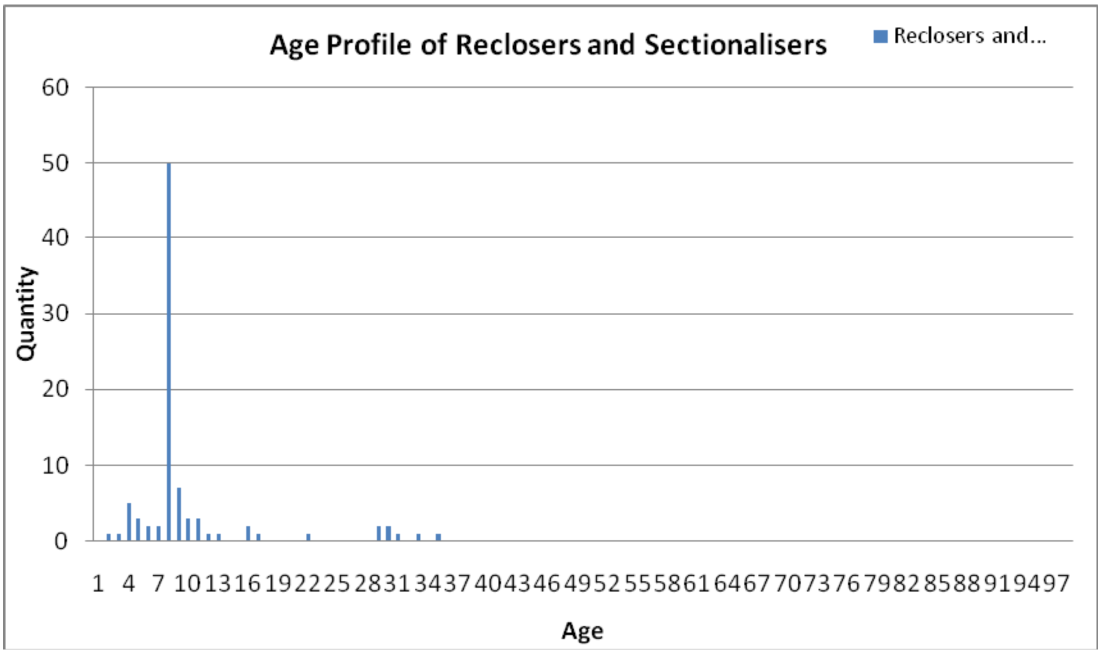


Figure 49. 11kV Reclosers and Sectionalisers – Age Profile

3.3.18. Distribution Transformers

Status

The population of distribution transformers covers a diverse range of sizes, types and ages. Many distribution transformers run well below their rated values for much of their life, resulting in long lives for the cores and windings. Provided that the tanks and oil are well maintained, the units may be kept in service for up to 55 years even though we consider the nominal life to be 45 years.

The majority of distribution transformer faults are caused by lightning damage. For the larger pole mounted units surge arrestors are now specified as standard at the time of installation to reduce this cause of failure.

The condition data for the distribution transformers for the last 5 years was examined. This data was overlaid onto the age profile to provide a condition profile that would give a holistic view of the status of the distribution transformers in the network (Figure 51). The condition of each asset was identified by a number between 0 to 5, with 0 being 'the most critical' and 5 being 'in good condition'.

Actions

Transformers that can be economically repaired will be refurbished and reused. The condition of transformers varies considerably depending on their physical location (pole or ground mount) and make and model. Some relatively new units have been found to have serious rust on their lids.

In order to further analyse the condition profile it was decided that the focus should be on assets with the conditions of 1, 2 and 3. The assets were thus identified and the most critical assets were grouped into feeders and plotted according to their respective feeders as shown in Figure 52.

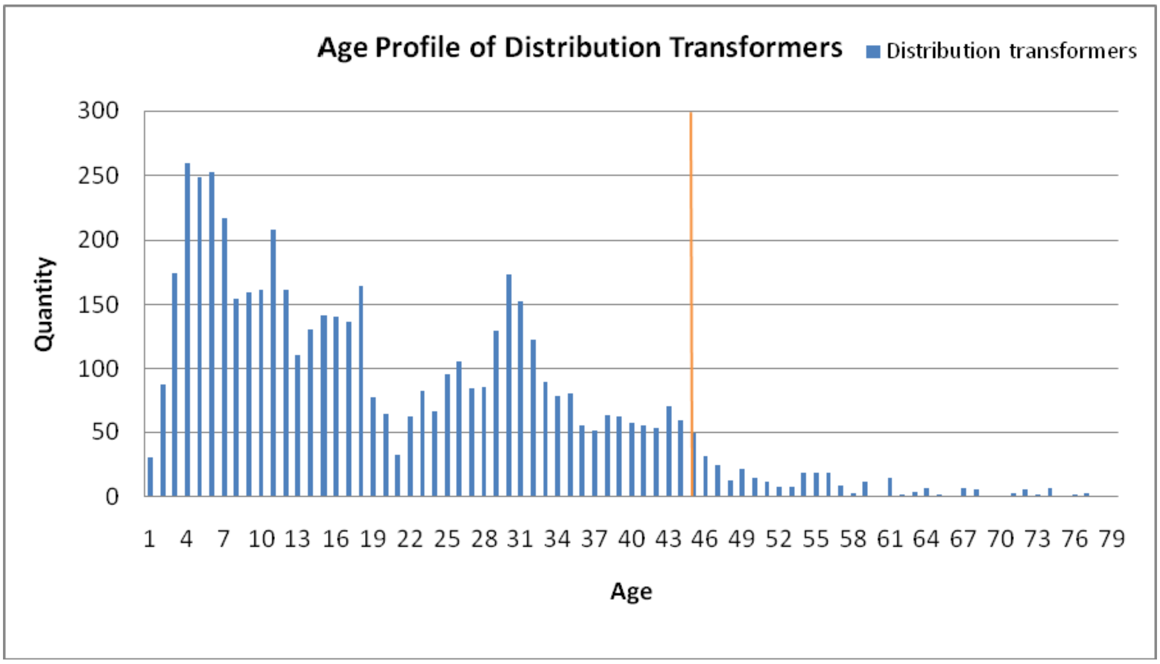


Figure 50. Distribution Transformers – Age Profile

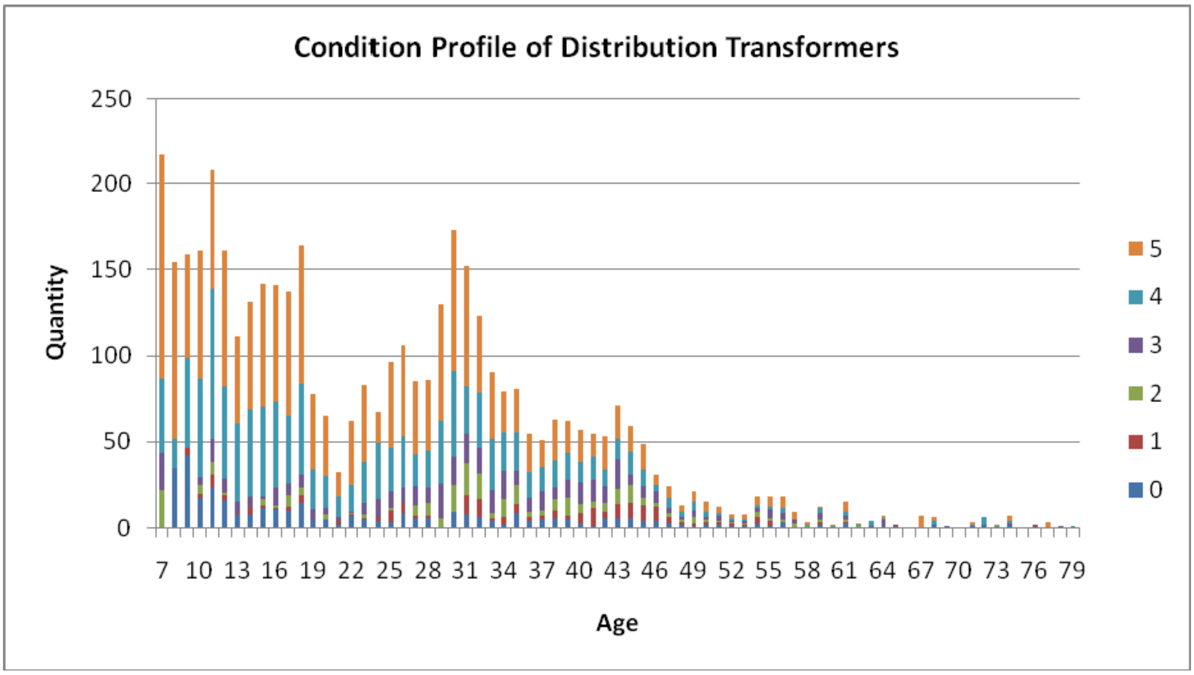


Figure 51. Condition Profile of Distribution Transformers

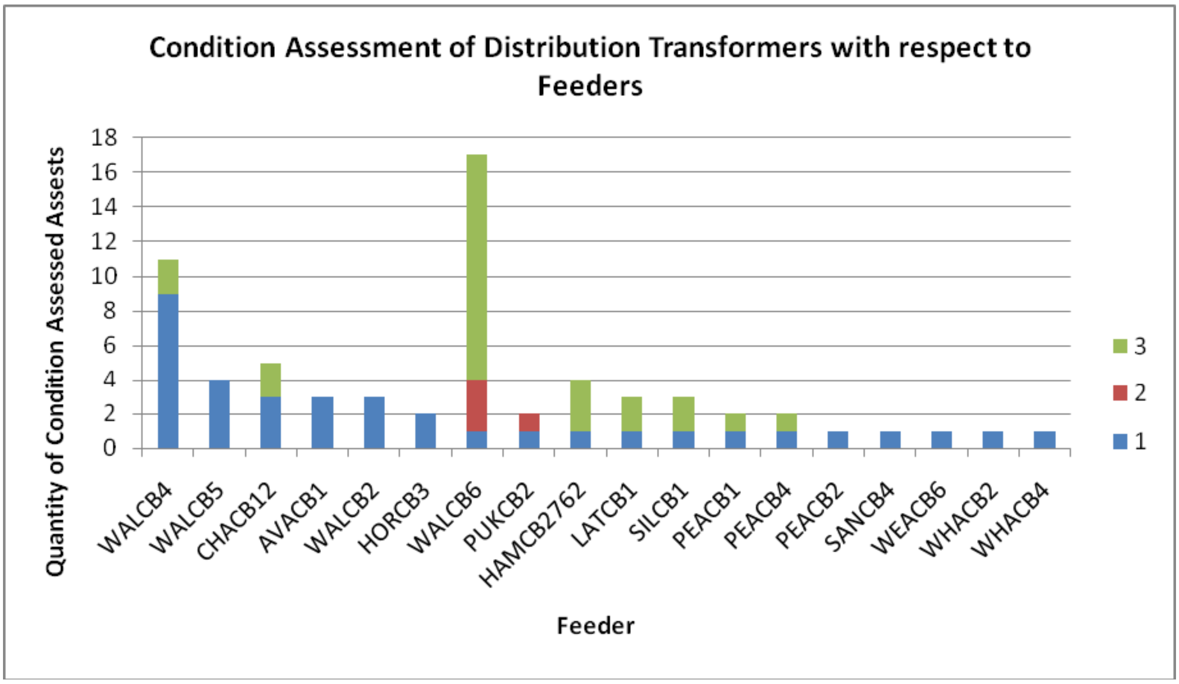


Figure 52. Feeders with Distribution Transformers in critical condition

3.3.19. LV Underground Cables

Status

Underground LV cables are exhibiting only a small number of failures, primarily paper-insulated types, which can be ascribed to age related causes. Most faults are caused by damage from external factors or from poor installation practices.

Actions

Condition is difficult to assess and issues only become apparent when faults begin to appear in particular localised areas.

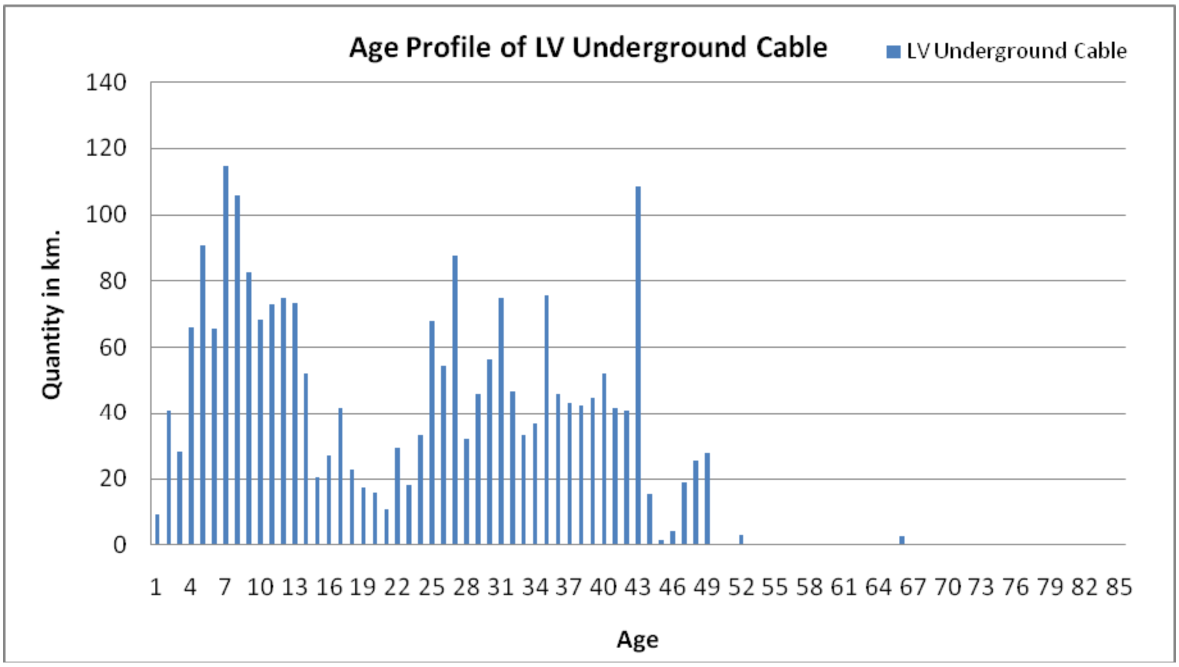


Figure 53. LV Underground Cable – Age Profile

3.3.20. LV Overhead Reticulation

Status

The LV overhead reticulation is generally in a satisfactory condition. The age profile shows that the nominal life of a typical conductor is 58 years. The age profile includes all the different types of LV conductors.

As for other overhead lines, the age profile is based on actual condition assessment rather than from construction dates as many sections have been rebuilt.

Actions

The LV lines will be replaced with any planned replacement of 11kV overhead lines.

Most lines have yet to reach their expected nominal life so only minor routine maintenance and no significant investment will be required within the planning period.

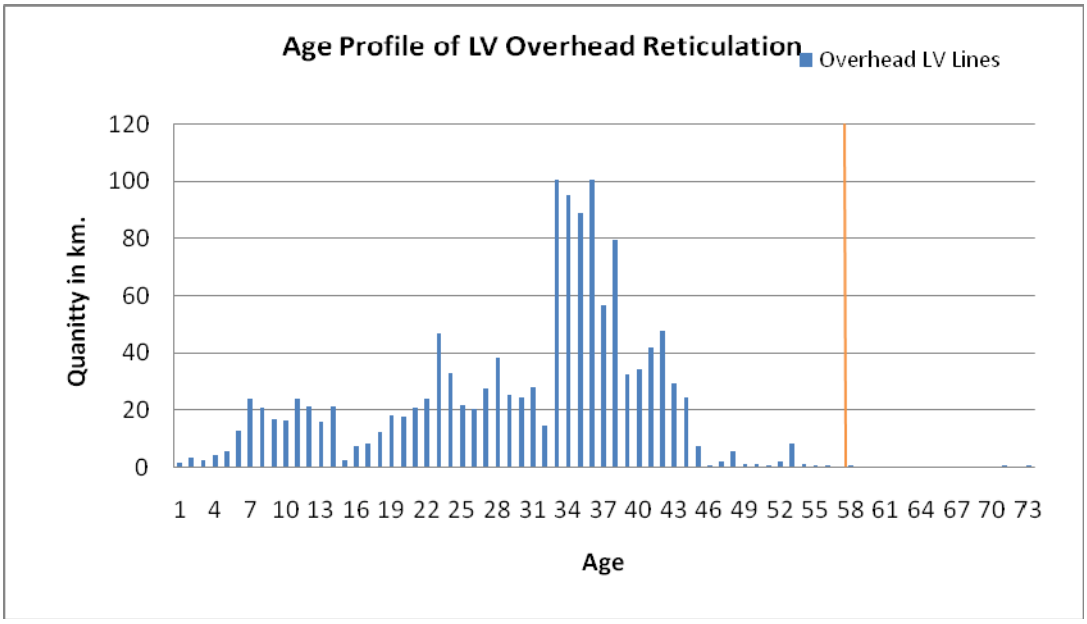


Figure 54. LV Overhead Reticulation – Age Profile

3.3.21. LV Service and Distribution Pillars

Status

The LV Service and Distribution pillars are generally in a satisfactory condition. The age profile shows that the nominal life of an LV pillar is 45 years. The age profile includes LV service pillars with outstanding notifications which were identified from the previous LV pillar inspections. The age profile (Figure 55) shows that a number of LV distribution pillars have exceeded their nominal life.

Actions

LV pillar inspections are being performed at 3 yearly intervals to monitor pillar condition. Notifications raised from inspections are being given higher replacement priority rather than replacements based on age. Replacements based on age will focus on particular age groups having substantial numbers of units.

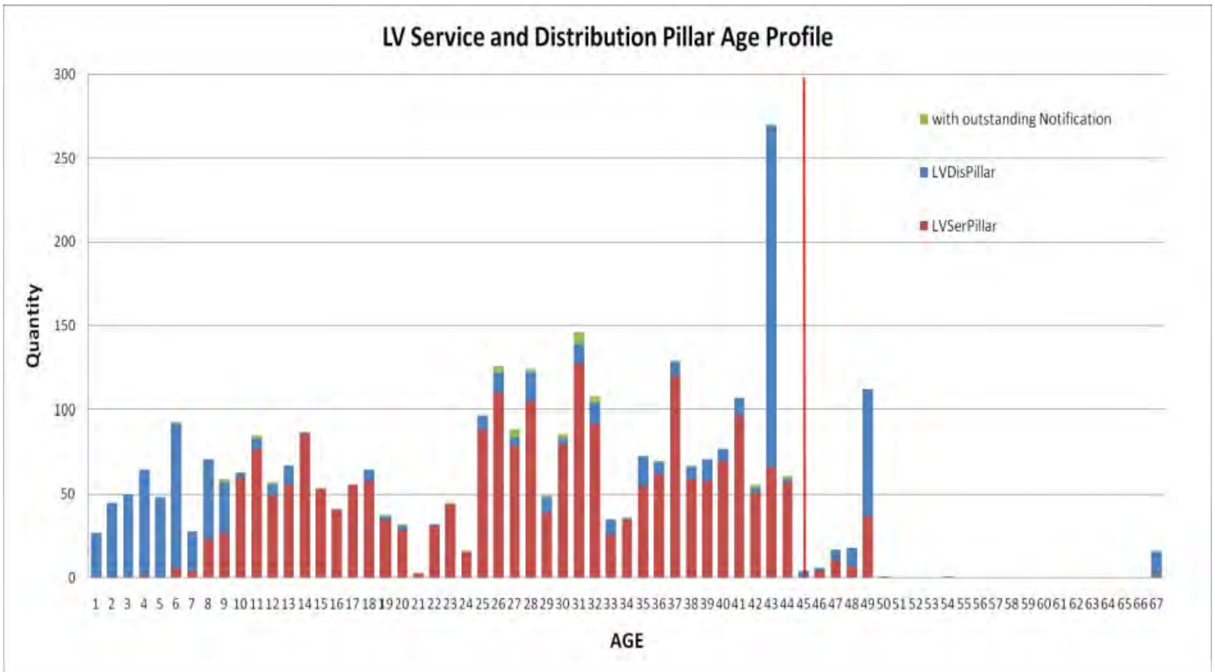


Figure 55. LV Service and Distribution Pillars – Age Profile

3.3.22. SCADA: Communications and Control Equipment

Status

WEL implemented its new GE PowerOn Fusion Network Management System (NMS) in February of 2011. It comprises of a master station, data storage systems, alarming and integrated outage management which includes call taking and dispatch functions. A third party load management system has also been integrated to the NMS.

Furthermore there is a communications infrastructure, RTUs and substation wiring.

Some of the master station equipment resides at WEL's main office and other parts of the system reside at WEL's disaster recovery site.

The condition and reliability of the Network Management System and communications infrastructure is generally good.

Actions

Older RTUs, though reliable, are progressively being upgraded or replaced to provide improved functionality and communications capability. Where possible, communication is progressively being upgraded to DNP3.0 over IP, sometimes in conjunction with development projects and switchgear/circuit breaker installations.

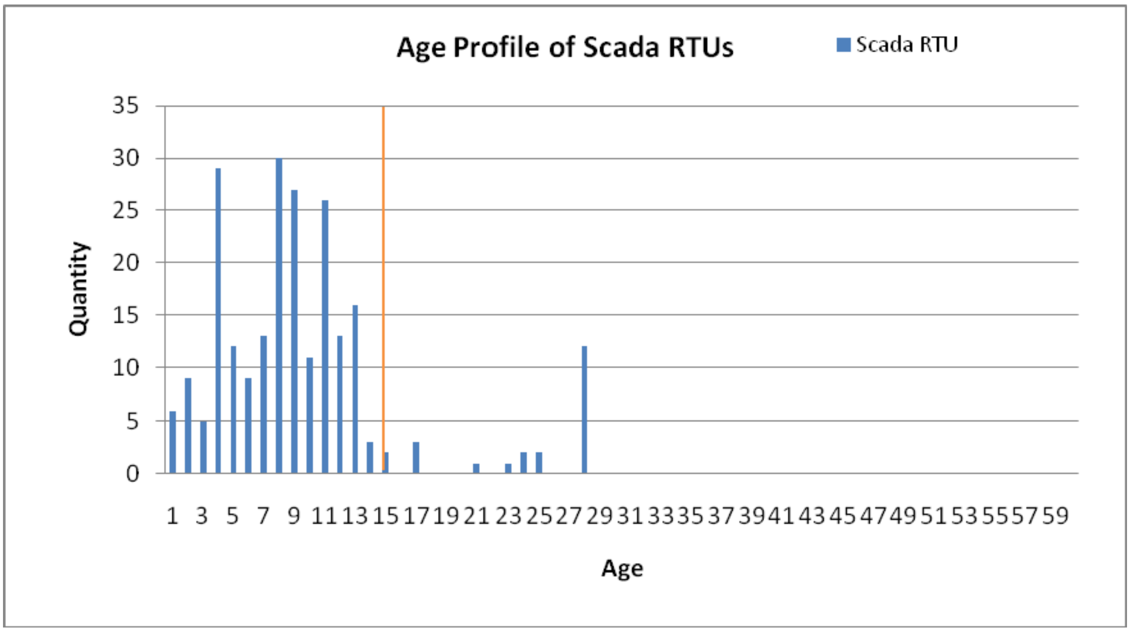


Figure 56. Substation SCADA and Control Equipment – Age Profile

3.3.23. Load Control Equipment

Status

The load control system operates via the NMS (Network Management System). This communicates to three primary 33kV static ripple injection sets on the WEL network with one set at the Hamilton GXP, one set at Te Kowhai GXP and one set which has been installed at Weavers for the Huntly GXP. These sets operate at 283Hz.

The condition and reliability of the equipment is good. Older rotary plants in the Northern network will be taken over by the static plant at Weavers once relays have been replaced.

Actions

The Weavers injector will allow old relays to be replaced with either new relays or smart meters and the removal of the five 11kV 500Hz rotary sets in the northern area. These rotary sets are located at Weavers, Te Kauwhata, Glasgow, Hampton Downs and Finlayson Rd substations.

An 11kV static injection plant is in service on the Hamilton 11kV GXP. An 11kV 283Hz static injection plant is also located at Pukete. The signals for this injector are initiated by SCADA load control commands simultaneously with the plant at Te Kowhai GXP.

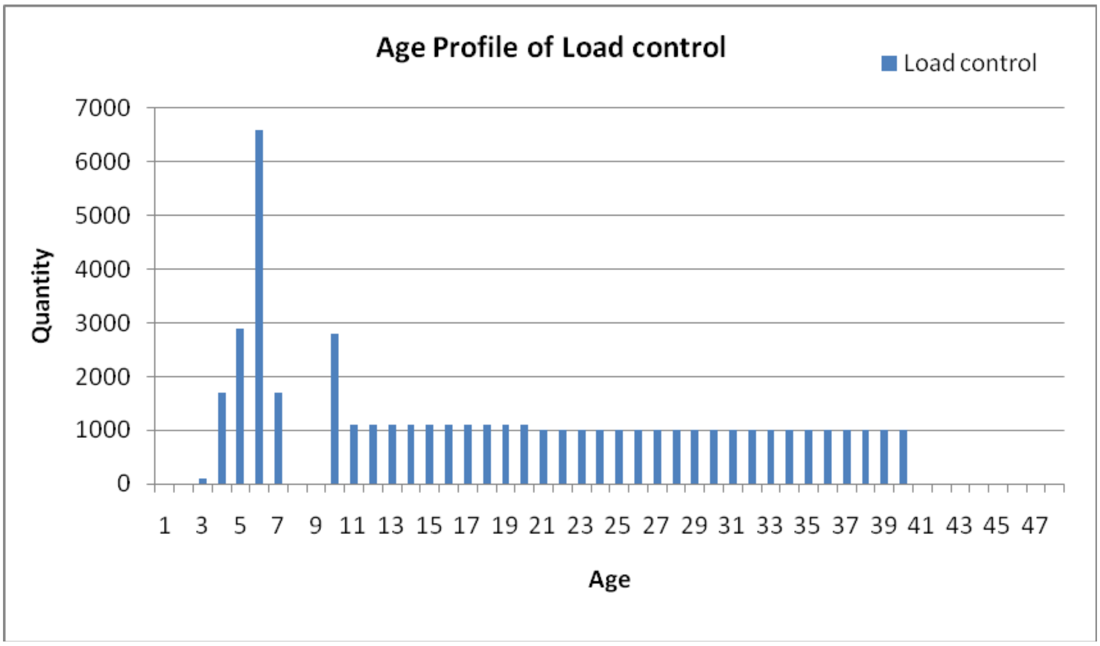


Figure 57. Load Control Equipment – Age Profile

3.4. Value and Quantities of Assets in Each Asset Category

Asset Values and quantities are shown below. Land and buildings were re-valued to market value on 31 March 2010 by independent valuers, TelferYoung (Waikato) Ltd Registered Valuers – Property Advisors. The distribution network before 31 March 2011 was re-valued on 31 March 2012 by independent valuers, Sinclair Knight Merz (NZ) Limited Registered Engineers and audited by PricewaterhouseCoopers (PwC) - electricity lines valuation advisors.

The valuation of the network fixed assets has been prepared on the basis of depreciated replacement cost (DRC) given the challenges of determining fair value on infrastructure assets. The DRC valuation approach is in line with the company accounting policies and consistent with NZ IAS 16: Property, Plant and Equipment.

The land and buildings have been valued on the basis of market value given the nature of the assets. Again this market value consideration is consistent with the accounting policies and accounting standards view on determining fair value. Table 5 includes only assets have been commissioned and capitalised as at 14 December 2012. WEL decided to change its asset valuation method from DRC to the Discounted Cash Flow (DCF) method for the March 2013 year.

Refer to section 3.3 for details about the age, condition and maintenance programmes for each asset category. Refer to section 6.4 for asset renewal programme information.

Asset Category	Unit	Quantity	"Asset Value ($000 in DRC)"
33kV Lines	km	195	4,971
33kV Cables	km	229	56,879
33kV Zone Substations and 11kV switching stations	No.	43	28,302
Zone Substation transformers	No.	46	7,910
11kV Lines	km	1,916	20,350
11kV Cables	km	501	43,711
Ring Main Units	No.	724	3,533
Air Break and Gas switches	No.	1,231	3,639
Reclosers	No.	116	2,846
Distribution Transformers	No.	5,339	38,274
LV Lines	km	1,106	12,002
LV Cables	km	1,039	32,378
Street Light Lines	km	261	1,955
Street Light Cables	km	1,167	27,940
SCADA; Communications and Control Equipment			4,331
Poles including Value of Crossarms	No.	38,628	38,974
Land and Building	No.		11,595
Other			18,555
Total			358,147

Table 5 Capitalised Asset Quantities and Value as at 14 December 2012

Photo 10 Vegetation Management

3.5. Justification for the Network Assets

WEL recognises that its network has been built up over 80 years by incremental investment decisions. While optimal at the time, it would probably not be optimal if the network were to be rebuilt at a single point in time to supply the exact needs of the existing consumers.

The WEL network was reviewed to determine the extent to which the network is over designed. The review was done with regard to the quality of supply criteria contained in the Network Connection Standard and also with regard to specific contracts with some large users of electricity.

The underground cabling systems in WEL's network were reviewed against the requirements of the Hamilton City Council and the Waikato District Council District Plans and requirements applying to lifestyle subdivisions. The use of separate trenches to bring cables out at rural zone substations was reviewed and considered appropriate to avoid uneconomic de-rating of cables.

In recent times there has been considerable load growth within the WEL network. This has placed significant demands on the capacity of the 33kV sub-transmission systems. A number of network augmentation projects are planned to overcome any load capacity limitations and security of supply risks.

The recent triennial asset valuation result considers WEL's network to meet the requirement to provide the desired quality of supply given reasonable load forecasts. Comments from the report on the suitability of various parts of the network include the following:

- All Transpower points of supply supplying WEL's network are required to meet WEL's quality of supply criteria.
- Load flow studies undertaken show that removal of any sub-transmission circuits would directly lead to security levels and voltage limits being exceeded.
- Removal of any one zone substation in urban areas would place unacceptable loadings on the 11kV network. Removal of any rural zone substations would directly affect voltage levels and require uneconomically large 11kV conductors to achieve the required quality of supply

criteria. One new zone substation is currently under construction to meet present load growth. Three new zone substations are planned for construction within the planning period to meet expected load growth.

- Local authorities require all new work within Hamilton City boundaries and all new work outside the Hamilton City boundary in urban, rural lifestyle and significant interest areas to be underground even though overhead reticulation would, in most cases, be less expensive.
- Due to the CBD requirement of (N-1) security the backup available via the 33kV and 11kV networks is appropriate.
- The use of indoor 33kV switchgear installed at Horotiu, Pukete and Sandwich Road zone substations is in line with current practice for newer, high density, industrial and residential locations where space, visual and pollution impacts are of importance.
- The majority of 11kV feeder cables and lines are appropriately sized to deliver WEL's forecasted loads within the planning period and to maintain the required quality of supply.
- Distribution transformer capacity utilisation is 38% which is consistent with the ODV handbook.
- The LV network in the CBD is an interconnected radial system which is appropriate given the (N-1) security requirement. In suburban and rural areas the LV network is radially fed and generally not interconnected. This is appropriate given the reduced level of security required, and is therefore not considered to be over designed.

Figure 58. 33kV – 11kV Standard Configuration

4. SERVICE LEVELS

This section describes how WEL sets its various service levels according to the following principles:

- What is most important to customers?
- Can WEL achieve consumers' expectations cost effectively?
- What trade-off between price and what customers consider is "most important" are customers willing to accept.

These issues are discussed more fully in the section below.

4.1. Customer Consultation Process

WEL maintains a relationship with major customers on its network. Major customers have direct access for any issues or questions they may have, whether this is concerning price, quality or load increase requirements. WEL also conducts a yearly survey of the top 50-100 major customers concerning growth intentions. This information feeds into network planning and the Asset Management Plan.

The aim is to hold annual summits with major industrial and commercial customers.

For the "Mass Market" one on one communication is not practical; instead WEL conducts annual customer surveys to assess views on the trade-off between price and quality.

A statistically significant number of WEL customers participate to ensure the data collected is valid and meaningful.

The surveys focus on understanding the level of customer satisfaction and their future expectations for reliability of supply. Information sought includes:

- What the customers' current feelings are on reliability of power supply
- What they want in the future in terms of reliability of supply
- Whether they are willing to pay more for higher performance or less for lower performance

The quantitative data gained from these surveys is supplemented by a series of qualitative focus groups. WEL has also been liaising with Federated Farmers to better understand opportunities for getting price/quality information to the rural sector.

Customers are placed into four classes to assist with understanding the collective requirements of each group. These classes are:

- Urban Residential
- Urban Commercial
- Rural Dairy and Business
- Rural Residential

The key points from the most recent customer survey undertaken February 2012 are that:

- 99% of customers rate WEL's present power supply in terms of reliability as either acceptable or more than acceptable
- 99% of customers felt the power supply reliability had stayed the same or improved over the past year

- 79% of customers would prefer to have the present level of reliability maintained at the present prices

The February 2012 results show a minor improvement in most of the above areas from those in previous years.

- 25% of customers would like to see further improvement in reliability, however only 8% (of that 25%) would be prepared to pay more
- 43% of customers would prefer fewer outages (accepting that, if outages occurred, they may be of a longer duration), whilst 45% would accept more outages provided they be of shorter duration.

The survey showed that different customers have different priorities and place different emphasis on network performance.

4.2. Justification of Reliability Targets based on Customer Consultation Process

Based on the recent customer survey results, the acceptable reliability targets of customers including the LV network are summarised below as shown in Figure 59:

- SAIDI of 135.78 minutes
- SAIFI of 1.92
- CAIDI of 70.83 minutes

Calculated SAIDI from Survey Result (including 400V)					
Customer Group	Input from survey		Output		
	Acceptable Outage Number Per Customer Per Year	Average duration (minutes)	SAIDI (minutes)	SAIFI	CAIDI (minutes)
Urban Commercial	1.00	48.00	3.98	0.08	48.00
Urban Residential	2.00	72.00	103.70	1.44	72.00
Rural Dairy and Business	2.00	60.00	7.86	0.13	60.00
Rural Residential / Lifestyle	2.00	77.00	20.24	0.26	77.00
Grand Total	1.92	69.88	135.78	1.92	70.83

Figure 59. Calculated SAIDI from Survey Results (including 400V)

WEL has collected LV reliability data since November 2007. LV SAIDI and SAIFI represent 19% and 11% of the system total respectively. Hence, customer acceptable reliability targets excluding the LV network can be derived as shown below:

- SAIDI of 109.98 minutes
- SAIFI of 1.71
- CAIDI of 64.46 minutes
- SAIDI for Urban Customers of 108.61 minutes
- SAIDI for Rural Customers of 115.58 minutes

The above customer acceptable reliability targets will be tested along with analysis of strategies to improve reliability and cost implications discussed below.

Strategies for Improving Reliability

WEL has focused on the following strategies:

- Segmentation of customer groups with targeted investment

Major customers and those in the Hamilton CBD are separately grouped and managed to ensure that the number of interruptions is at an acceptable level. Investment will also target those customers with the worst network performance.

- Reducing the number of customers affected when a fault occurs

The strategies include a continuation of distribution automation projects. However the major focus will be on reducing the number of customers on large feeders. These capital projects will result in a significant increase in capital expenditure required for each SAIDI minute saved.

- Improving restoration time

Restoration times will be reduced by the use of remotely monitored and controlled network components e.g. remote operated switches and ring main units. This will ensure that switching to restore supplies can commence before fault staff arrive on site to carry out manual switching.

- Maintenance and asset renewal strategies

Improvement of network reliability features as a determinant of maintenance and asset replacement programmes.

- Vehicle related outages

Incidence and location of car vs. pole accidents are being analysed to identify where improvements can reduce vehicle accidents.

- Reducing the impact of outages

The investment made to maintain the current condition of the network will focus on the components that cause the maximum supply interruption impact. For example maintenance on a component that fails but does not interrupt supply to customers may be reduced as long as public safety is not compromised. In this way improved performance should be achieved at the same cost.

In order to gain the maximum improvement in reliability from the minimum investment, WEL studied the sensitivity of SAIDI to a range of factors. The list below ranks the factors with the most sensitive at the top.

1. System length

2. Total Number of ICPs on the feeder
3. Average number of customers affected by the outage
4. Average switching time
5. Controllable outages
6. Uncontrollable outages
7. Average repair time
8. Average number of customers affected by repair

The study was used to guide reliability asset strategy development. As a result of the strategy development, a number of projects were identified. These projects have been rated for cost per expected SAIDI minute savings, linked to the reliability strategic glide path. This allowed us to clearly communicate to the Board the reliability strategy to achieve the strategic objectives, and to engage with them on a cost/benefit basis relating to reliability improvements. The reliability project has seen an average annual improvement of 23 SAIDI minutes. This improvement has allowed WEL to meet regulatory requirements despite a significant increase in uncontrolled outages.

In addition to these reliability strategies, WEL has decided to continue its live line approach to maintenance. This helps to keep WEL's planned outage SAIDI minutes to a minimum.

In addition WEL is increasing the level of expenditure on items requiring planned replacement. These assets are identified in the five yearly line patrols. Condition grading has been implemented in these patrols and the grading information has been stored in the maintenance management system. It is planned to introduce automatic criticality assessment based on condition grading, equipment type and location to determine the priority of work.

WEL has used historical data from 28 lines companies in a study to determine the relationship between controllable failure rate and maintenance cost, refer to Figure 60.

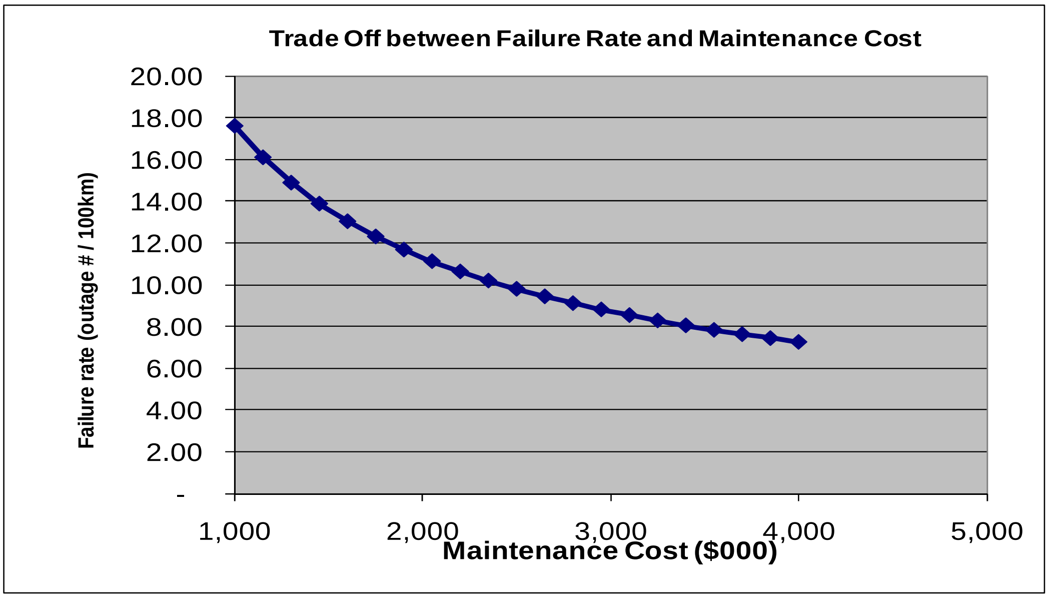


Figure 60. Likely Trade Off Between Failure Rate and Maintenance Cost

Most of the 33kV sub-transmission system is meshed. An insulator replacement programme was commenced in 2005 to improve security and reliability on radial sections of the network. Most of the lines were completed in the 2007/08 year. The project of replacing insulators in the Te Kauwhata to Meremere circuit, which contributed to around 6 SAIDI minutes in 2008/09, was completed in the 2009/10 financial year.

WEL has selected repeated rural interruptions as a focus area for network reliability improvement. This area was of concern to the company with approximately 1600 rural consumers experiencing more than eight outages per annum four years ago.

WEL started the project by looking at five years' worth of history to identify main outage causes. The staff then initiated reliability projects to address the main outage causes (e.g. broken lines) that would improve performance by up to 48%.

Outage causes were classified as being either controllable or uncontrollable. Controllable causes (insulators and disks, broken lines and defective equipment) make up nearly two thirds of all outages and were the focus of reliability projects. Uncontrollable causes (bird strike, adverse weather etc.) were not targeted but the expectation was that some of these would also reduce.

A $1.1M reliability project to improve rural repeated interruption performance has been scoped and is mainly focused on the Weavers and Raglan substation areas. Four design packages have been completed and work started in October 2012. The 2013 AMP includes a significant increase ($11.1M in total) for identified 16mm² copper (Cu) conductor replacements to improve rural reliability including repeated interruption reduction. There is 474km of 16mm² Cu conductor in WEL's network. The increased $11.1M funding represents replacing 17% of the total 16mm² Cu conductor.

WEL is developing a Condition Base Risk Management (CBRM) model for RMU and 11kV Conductor and its associated poles and crossarms. Most of the controllable interruption events were due to broken 16mm² Cu conductor in conjunction with adverse weather. It is expected that the detailed conductor replacement programme will be prioritised according to the CBRM results.

WEL's work in this area continues and reliability projects are routinely factored into the company's annual asset management planning process.

Setting Strategic Reliability Targets

In addition to customers' requirements and cost for implementation, WEL has developed a benchmarking reliability indicator known as the "New Zealand Best Practice Index" (NZBPI). Each year WEL uses this index to compare the top quartile performers for SAIDI, CAIDI, and SAIFI.

Figure 61 shows WEL's historical reliability performance and future targets compared to the NZ Best Practice Index trend.

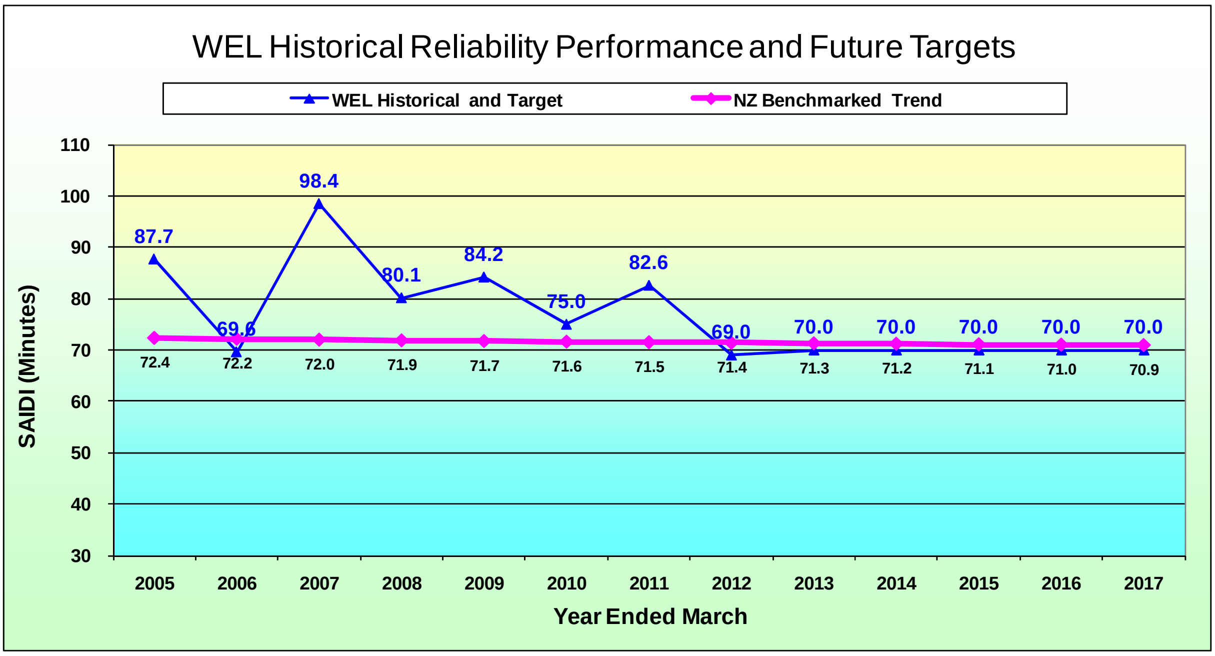


Figure 61. WEL Historical and Target SAIDI vs. NZBPI

The 2011/12 SAIDI target was 72 minutes and included 5 minutes of planned SAIDI for the identified asset replacement works programme. The actual performance achieved was 69.01 SAIDI minutes which included 8.78 minutes of planned SAIDI due to a greater number of shutdowns required for asset replacements than initially planned. The 2012/13 SAIDI performance is forecasted to be 70 minutes, compared to a target of 70 minutes.

The 2013/14 SAIDI target of 70 minutes includes 15.3 minutes of planned SAIDI.

The strategic SAIDI target of 70 minutes is aligned with the up to date NZBPI industry benchmarking trend and will position WEL in New Zealand's best practice performance category. In addition, WEL sets its long term SAIDI target (for 2023) for urban to be 50 and for rural to be 106 minutes respectively. It also meets customer acceptable reliability targets. However, we are under increasing cost pressure to maintain this – e.g. traffic management, safety compliance, significant back-up generation costs, premium of live line work, and ageing assets.

4.3. Consumer Oriented Performance Targets

WEL's goal is to provide a quality level of service to all consumers. WEL defines quality as "providing a network that is safe, reliable and fit for purpose". Appropriate levels of reliability are determined by combining customer survey results with benchmarking studies and by taking implementation costs into account. Primary customer service levels are measured by the safety and reliability indicators shown below.

Secondary service levels are those attributes which consumers rank behind safety and reliability. These service levels are "timely shutdown notices", "customer service level for load control" and "timely response to customer enquiries".

Safety

- WEL's Public Safety Management System focuses on the risk of harm to the public and damage to property for each asset class and details controls to mitigate these risks.
- Total Injury Rate (TIR) has been used as a measure and the target is for all employees to go home every day safe.
- Key processes are:
  - Hazard identification through a formal on site hazard identification process and record
  - Issues identified for further action or investigation through Field Action Reporting (FAR)
  - Continuous development of controls
  - Defining clear accountabilities by assigning control owners
  - Control owners conducting self assessments to verify:
    - Adequacy
    - Effectiveness
    - Cost-effectiveness
  - Measuring and monitoring performance of controls
  - Performance review and audits for corrective and preventative actions
- Key controls are:
  - Design standards
  - Restricted access to dangerous equipment
  - Use of qualified staff, that have been trained and are deemed competent
  - Field staff and contractors using safe work practices
  - Adequate electrical protection systems to cut the power to potentially dangerous situations
- Accreditation
  - WEL has achieved tertiary level certification for ACC WSMP (Workplace Safety Management Practices).
  - WEL operates a Public Safety Management System conforming to NZS 7901:2008. The audit conducted by Telarc in June 2012 registered WEL for the implementation of a safety management system for public safety in the electricity distribution industry for the sites and assets owned and operated by WEL Networks.

Reliability

Reliability means continuity of supply and quick restoration if an outage occurs. It can be measured in a number of ways. WEL uses the following indicators to measure reliability performance:

- Number of Faults per 100km of circuit

- System Average Interruption Duration Index (SAIDI)
- System Average Interruption Frequency Index (SAIFI)
- Customer Average Interruption Duration Index (CAIDI)
- Maximum outage duration for each outage for urban and rural customers
- Number of interruptions
- System Average Interruption Duration Index for Urban Customers (SAIDI_Urban)
- System Average Interruption Duration Index for Rural Customers (SAIDI_Rural)
- Customer repeated interruptions for urban and rural customers

The following table depicts the reliability targets for the plan. These targets exclude interruptions and faults emanating from Transpower's system or from the WEL low voltage systems.

Measure	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023
Unplanned 33kV	3	3	3	3	3	3	3	3	3	3	3
Unplanned 11kV	554	537	524	512	500	489	489	489	489	489	489
Planned	412	400	400	400	400	400	400	400	400	400	400

Table 6 Number of Interruptions – WEL Networks

Measure	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023
Planned SAIDI	14	15	15	15	15	15	15	15	15	15	15
Unplanned SAIDI	56	55	55	55	55	55	55	55	55	55	55
Planned SAIFI	0.13	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Unplanned SAIFI	1.15	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16
Planned CAIDI	99	100	100	100	100	100	100	100	100	100	100
Unplanned CAIDI	49	48	48	48	48	48	48	48	48	48	48
33kV Faults/100km	0.70	0.70	0.70	0.70	0.70	0.67	0.64	0.64	0.64	0.64	0.64
11kV Faults/100km	21.49	20.62	19.92	19.27	18.64	18.05	17.87	17.69	17.51	17.34	17.17

Table 7 SAIDI, SAIFI and CAIDI for WEL Networks & Faults per 100km

Measure	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023
SAIDI_Urban	40	42	44	46	49	50	50	50	50	50	50
SAIDI_Rural	194	184	173	163	153	145	136	128	120	113	106

Table 8 SAIDI Targets for Urban and Rural Customers

Refer to 4.2 for a description of how those reliability targets are set. The number of interruptions has increased significantly as a result of more accurate recording in the recently implemented Network Management System (NMS) such as EDO or DDO faults. Planned interruptions will be increased significantly due to ageing asset replacement programme.

4.3.1.1. Maximum outage duration

As an overall incentive to meet outage duration target levels for urban and rural customers, identified by way of survey, WEL has initiated the WEL Customer Promise with customers, which provides a payment to customers for non-performance. The current standards are:

- Urban customers: supply to be restored within three hours
- Rural customers: supply to be restored within six hours

4.3.1.2. Customer Repeated Interruptions (CRI)

WEL has introduced a new reliability measure called “Customer Repeated Interruptions” for urban and rural customers.

“Customer Repeated Interruptions” is the sum of the number of interruptions for individual customers. CRI is applied at distribution transformer level for analysis.

The current standards are:

- Urban customers: 90% of customers have less than or equal to two outages per year
- Rural customers: 80% of customers have less than or equal to four outages per year

The aim is to define a minimum standard of service for customers based on the number of interruptions that they have in a year. In the most recent customer survey, both urban and rural customers stated that two outages per year would be acceptable. WEL intends to further discuss the number of acceptable outages and the price/quality trade off through a series of focus groups, amending targets and investment as needed.

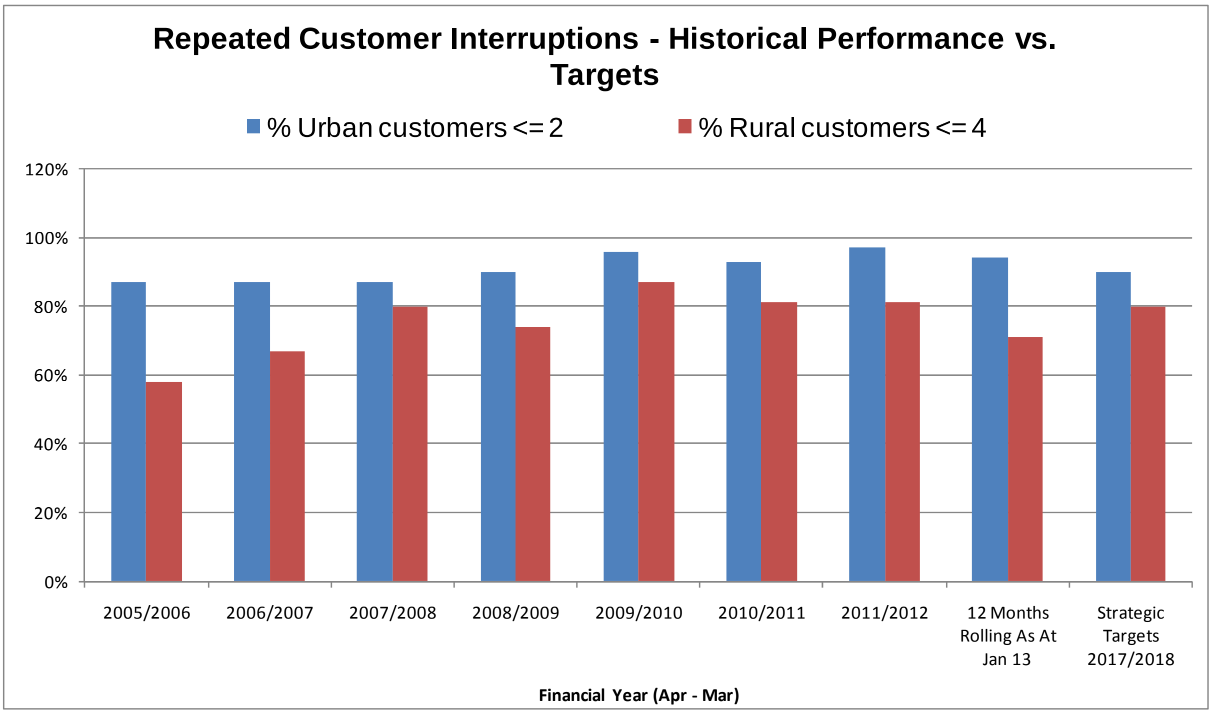


Figure 62. Customer Repeated Interruptions Historical Performance and Future Targets

Secondary Customer Services Level

These service levels include "timely shutdown notices", "customer service level for load control" and "timely response to customer enquiries".

"Timely shutdown notices" – this is something that can be improved and moreover it can be done by improving processes in non-real time. WEL acknowledges issues such as working with large customers to schedule shutdowns during their quiet periods, ensuring that shutdown notices are correctly addressed and confirming the shutdown 30 minutes ahead so customers can initiate controlled shutdown procedures.

"Customer service level for load control" – WEL has a very comprehensive demand management strategy to minimise Transpower costs and improve load factor. However, the load control strategy shouldn't compromise the following customer service level under normal conditions:

- No customer controlled load off for greater than 7 hours in any 24 hour period
- Maximum continuous time off in one switching period is 3 hours
- Minimum recovery time (between sheds) is 2 hours (after 3 hours off)

"Timely response to customer enquires" – these are typical customer response levels such as answering the phone, design and quotation of customer driven projects, (e.g. new connection, subdivision, relocation and undergrounding), invoicing and quality delivery of fault services and projects. WEL acknowledges that timely response to customer issues varies due to the nature of the enquiries and the complexity of the enquiries.

WEL has implemented a customer complaint and compliment process to improve the secondary customer service level performance.

Performance targets:

- Immediate response for safety issues – resolving the issue after discussion with the customer if appropriate, but taking no longer than three days
- Resolution within ten working days for other complaints (this excludes agreed time for follow up actions)

4.4. Other Performance Targets – Operating and Asset Efficiency

Operating Efficiency – Cost per Customer

Operating Efficiency is defined as Operating Cost per Customer (CPC). This measure is used to monitor and compare operational performance on a continuing basis. WEL's strategic goal is to deliver costs in line with the best quartile of lines companies within New Zealand. Cost per Customer performance for the year 1 April 2011 to 31 March 2012 was $211 compared to a target of $217. Forecast cost per customer performance for the year 1 April 2012 to 31 March 2013 is $230 compared to a target of $232 and the target for 2013-14 is $253.

WEL has significantly improved the maintenance programme in the last few years. SAP now records condition assessments, inspection results and maintenance records. This has significantly reduced compliance risks, but has added to our operating costs somewhat because of the additional information and detail relating to assets which is being recorded.

Delivery Efficiency – Billability and Productivity

WEL introduced the measures of "billability" and "productivity" to ensure that the in-house workforce is effectively and efficiently delivering the approved capital and maintenance programmes.

"Billability" is defined as the hours charged to jobs divided by the hours paid to the field staff. Only time spent working on the job is chargeable with non-working time such as annual leave, sick leave, training, meeting attendance and waiting in the yard being excluded.

"Productivity" is defined as the planned labour costs divided by the actual labour costs (including subcontractors' costs).

The targets for the 2013-14 financial year for billability and productivity are 80% and 95% respectively.

WEL designs, prices and plans most projects in-house. The design team prices work with a software package known as "CUE" (Comparable Unit Estimation). The price is then peer reviewed before the proposed work is accepted by Field Services for delivery.

Designs must comply with WEL's Design and Construction Standards. CUE generates an "assembly list" which provides a detailed listing of all materials, labour, transport and other cost items required to complete the work. The CUE assembly list matches WEL's latest Design and Construction Standards.

The strategic targets for billability and productivity are 80% and 95% respectively. WEL carries out regular benchmarking of labour rates and task times to ensure the data used in CUE is competitive in the market.

Asset Efficiency – Load Factor

WEL faces two emerging risks to the business:

- Investment Return Risk

  The return achieved for the large investment in the network could be compromised if certain changes occur within the network. An example of this would be increased use of distributed generation which could significantly change the energy and load flows around the network.

- Risk of a Shrinking Business

  Several trends threaten to divert revenue from us which would reduce income and could strand some assets.

Traditional network planning is based on potential system peak demand. However, income is mainly from total energy used. Load factor is a measure of the relationship between peak demand and energy used and indicates how much of the asset capacity is being used on average.

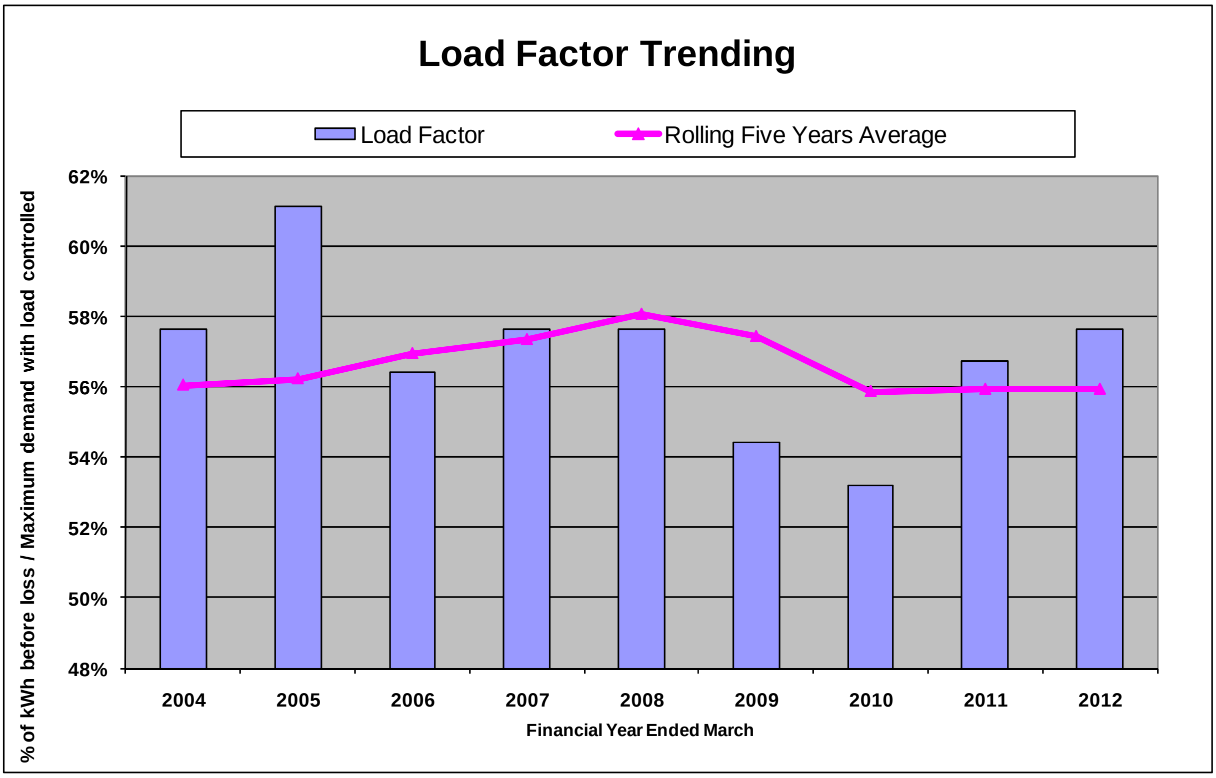


Figure 63. Network Load Factor Trending

Figure 63 shows annual historical load factor in comparison to the five year rolling average. Load factor is currently trending up from a previous downwards trend as a result of management efforts.

WEL is introducing load factor measures as a strategic means to monitor investment costs.

WEL's long term objective is to achieve a load factor of around 60%

Asset Efficiency – Capacity Utilisation

Asset utilisation is defined as the peak load divided by the installed capacity of the asset and is a measure of how much of the capacity of an asset is used efficiently. All assets must be able to carry the transient, daily, weekly and seasonal peak loads hence asset utilisation will always be less than 100%. Target transformer utilisation for industrial customers is set at 80%, unless requested differently by the customer.

WEL has set a network wide capacity utilisation target to maintain or exceed 38%.

Low Voltage Complaints

WEL records all low voltage complaints (LVCs). The total number of LVCs and the details of each are monitored to determine the quality of voltage supplied to customers. A process has been put in place to identify the root causes of the LVC. WEL's aim is to reduce the number of LVCs that WEL is responsible for and to respond to all customer requests promptly. Current initiatives include the installation of load monitoring devices on distribution transformers, which will assist in identifying power quality issues before they reach unacceptable levels. With the installation of Smart boxes gaining momentum, there are also exception reports being received from the smart devices that advise of voltage excursions outside the regulatory threshold levels. These reports are reviewed and analysed monthly to determine which areas of the network may require remedial works to maintain healthy supply levels.

Figure 64. WEL competing in the line mechanic competition 2012

4.5. Network Operations and Asset Management Priorities

WEL controls network operations in real-time from the Control Centre (SYSCON). SYSCON is staffed 24/7 by shift operators who are responsible for maintaining network integrity and for ensuring continuity and quality of supply to WEL's customers in real-time. In addition to SYSCON, WEL uses a Call Management Centre for handling customer phone calls, and after hours dispatch of faults staff. WEL has its own working hours dispatch.

WEL treats all loss of supply issues with urgency. In situations where multiple faults have taken place, resources have to be prioritised to restore all supplies. Due to the company goal of minimising SAIDI, the fault affecting the most customers would normally be addressed first. The exception to this is where one of the supplies affected is likely to have an effect on the public good or have a serious economic impact on one or more parties. In such cases the priority order is altered. For example customers with critical supplies such as those requiring dialysis, flood pumps and dairy farms during milking periods would be prioritised ahead of others.

WEL's Network Planning policy is to provide a level of security that is proportional to the load magnitude. Therefore larger loads are likely to be provided with higher levels of security. The cost of providing a certain level of security is also taken into account. Projects designed to improve security are prioritised using the following table. The following points are noted:

At the zone substation level currently 25% of WEL customers have a C2 security level, 47% have a C3 level, 18% have a B1 level, 3% have a B2 level, 3% have a B3 level and 4% have an A level.

The Hamilton CBD is wholly supplied by Bryce Street, Kent Street, Cobham and Claudelands zone substations all of which supply power at the C2 security level.

Class	Range of Post Contingent Demand (PCD) MVA	Customer Impact	Security Level	Contingent Capacity	Time to Restore after 1st Interruption	Time to Restore after 2nd Interruption
E	Above 140MVA Major Transpower GXP 3 transformers	>10k	n-2	100%	Maintain 100% of PCD	Maintain 100% of PCD Immediate offloading required (switching)
D	25 to 140MVA Transpower GXP 2 transformers	>10k	n-1	100%	Maintain 100% of PCD	Majority restored within an hour (switching), 100% in repair time. For longer repair time – field generation
C1	20 to 50 MVA Super zone substations 3 transformers	>5000	n-2	100%	Maintain 100% of PCD	Maintain 100% of PCD Immediate offloading required (switching)
C2	10 to 25 MVA CBD zone and switching substations	>2000	n-1	100%	Maintain 100% of PCD	Majority restored within two hours, 100% in repair time
C3	10 to 25 MVA Small GXP or large urban zone substations	>5000	n-1	100%	Maintain 100% of PCD	Within three hours restore 90%, repair time 100%
B1	5 to 10 MVA Medium urban zone substations	>2000	n	100%	Within 15 minutes restore 75%, within three hours 90%, repair time 100%	Within three hours restore 90%, repair time 100%
B2	2.5 to 5 MVA Rural zone subs and urban interconnected feeders	>1000	n	80%	Within one hour restore 75%, within three hours 90%, repair time 100%	Restore 100% in repair time
B3	1 to 2.5 MVA Urban & rural interconnected feeders	>300	n	67%	Within one hour restore 50%, within three hours 75%, repair time 100%	Restore 100% in repair time
A	Under 1 MVA Rural feeder, urban spur, distribution transformers	<300	n	Note 1	Restore 100% in repair time	Restore 100% in repair time

Table 9 WEL security criteria applied in system design

Note 1: Refer to WEL's Customer Service Standards for LV Network backup, dual distribution transformer capacity or temporary supply criteria

Other Notes:

No interruption at first event (N-1) and under switching (N-2) with or without a short outage.

Post Contingent Demand is the peak demand after effecting demand reduction through contracted load control services

5. NETWORK DEVELOPMENT PLANNING

WEL is continuing to have a high level of capital expenditure over the next 10 years to meet growth, security, quality of supply improvement, asset replacement and regulatory requirements.

5.1. Planning Criteria and Assumptions

Planning Assumptions

The key assumptions taken into account during the planning process include:

- Load growth will generally follow the trends for both the region and areas of the region as modified by input from local authorities
- Interconnection with adjacent distribution companies
- Generation within the service area
- Embedded generation (i.e. Te Rapa CoGen or the Wind Farm) is considered not to be available during post contingent events

Planning Criteria

- Determining future customer needs through changing load patterns, security of supply, reliability and customer surveys
- Territorial Authority District Plan requirements for distribution asset integration
- Public safety
- Adequacy of supply capacity to customers
- Acceptable voltage regulation
- Appropriate reliability and levels of system security meeting the security standards as set out in Section 3. For example, 11kV feeders are considered for augmentation when their loading reaches 60% of nominal rating. Maximum ICPs per feeder is set at approximately 1200
- Major Transpower GXPs, having N-1 security, will presumably have available post contingent rating (PCR) at least
- Correct limitation of the maximum loadings as well as fault ratings applied to network elements
- Economic loading of circuits and optimal selection of conductors
- Acceptable system performance under contingent and emergency conditions

5.1.1.1. Customer Capacity Development

- Capacity required by new customers, or alterations to capacity required by existing customers, are calculated by WEL's Planning Engineers in consultation with the customer concerned. As a minimum, new assets (or changes to existing) are sized such that all loadings are maintained within rated asset limits and all voltages are maintained within regulatory requirements.

- Where the customer requires a greater level of security the capacity of the new installation will be chosen such that the required level of security is met. An example of this is where a customer requires full restoration within 30 minutes for the loss of any one network asset item. In such a case it is likely that full backup from an independent feeder would be provided and all switching would be automated. In general the customer contribution towards the installation would increase with the required security level.
- Where, as a result of a new customer installation, security levels to other customers are affected, a solution is developed that ensures the required levels of security are met into the foreseeable future. Any customer contribution towards that cost will depend on their capacity requirements as a proportion of the overall network capacity achieved by the project.
- Connection studies for major new load developments or distributed generation are undertaken on an asset-specific basis. Many of these types of projects are fully or partially funded by customers through capital contributions.

5.1.1.2. Network Capacity Development

Computer based load flow modelling of the network is used to ensure the desired level of security is met and so that the capacity of new power system equipment is chosen appropriately. This process usually involves modelling the worst case situations and the required investment to ensure restoration can occur.

Known future step load increases, expected population growth and other estimates of future load growth are fed into the network load forecasting model. The model is then used to compare the forecast levels of security versus the network security level requirements as set out in Table 9. Where a future shortfall in required security levels is forecasted, options to restore the security levels are identified, evaluated, costed and compared.

Photo 11 Live Line Maintenance 2012

Asset Planning Criteria

Asset	Description	Criteria
Zone Substation	Structures	Where possible structures and buildings are designed and selected to ensure standard plant and components are used and extensible future activities are not restricted.
	Transformers	Selection is based on the capacity requirements matched against standard sizes and the economic operating factors.
	Switchgear	Selection is based on the capacity requirements and fault rating matched against standard sizes and supply transformers.
33kV Cables	Conductor	Selection is based on the capacity requirements matched from the standard sizes.
	Terminations	Terminations are selected to withstand network voltages and minimisation of discharge between cores.
	Surge Arrestors	Selection is based on the surge capability requirements matched against standard sizes from distribution or substation class units.
33kV Lines	Conductors	Selection is based on the capacity requirements matched from the WEL standard sizes
	Poles	Poles are selected from WEL standard adopted sizes and the mechanical strength requirements for the specific application and ensuring the appropriate code of practice is met.
	Insulators	Selection is based on the voltage withstand requirements matched from the optimised WEL standard adopted sizes. These must meet the specific application with creepage and over voltage withstand needs.
Distribution Cables	Conductor	Selection is based on the capacity requirements matched from the WEL standard sizes
	Terminations	Terminations are selected to withstand network voltages and minimisation of discharge between cores.
	Surge Arrestors	Selection is based on the surge capability requirements matched against standard sizes from distribution or substation class units.
Distribution Lines	Conductors	Selection is based on the capacity requirements matched from the standard sizes.
	Poles	Poles are selected from WEL standard adopted sizes and the mechanical strength requirements for the specific application and ensuring the appropriate code of practice is met.
	Insulators	Selection is based on the voltage withstand requirements matched from the optimised WEL standard adopted sizes. These must meet the specific application with creepage and over voltage withstand needs.
Distribution	Transformers	Selection is based on the capacity requirements matched against standard sizes and the economic operating factors.
	Switchgear	Selection is based on the capacity requirements matched against standard sizes with suitable fault rating and specific design for each application.
	Low Voltage	Capacity is based on an average of 4kVA per dwelling with a range between 3kVA and 6kVA. Commercial applications are through specific design selection based on the customer's requirements for supply capacity.

Table 10 Asset Planning Criteria

5.1.1.3. Safety

It is WEL's policy that the safety of the public and staff is paramount. It is necessary that system design, equipment type and size selection, protection design and work execution is reviewed, checked and appropriately carried out.

Reliability

WEL has a continuing focus on providing a reliable network by:

- Monitoring and reporting of performance in relation to both the network and types of equipment
- Development of planning and design methodologies with an emphasis on industry best practice
- Use of modern technology to continually improve asset performance and incident responses, for example fibre optic communications and electronic protection relays
- Training of staff at all levels to ensure the highest levels of competency and service
- Setting of service level standards and implementation of processes to ensure compliance.

Planning criteria to improve reliability is an ongoing activity with initiatives driven by and aligned to the service levels and performance as described in section 4.

5.1.3 *Security*

Planning criteria are aligned to the security standard as defined in Table 9 for Asset Management Priorities. A post contingent demand (PCD) increase may trigger an improvement in the applied security level. In addition customer driven security levels may be applied through negotiation, line charges and/or capital contributions.

5.2. Prioritisation Methodology for Development Projects

Throughout the year the Asset Management division within WEL builds up a list of capital projects aimed at addressing customer security, compliance, reliability, load growth and asset replacement needs based on asset management strategies while providing support for customer driven projects such as new connection, subdivision, relocation and undergrounding. Table 11 provides a framework for investment decision making on different type of projects.

Investment Category	Factors for Decision	Optimal Decision Making
Customer Connection	Rate card, ratio between network enforcement and customer dedicated costs	Approval for customer project quotation process is in place and in alignment with pricing strategy and policy.
System Growth	Security standard, load forecasting, capability of load transfer and switching, lead time for projects	Defer the investment as far as possible without compromising approved security standard to ensure network resilience. Option analysis for best technical solution.
Safety, Environment and Compliance	Zero safety tolerance Meeting regulatory compliance requirements Environmentally friendly	Immediate response to resolve public safety and non-compliance issues. Proactive identification of voltage no-compliance issues through Smart Box installation.
Reliability	Reduction in SAIDI and repeated customer interruptions, cost, value of lost load to customers	Total budget for this investment category is traded off between target setting and costs to achieve it. Ranking for projects is based on $ / SAIDI saving or $ / reduction in repeated customer interruptions, variance between cost and VOLL with the approved investment budget.
Asset Replacement and Renewal	Risk profile including safety, reliability, customer services especially critical customer services, asset age and conditions as well as costs	Trade off between costs and acceptable risk profile based on Condition Based Risk Management Tool.
Asset Relocations	Mainly driven from councils and roading works	Proceed with agreement supported by Trust funding on undergrounding projects.

Table 11 Investment decision making framework

The overall investment programme is then developed and tested against the delivery capability of the in-house work force as well as preferred contractors for programme delivery effectiveness and efficiency.

5.3. Demand Forecasting

Methodology

WEL has developed an electronic model for network demand forecasting that derives input from a number of sources such as:

- Load forecast data updated several times per year from SCADA/metering data and zone substation data
- Distribution transformer recording equipment
- Inputs from larger commercial customer surveys
- Economic indicators
- Proposed regional projects (e.g. the expressway)
- Local developments such as proposed land subdivision
- Council population and development data
- Regional plans

The model includes expected point loading, allowance for the risk of uncertain loads and for unexpected loads. The impact of embedded generation on feeders and zone substations is also included. Embedded generation is considered as being either WEL controllable and thus operationally supportive to demand, or externally controlled and thus not reliably or continuously supporting demand under contingency.

The model determines the loading and energy throughput separately for each zone substation. Present energy throughput is taken and projected forward in each of the following four sectors: residential, commercial, industrial and farming. The energy forecast is converted to maximum demands by applying historical consumption data and zone substation load factors, and then projected forward. The forecasted load for each zone substation and each GXP is shown in Appendix 3.

Figure 65 shows the aggregated load growth values as one tool in the model generated results and the required planning period to which due cognisance is given.

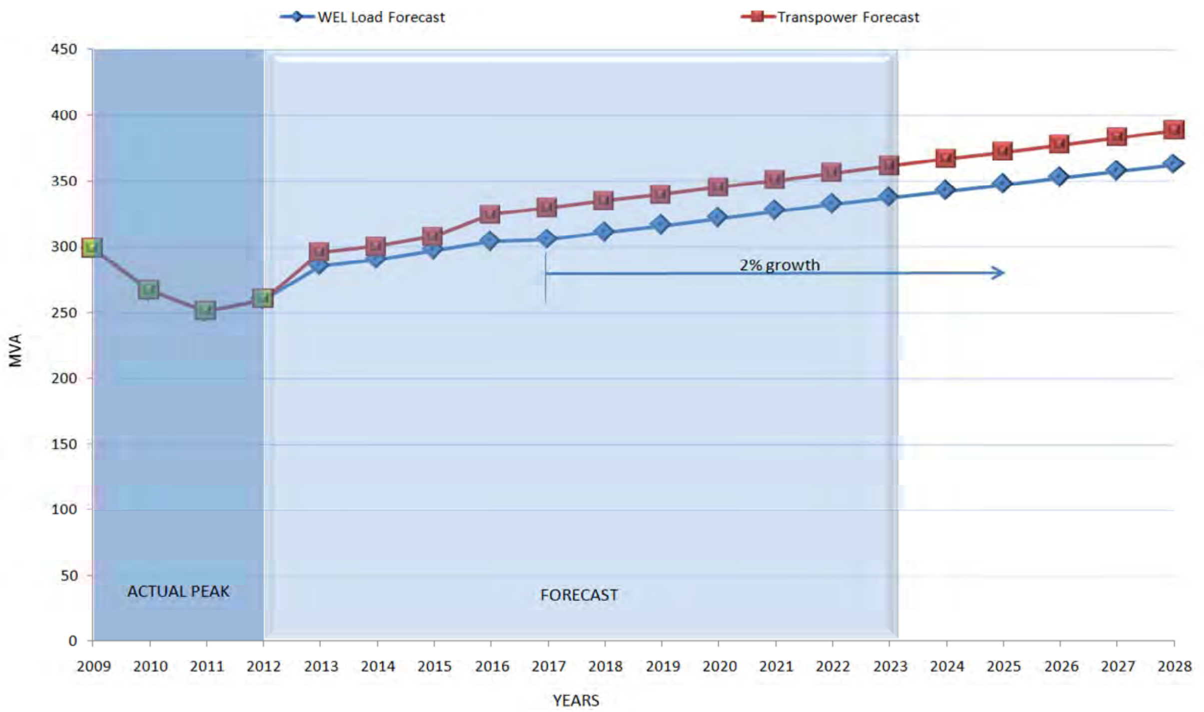


Figure 65. Overall Load Growth for The Greater Waikato

Factors Affecting Load Growth

Factors that influence load growth and are included in the forecasting model are:

- Population growth - large areas of land have been subdivided within the WEL service area especially in the north and west of Hamilton. This land has been subdivided for residential, commercial and some industrial development. Council plans for these developments greatly assist load forecasting although the recent rapid turnaround of economic conditions has made load prediction inaccurate and led to a slowdown in the rate of growth.
- Changing load patterns in the residential sector - load patterns change due to factors such as appliance efficiency, number of appliances in households, increasing use of electrical technology and an increasing use of gas for heating and cooking.
- Changes in the major industries in the WEL service area - although industry changes are difficult to predict effort is made to include provision as follows:
    - For residential loads: using the projected population load growth (as per the Future Proof Strategy) and applying a calculated load profile specific to the residential type (i.e. urban or rural) and suburb.
    - For commercial/industrial loads: determining the area usage as per the district and council plans and applying a demand usage based on existing similar loads (i.e. commercial, office, industrial). Known spot loads were also taken into account.
- Embedded generation - embedded generation can substantially change the loading on a zone substation. Embedded generation that can be controlled by WEL can be used to manage the network and is especially useful for controlling the peak demand. Generation not controlled by WEL is not considered in load forecasts.

The forecast projections include a diversity factor derived for each zone substation and based on historical data and trends. No increase in base load has been identified.

The forecast peak loads are subject to variations due to uncertainties in:

- The council plans for commercial and industrial growth
- Economic conditions
- Climate conditions, especially cold and/or wet weather
- Other factors, such as the availability and changes in technology

Demand management - WEL has in place demand management by:

- Controlled load (ripple control of hot water and controllable loads)
- Tariffs
- Distributed generation agreements

The impact of each of these factors is included in the demand forecasting model.

By the winter of 2023 the ADPCD (After Diversity PCD) on the existing GXPs is projected to rise as shown in Table 12 below. The loading of Te Kowhai excludes the embedded Contact generator at Pukete Zone Substation and Te Uku wind farm.

The uncertainties in predicting demand can result in either overestimating load or underestimating load. Overestimation of load will cause unnecessary capital investment in assets that are underutilised while underestimation of future load can result in poor service, increased faults and lower customer satisfaction. Electricity distribution is capital intensive which requires careful consideration of demand before investing in new or renewing of assets.

Grid Exit Point	**Transformers**	**Firm Capacity N-1**	**Post Contingent Limits (2012)**	**Customers Supplied**	**Winter 2012 ADPCD (Actual)**	**Winter 2023 ADPCD (est.)**
Hamilton 33kV	100+120 MVA	100 MVA	132 MVA	41,140	126 MVA	150 MVA
Hamilton 11kV	2 x 40 MVA	40 MVA	40 MVA	13,068	36 MVA	Nil
Te Kowhai 33kV	2 x 100 MVA	100 MVA	109 MVA	21,028	80 MVA	148 MVA
Meremere 33kV	Nil	14 MVA	4.5 MVA	1,424	3 MVA	Nil
Huntly 33kV	2 x 60 MVA	60 MVA	82 MVA	7,280	21 MVA	38 MVA

Table 12 GXP ADPCD

Detailed demand forecasts for each GXP and zone substation are shown in Appendix 3.

Assumptions about Future Demand Management

Technology and customer awareness will likely impact future load growth. Government initiatives are encouraging customers to be more involved in managing their own demand through home efficiency programs. WEL, in its own initiative, is introducing technologies such as Smart Boxes and appliance control devices which will provide customers with better appreciation of their power consumption. WEL's goal is to encourage customers to appropriately manage power consumption, use more efficient appliances and time-of-use tariffs.

5.4. Growth Related Network Constraints

Potential network constraints that have the effect of restricting substantive load connection within the network have been identified, including:

- Remote rural industrial load such as quarries and mining, requiring feeder upgrades and/or voltage support
- Rapid point loading through commercial growth beyond expected predictions, requiring network augmentation and new zone substation capacity installations
- Rapid loading through residential subdivision within new territorial boundaries for growth beyond expected predictions, requiring network augmentation and new zone substation capacity installations
- Reliability of feeder supplies, requiring feeder augmentation or installation of a new zone substation
- Northern network security, requiring new 33kV sub-transmission circuits from Huntly GXP

Each of these constraints is addressed in the AMP as network augmentation, capacity monitoring and upgrade. Detailed investigations or non-network solutions are detailed in section 5.5 to 5.7. This is a standard monitoring and ongoing planning process activity.

5.5. Distributed Generation Policy

Since the Electricity Industry Reform Act 1998 was amended allowing lines companies to participate in distributed generation from renewable energy sources, WEL has carried out research into opportunities in the Waikato region and has found that there are future opportunities such as landfill gas generation, municipal solid waste biomass generation, wind generation, wave generation, woody biomass generation, hydro generation and coal seam gas. Some of these options have been investigated in detail for their overall benefits and fit to the economic development of the network.

WEL's website at www.wel.co.nz contains an overview of distributed generation information and links to the policy and implementation requirements. The information provided is:

- Generation less than 10kW
    - Information and Application Process
    - Connection Application form
- Generation greater than 10kW
    - Policy and process overview

    - Connection Application Form (Initial)
    - Connection Application Form (Final)
- Distributed Generation regulated terms
- Electricity Industry Participation Code 2010, Part 6 Connection of Distributed Generation
- WEL's policy is that Distributed Generation (DG) connection and processes comply with the Electricity Governance (Connection of Distributed Generation) Regulations 2007. To achieve this WEL has provided information on connection and the application forms required to collect the data needed to manage set-up and maintenance of the connection. The size of the generation is important for management of the network loading so generation is split into below 10kW and above 10kW.

Once an application for connection of generation is received, WEL, in conjunction with the customer, will evaluate the project on a case by case basis taking into account network capacity, stability and performance, cost of transmission, cost of line and reactive power and avoided planned network development costs. Once the embedded generation is confirmed with the customer a plan of integration is prepared. The planning and forecast models are updated to establish the impact on network development plans and how the network is required to be changed to reflect the new generation injection.

Fonterra owns and operates a 50MW co-generation plant at Te Rapa. Meridian owns and operates the 65MW Te Uku wind farm.

Photo 12 Turbine constructed at the wind farm site at Te Uku

Photo 13 Wind turbine and electricity distribution lines at Te Uku

5.6. Non - Network Solution Policy

The primary non-network solution to relieve constraints on the network employed at WEL is by the use of Demand Side Management (DSM) techniques.

DSM can be defined as shaping the overall consumer load profile. This is principally achieved by reducing the peak load which governs much of the network physical development since a network must be capable of supplying the anytime peak. The benefits from DSM are:

- Increased utilisation of the network and increased effective investment return
- Improved utilisation of Transpower's transmission capacity

The above benefits flow on to consumers who are the ultimate beneficiaries of WEL Networks.

Strategies for implementing DSM include:

- Directly controlling or interrupting thermal loads
- Providing pricing options using differential rates
- Arranging with large customers for them to shed load at peak times
- Arranging with customers for them to start their emergency generators to reduce the load taken from WEL at peak times
- Optimising the Power Factor of industrial loads by pricing incentives
- Promoting heat pumps, which are more efficient than ordinary electrical heaters
- Promoting home energy efficiency by providing audits for low income consumers (funded by the WEL Energy Trust)
- Assisting developers at the design stage to help new commercial buildings benefit from demand management

- Introduction of Smart Boxes

Direct control and interruption of hot water and other storage heating loads at peak times is achieved by employing the ripple relay system.

A Te Rapa industrial customer operates a 50MVA co-generation scheme, which produces power and heat for the factory processes and power for export into WEL's network. In the dairy off season this unit is normally shut down for maintenance.

5.7. Smart Network Project

Over the next three years WEL expects "Smart Boxes" to be deployed to all ICPs within its distribution area. These Smart Boxes are expected to provide considerable demand side management opportunities.

A Smart Box consists of an electronic power meter coupled to a radio communication module. The associated two way communication system from WEL to each Smart Box is via a purpose built meshed radio system covering all of WEL's network service territory. This radio network is capable of communicating for other purposes such as distribution automation.

Smart Boxes with home area networks and in home displays (IHDs) deployed at customer premises will allow in the future any and all residential and commercial consumers to:

- Accurately monitor and manage their energy consumption
- Set consumption limits and/or financial limits
- Respond to time of use price differentials and incentives
- Respond to messages sent from WEL Networks or their retailer
- Time shift or adjust smart appliances such as heat pumps and refrigerators

As stated in 1.6, a target has been set to reduce peak demand growth by 10% through the implementation of network intelligence.

Figure 66. Completed Smart Box installation

The first stages of the project which has involved the installation of the mesh radio communications infrastructure for the entire WEL area has been completed , as at the October 2012 over 3000 Smart Boxes are in service largely in the Western (Raglan area) part of WEL's network, and also parts of Hamilton City. The installation plan is expected to achieve its original target of 45,000 Smart Boxes installed by July 2013. The balance of the Smart Box installation program to reach all of the 85,000 WEL customer connections is subject to Board approval and is planned to be completed during the 2014/15 year.

In addition to the opportunity for peak demand reduction, the introduction of Smart Boxes is expected to provide the following benefits:

- Replacement of obsolete ripple control relays in the northern region
- Enhanced consumption and demand information at each ICP for network operation and management (such as transformer utilisation, ability to parallel or back-feed between feeders)
- Monitoring of network performance at each network connection (we have traditionally relied on the customer to contact our call centre to advise us of localised and low voltage network faults or low voltage issues). The Smart Boxes are interfaced to the OMS for reporting of power outages
- Monitoring and understanding the impact of increasing distributed generation on the low voltage network
- Real time communication providing network pricing and customer signalling support
- Deferral of network investment through the ability to produce real time loading profiles beyond our zone substations
- The communications network will also provide a mechanism for further introduction of distribution automation equipment

The convergence of cost effective metering and communications technologies will enable WEL to extend monitoring and control to potentially every part of the network. It will be possible to monitor what is happening at every customer connection and understand power flows along feeders, gain visibility across our low voltage networks, improve ability to back feed and automate switching, better size network assets, automate switching of load, and pro-actively respond to outages.

The ability to reduce investment and operational costs through smart grid technology has been identified. Modelled benefits are summarised below.

- Network operational benefits
  The following network operational benefits have been identified and are supported by work carried out by the Electricity Network Association's smart grid working group:
  - Fault management savings, e. g. reduced customer fault visits
  - Additional peak load reduction (Transpower charges)
  - Reduced non-technical losses, better energy reconciliation
  - Reduced technical investigations such as low voltage issues
  - Additional reserves market benefits
- Deferring network investment
  In addition, better planning and having a clearer understanding of load flows means we can defer network upgrades and improve our design.

- Deferring Transpower investment

  Other benefits include deferring Transpower investment through improved load flow management across Hamilton. The deferral of a new Grid Exit Point and instead upgrade of the existing Grid Exit Point is a significant saving and will be supported by the introduction of Smart Boxes.

- Other benefits

  There are a number of unquantified operational and customer service benefits such as improved reliability and responsiveness to outages that have not been factored into our benefits modelling.

5.8. Analysis Of Network Development Options Available and Details Of Decisions Made To Satisfy And Meet Target Levels of Service

The WEL planning processes include assessment of all viable ways of achieving the target level of service. The following three high level options are always considered in conjunction with benefit, cost and risk:

- Do nothing
- Network solution
- Non-Network solution

Options are evaluated technically and financially and the most appropriate solution selected that, on balance, provides the best outcome in conjunction with benefit, cost and risk. Factors that are considered are:

- Technical
- Network connection arrangements
- Present and future loading
- Equipment type and rating
- Use of recovered equipment
- Equipment upgrade
- Load transfer to under loaded plant
- Load flow analysis
- Load control
- Non-technical
- Customer agreements
- Construction contract arrangements and methodology
- Financial
- Procurement
- Timing with Transpower and/or other party’s investment plan

The options available are unique to each project and are identified, analysed and the most suitable option selected depending on compliance with WEL standards, regulations and financial performance requirements. The options considered for some of the major projects are identified in the following paragraphs.

5.9. Grid Exit Points

Site	Issue	Options	Decision Made	Principal Reasons
HAM 33 & 11	Load exceeds capacity, particularly under contingent event	New GXP, increase capacity, transfer load	Increase capacity, balance loads across GXP's	Optimise timing through demand management technique
Te Kowhai	Load exceeds capacity particularly under contingent event in 10 year planning period	Increase capacity, New GXP	Fit cooling to existing Transformers and eventually add 3rd transformer unit	Optimise timing through demand management technique
Huntly	Nil			
Meremere	Nil			

Sub-transmission Network Enhancement or Upgrade

Site	Issue	Options	Decision Made	Principal Reasons
LAT-PEA 33kV cable overlay of overhead	Under contingency circuit overloads	Nil, urban district plan constrained Cable overlay	Cable overlay	Contingency overload
AVA-TAS 33kV link	Load Growth and Security	Install 33kV ccts between AVA and TAS Install 33kV ccts from TAS to TWH	Install 33kV ccts between AVA and TAS	Increase security of TAS and to cater for load growth
TWH –AVA 33kV cable circuits and AVA 33kV GIS install	Security during contingency event Transfer AVA, WAL & LAT substations to TWH from HAM to balance load between GXPs Increase transfer capacity between TWH and HAM	Install new 33kV ccts between TWH and AVA and replace AVA switchgear to GIS Install new 33kV ccts from Forest Lake switching station to TWH and leave existing switchgear at AVA Install new 33kV ccts from LAT to TWH and leave existing switchgear at AVA	Install new 33kV ccts between TWH and AVA and replace AVA switchgear to GIS	Increase security during contingency event and increase transfer capacity between TWH and HAM
Forest Lake 33kV	Security during contingency event	Construct new switching station on	Construct new switching station	Security during contingency event

Switching Station	Transfer AVA, WAL & LAT substations to TWH from HAM to balance load between GXPs Increase transfer capacity between TWH and HAM	the 33kV route adjoining AVA-HAM ccts and KENT-AVA ccts and use the same cables to link AVA and Forest Lake No switching station but install new 33kV ccts and new CBs at AVA for LAT-AVA ccts No switching station but install new 33kV ccts and new CBs at TWH for LAT-TWH ccts		Transfer AVA, WAL & LAT substations to TWH from HAM to balance load between GXPs
Latham – Forest Lake 33kV link	Security during contingency event Transfer AVA, WAL & LAT substations to TWH from HAM to balance load between GXPs Increase transfer capacity between TWH and HAM	Install new 33kV ccts between LAT and Forest Lake Switching Station Install new 33kV ccts at AVA for LAT-AVA ccts	Install new 33kV ccts between LAT and Forest Lake Switching Station	Security during contingency event Transfer AVA, WAL & LAT substations to TWH from HAM to balance load between GXPs
Chartwell 3rd Transformer	Load Growth	Install 3rd Transformer	Install 3rd Transformer	Cater for the expected Load Growth
Crosby 33kV Switching Station and cabling	Load Growth, Security and Asset Replacement	Construct new switching station to replace existing ABS atop wooden poles and have provision for future 3rd cct to HAM GXP to cater for load growth Do nothing	Construct new switching station and have provision for future 3rd cct to HAM	Cater for the expected Load Growth and increase security
Crosby 3rd 33kV circuit	Load Growth and Security	Install a 33kV cct from HAM GXP to Crosby Switching Station Do nothing	Install a 33kV cct from HAM to Crosby Switching Station	Cater for the expected Load Growth and increase security

Substations Including New Substations and Substation Upgrades

Substation	Issue	Options	Decision Made	Principal Reasons
Peacockes 33kV GIS Installation	Load growth and Asset Replacement	Upgrade Capacity and replace aging assets Do nothing	Install indoor 33kV and remove redundant outdoor equipment	Long term cost effective solution. Enable the roll out of the 33kV sub-transmission network differential protection upgrade program to maintain and improve security Removal of aging assets and make space for the new 11kV switchboard and zone transformer installations
Peacockes 11kV Switchboard Peacockes Transformers	Load growth	Replace with new transformers and 11kV switchboard. Replace with used transformer with higher rating and 11kV switchboard. Construct Airport Zone Substation to off-load Peacockes, then replace Peacockes transformers and 11kV switchboard.	Replace with new transformers and 11kV switchboard.	Long term cost effective solution Most flexible option to address the future load growth in both Airport and Peacockes areas. Eliminate noise and environmental compliance risk
Hoeka Rd Zone Substation	Transfer load from HAM11 to HAM33 to remove phase shift and increase security. Increase capacity to cater for future loads.	New zone substation to cater for loads on the far south east and transfer some load of HAM11 which has a 30˚/90˚ degree phase shift with other 11kV network Do nothing	New zone substation and transfer to HAM33 to remove phase shift Increase ability to backfeed other 11kV feeders in the network	Remove phase shift and increase ability to backfeed other 11kV feeders in the adjacent network

Ruakura Zone	Transfer load from HAM11 to HAM33 to remove phase shift and increase security Increase capacity to cater for future loads	New zone substation to cater for loads on the far south east and transfer some load of HAM11 which has a 30˚/90˚ degree phase shift with other 11kV network Do nothing	New zone substation and move to HAM33 to remove phase shift Increase ability to backfeed other 11kV feeders in the network	Remove phase shift and increase ability to backfeed other 11kV feeders in the adjacent network
Rotokauri Zone	Considerable Immediate Load Growth	Install 3rd Transformer at Tasman substation Construct new zone substation Optimize network capacity	Install 3rd Transformer at Tasman substation	Cater for the immediate and Future Load Growth
Tainui Developments – Ruakura inland port facility	Load growth	New Zone – Will cater for loads around the Tainui Ruakura inland port development facility Optimize network capacity	New zone substation	Long term cost effective solution

11kV Distribution Network Enhancement or Upgrade

Feeders	Issue	Options	Decision Made	Principle Reasons
SANCB1	Load exceeds 60% of thermal capacity and will not be able to provide security under contingency	Do nothing Upgrade feeder Load transfer to other feeders. Install standby diesel generators	Upgrade feeder capacity	Long term cost effective solution
AVACB1	Load exceeds 60% of thermal capacity and will not be able to provide security under contingency	Do nothing Upgrade feeder Load transfer to other feeders. Install standby diesel generators	Upgrade feeder capacity	Long term cost effective solution
LATCB3	Existing OH 16 mm² Cu has a risk of overloading and	Do nothing Upgrade feeder	Upgrade feeder capacity	Long term cost effective solution

	capacity limits to provide security under contingency	Load transfer to other feeders Install standby diesel generators		
WHACB3	Existing OH 16 mm² Cu have risk of overloading and capacity limits to provide security under contingency	Do nothing Upgrade feeder Load transfer to adjacent feeder. Utilize redundant 33kV OH line	Load transfer to adjacent feeder Utilize 5 km of redundant 33kV OH line	Utilize redundant Network assets to increase reliability & security of feeder

5.9.1.1. 11kV Feeder Upgrades

Loads on 11kV feeders are constantly monitored to ensure overloading does not occur and solutions to prevent overloading are evaluated. These are usually a combination of network configuration changes, upgrades of feeder conductors, and construction of new feeders and feeder links as required. Each year the top ten 60% plus loaded 11kV feeders are identified and plans are put in place to alleviate any issues that exist.

Upgrade SANCB1 to provide security – necessary to increase capacity and provide N-1 security to SANCB2, SANCB5, SANCB6 and SANCB7.

Upgrade AVACB1 to provide security – necessary to increase capacity and provide N-1 security to AVACB4, AVACB8, X92 and X91.

Upgrade 16 mm² Cu OH on Duke St to mitigate risk of overloading and provide security – This project will increase capacity and provide strong link between LATCB3 and LATCB8.

Utilize redundant 33kV OH line to offload WALCB2 and HORCB5– this will utilize redundant 33kV OH lines to replace existing 16 mm² and 25 mm² OH conductor to offload WALCB2 and HORCB5 to WHACB3.

Related Computer Systems Development Options

Key Functions	Issue	Options	Decision Made	Principal Reasons
Communication Systems	Overloaded analogue system channels, slow and issues with reliability Enabling of a high level of SCADA & Network Management System functionality Unable to get full advantage of functionality of installed IEDs on the network. Limited availability of 12 core fibre circuits without sharing of functions Predominantly single path radial communications to sites Smart Metering requires cost effective backhaul communications paths Secure and reliable communications paths required for unit protection signalling.	Upgrade network hardware using existing frequencies Upgrade systems to modern IP technologies Multiplexing of fibre circuits for better utilisation Utilise multiple comms paths provided when fibre installed with new cable runs and backup radio paths. Automatic failover using dynamic routing. Utilise existing communications network, where available, for smart metering data backhaul from access points at major communications nodes Provide low latency secure paths in existing communications network	Upgrade systems to modern IP technologies Multiplexing of fibre circuits for better utilisation Utilise multiple comms paths using dynamic routing Provide low latency secure paths in existing communications network	Long term cost effective solution Technology to cater for future trends Reliability Capacity for expansion Flexibility for changing requirements. All new devices are IP enabled

Load Control	Replacement of aged load control plants and relays in northern network	Relocate underutilised second static ripple injection plant from HAM 33kV GXP to WEA Utilise Smart Box load control functionality as replacement relays in northern network	Relocate underutilised second static ripple injection plant from HAM 33kV GXP to WEA Utilise Smart Box load control functionality as replacement relays in northern network	Cost effective solution to replace 5 aged rotary plants with one static plant Utilise meter hardware Save space on customer meter boards Provide reserves market participation in northern network
Load Control	Refurbish and re-program 283Hz load control relays removed from Raglan and Hamilton area Install in Northern area where Smart Box installation not possible or practical	Utilise Smart Box load control functionality as replacement relays in northern network Where this is not possible then install refurbished RO relays	Refurbish and reprogram 283Hz load control relays removed from Raglan and Hamilton area. Install in Northern area where Smart Box installation not possible or practical.	Provide reserves market participation in northern network Utilise reusable relay hardware Replace existing 500Hz relay in same space on board
Smart Metering	Implement a complex head end software system with limited time and resources	Implement a licensed, managed or Software as a Service model for head end deployment	Implement head end through Software as a Service	Only practical way to implement such a complex system with limited time and resources Migration to a managed or licensed model is possible in the future. Consistent with SmartCo decision

DR Site relocation	Relocate DR site	Leave DR site at present location Relocate DR to a more suitable site	Relocate DR to a more suitable site	Proposed building meets requirements after seismic strengthening Sited at essential communications node Close enough and far enough away

5.10. Programme of Works for AMP Planning Period

Introduction

The following programme of works is planned for network investment for the period covered by this AMP.

Project information is organised in the categories listed below:

- Asset replacement and renewal
- System growth including load growth, security - POS and zone sub, load control and smart grid projects
- Reliability, safety and environment including safety and compliance, reliability and communication enhancement projects
- Customer connections including new connections, subdivision and new relays
- Asset relocations including undergrounding

Where investment in a project is split by asset the discussion is presented under the dominant asset and reference is made to the other asset types.

Projects are summarised based on project timing for:

- The projects currently underway or planned to start in the next twelve months
- The projects planned for the next four years
- The projects being considered for the remainder of the AMP planning period
- The projects carried out for the whole AMP period

Refer to Appendix 6 for detailed project information in the summarised Project Definition Documents for projects to be currently underway or planned to start in the next 12 months.

Refer to Appendix 8 for project maps of a selection of the major projects WEL plans to undertake within five years from 1 April 2013.

Unless stated otherwise, budgets are for the entire project in this AMP period, and may span financial years.

All costs are stated in 2012 dollars. Project timeline may vary from time to time due to the difference between forecasted load growth and actual growth. Estimated project cost may also vary from time to time due to the following reasons:

- Project scope change due to unforeseen circumstances such as results of consenting process, etc.
- Raw material price movement. There were dramatic changes in previous years for the key assets used on WEL's network.
- Exchange rate variations. Exchange rates between New Zealand and other main currencies have varied significantly. It has a huge impact on cost variance between AMP indicated cost and actual spending for some projects.

Significant Assumptions and Uncertainties Affecting Forecast Expenditure

The forecasted expenditure is based on a number of assumptions shown below:

- Historic load trends, modified by the latest knowledge of business and economic conditions and population changes, are a reasonable indicator of the future.
- The roll out of the new advanced technologies (Smart Boxes) will allow the capital expenditure deferral and reduce operational expenditure improving the customer service at the same time. Hence the base peak load growth forecast is appropriately considered.
    - New technology is usually introduced gradually and its use can therefore be well planned. However, significant new technologies can lead to the early retirement of older less efficient or poorer performing plant resulting in higher than expected lifetime costs.
    - Customers are also using new technology such as more efficient appliances and better control and this can lead to lower demand or lower peak demand due to a shift in the time of peak demand. Lower consumption reduces the Company's income while lower peak demand can reduce the utilisation of assets.
- Significant effort is invested into demand forecasting. Commercial and residential development will not significantly deviate from what is known. As discussed section 5.3, WEL models zone substation demand twice per year. The model trends demand but also modifies demand according to information from Council planning and customer surveys as well as economic indicators. The total load on plant depends on both the number of customers and the average load per customer. Any unpredicted decrease or increase in these values will result in over or under expenditure in the Company's network.
- Electricity distribution is capital intensive and requires long term planning. Short term variations of two to three years will not materially affect long term planning though short term planning and investment will change in response. Development by large customers is monitored closely to ensure investment is timed appropriately.
- The Company's financial performance will follow recent trends:
    - WEL has strong governance and management systems in place, however rapid changes in conditions can affect WEL's financial performance (e.g. a major storm).

- The regulatory environment may be subject to change. Any increase or decrease in the extent of regulatory compliance requirements may affect operating costs of the business or the financial performance of new and continuing investment. Regulation changes are usually signaled well ahead of time and provision will be made where needed.
- Estimated project costs may also vary from time to time due to the following uncertainties, project pricing in the AMP doesn't include contingency allowance for these elements of potential cost increases; project scope change due to unforeseen circumstances such as results of consenting process etc.
- Raw material price movement. There were dramatic changes in previous years for the key assets used on WEL's network. Cost of materials can exceed 70% of investment in new projects. The cost of raw materials is very dependent on the international price of raw materials.
- Exchange rate variations. Exchange rates between New Zealand and other main currencies have varied significantly. It has a huge impact on cost variance between the AMP indicated cost and actual spending for some projects.

Short Term - Projects Planned for 2013/14– 2014/15

The following projects are in progress or planned for completion by the end of the 2014/15 financial period.

Category	Project Description	Options	Decision Made	Justifications	Budget in AMP Period ($000)
Security	Te Kauwhata Zone Substation replace transformers	Do nothing Upgrade transformers.	Upgrade transformers.	Increase security level of site. Cater for load growth predicted by lifestyle blocks close to South Auckland Optimise assets being removed from other site.	360
Asset replacement / Load Growth	Peacockes 11kV Switchboard and Peacockes Transformers	Do nothing Upgrade transformers and 11kV switchboard. Shift load by changing Network open points	Upgrade transformers and 11kV switchboard.	Increase security level of site. Increase load transfer capability to the adjacent substations. Most flexible option to cater for the load growth in both Airport and Peacockes areas. Reduce maintenance costs	3,167
Asset Replacement / Load Growth	Peacockes Rd Zone Substation replace outdoor 33Kv Circuit Breakers	Replace with new outdoor circuit breakers Replace with indoor GIS	Upgrade to 33kV Indoor GIS	Reduce ongoing maintenance costs Enable the roll out of the sub-transmission network differential protection upgrade program to maintain and improve security. Reduce visual impact of site	1,549

Category	Project Description	Options	Decision Made	Justifications	Budget in AMP Period ($000)
Security	Hamilton GXP 3rd Transformer	New GXP, Increase GXP capacity with addition of 3rd transformer unit.	Increase GXP capacity with addition of 3rd transformer unit.	Removal of phase shift and increase GXP capacity. Increase transfer capacity between HAM & TWH during contingency. Balance load between TWH and HAM	201
Load Growth	Hoeka Rd Zone Substation	Do nothing. Shift Network open points. Upgrade conductor and install voltage regulators. Construct new Zone Substation	Upgrade conductor and install voltage regulators – Stage 1A and 1B Install new Zone Substation – Stage 2	Mitigate against immediate voltage support issues. Provide long term security. Ability to connect and support planned rural lifestyle areas. Phase shift removal.	7,221
Security	Latham – Peacockes upgrade of weak section of 33kV circuit	Do nothing. Upgrade smallest section of conductor Reconductor entire circuit. Replace overhead with cable circuits.	Upgrade smallest section of conductor	Increase security level of site. Increase sub-transmission load transfer capability. Optimise existing assets and established sites. Avoid the need for easements	879
Safety and Compliance	Designate existing Zone substation sites	Do nothing. Designate sites Apply for resource consents as projects arise	Designate sites across three years	Reduce on-going costs for resource consent applications. Surety around the ability to upgrade / modify existing sites.	100

Customer Driven	Caro St - Install 11kV switching station	Do nothing. Install additional 11kV RMU and transformer Establish 11kV switching station. Install diesel generators to support major customer.	Establish 11kV switching station.	Increase security level of site. Provide for large proposed increased load by critical major customer. Ability to decommission and abandon existing site with old assets and difficult access. Avoid noise pollution of generators.	1,078
Safety and Compliance	Seismic strengthening of Glasgow and Avalon (old) substation buildings	Do nothing. Install seismic bracing. Replace non-compliant section of building.	Install seismic bracing.	Protect against risk of earthquake damage. Increase security level of site Possible DR location site	560
Asset Replacement	Findlay Rd reconductoring	Do nothing. Upgrade conductor to replace large section of $16mm^2$ Cu in 11kV feeder.	Upgrade conductor.	Increase voltage capacity of circuit Increase security level of feeder Reduce maintenance costs.	36
Customer Driven	Dannemora Subdivision remedial work	Do nothing. Complete remedial work. Sell subdivision	Complete remedial work.	Improve reliability performance for subdivision. Potential to sell subdivision once improvements completed	773
Security	Pukete substation 33kV cable reterminations	Do nothing. Reterminate 33kV cables.	Reterminate 33kV cables.	Reduce maintenance costs. Ensure protection operates correctly.	96

Load Growth	Tasman CB5 11kV extension	Do nothing. Shift Network open points. Install voltage regulator. Upgrade circuit and offload TAS CB6	Upgrade circuit and offload TAS CB6	Off-load existing 11kV feeder to increase security and reduce loading levels. Increase security level of feeder	50
Load Growth	Distribution Transformers Upgrade T2069, T2543 and T2124	Do Nothing Replace existing Transformers with 300kVA units	Replace existing Transformers with 300kVA	Ensures transformers are not exceeding their kVA rating capacity Allows for future capacity growth	120
Load Growth	SAN CB1 11kV feeder upgrade	Do nothing. Install new cable to increase rating of 11kV feeder. Rearrange circuits to off-load feeder circuits	Install new cable to increase rating of trunk feeder.	Increase security level of trunk feeder by increasing cable size to reduce loading levels. Provide for load shifting to other feeders under contingency events.	342
Security	AVA CB1 11kV feeder upgrade	Do nothing. Install new sections of OH conductor to increase rating of 11kV feeder. Underground feeder. Rearrange circuits to off-load feeder circuits	Install new sections of OH conductor to increase rating of 11kV feeder.	Increase security level of 11kV feeder by increasing conductor size to reduce loading levels. Provide for load shifting to other feeders under contingency events.	496

Security	CLA – STE 11kV trunk feeder	Do nothing. Install new cable to increase rating of trunk feeder. Rearrange circuits to off-load feeder circuits	Install new cable to increase rating of trunk feeder.	Increase security level of trunk feeder. Provide for load shifting under contingency events.	200
Load Growth	Whatawhata CB6 11kV extension	Do nothing. Shift Network open points. Install voltage regulator. Extend circuit and offload WAL CB6.	Extend circuit and offload WAL CB6.	Off-load existing 11kV feeder to increase security and reduce loading levels. Increase security level of feeder	460
Safety and Compliance	Temple View pole removal.	Do nothing. Install taller poles. Install cable section and remove poles from private property.	Install cable section and remove poles from private property.	Provide acceptable solution for property owners Increase security level of feeder Reduce maintenance costs.	50
Load Growth	Utilize redundant 33kV OH circuit to off-load WAL CB2 and HOR CB3	Do nothing. Remove redundant conductor Upgrade 11kV circuit. Convert redundant 33kV OH line to 11kV.	Convert redundant 33kV OH line to 11kV.	Reduce demand on heavily loaded WAL CB2 and HOR CB3 circuits by off-loading to Whatawhata substation Utilize existing redundant assets and established sites. Further load WHA substation for better asset utilization.	340

Reliability	Weavers Resonant Earth System (RES) installation.	Do nothing. Major upgrade of all 11kV feeders in worst performing area of network Install GFN at substation	Install GFN coil at substation	Eliminate high SAIDI impact of worst performing feeders. Provide for continuation of supply during adverse weather events	580
Load Growth / Safety and Compliance Asset Replacement	Wallace Rd Transformer Upgrade Wallace Rd 33kV switchgear replacement	Install noise buffers to mitigate against non-compliant transformers Do nothing – wait until the outdoor CBs are due for replacement by age profile ranking Extend footprint of site to allow new transformers to be installed Install 33kV GIS switchgear to allow site to be modified to accommodate new 15/23MVA transformers Replace with new 15/23 MVA transformers	Replace with new 15/23 MVA transformers Bring replacement date forward regardless of age and modify the existing building to install new 33kV GIS switchgear indoors	Increase capacity of site Increase security level of site Reduce maintenance costs. Eliminate noise and non-compliance issues. Increase capacity of site Increase security level of site Reduce maintenance costs Allow the safe installation of the new 15/23MVA transformers without having to extend the footprint of the site	3,207

Load Growth	Installation of LV transformer load monitoring devices.	Do nothing Install LV load monitors. Install temporary data loggers as required. Acquire data from Smart Meters	Install LV load monitors while waiting for smart meter's technology trial. Across four years' period	Proven technology available now. Permanent installation Smart meters may provide what is needed if the business case approved	220
Reliability	Duke St 16mm² Cu conductor replacement	Do nothing. Install 11kV cables Replace 16mm² Cu conductor	Replace 16mm² Cu conductor	Eliminate potential failure mode to increase reliability of feeder Accommodate load increases in that portion of the Network	370
Safety and Compliance	Arc flash protection installation	Do nothing. Provide full-cover flash protection PPE Install arc flash protection.	Install arc flash protection.	Comply with latest safety standards Provide safe environment for switching operators.	559
Communication enhancement	Completion of Conversion of Conitel Pole top sites. Includes new RTUs and 4RF Radios	Do nothing. Install new radios with serial Comms and Ethernet IP ports	Install new radios with serial Comms and Ethernet IP ports	Reduce annual radio licence fees Future-proof for changes to Radio Spectrum Management procedures	88
Security	33kV Protection Upgrade distance to differential	Do nothing. Review settings to reduce Permissive Over-reach Install differential protection on circuits.	Install differential protection on circuits. Project is planned to be completed by 2015	Better tripping discrimination for meshed 33kV Network. Reduces the risk of cross-system faults	2,054

		Install open points in the 33kV mesh.			
Safety and Compliance	DR Site relocation	Do nothing and retain existing facility Relocate to another site	Relocate to alternate site	Location of site Accessible by major roads Suitability due to physical assets, yard size and site already under WEL lease	459

Medium Term - Projects Proposed for 2015/16 – 2017/18

The following projects are proposed for completion by the end of the 2018 financial period.

Category	Project Description	Options	Preferred Option	Justifications	Budget ($000)
Security	Weavers Zone Substation replace transformers	Do nothing Upgrade transformers	Upgrade transformers	Maintain N-1 security level of site with the projected demands of load growth in the area Optimise assets being removed from other site	2,000
Load Growth	Tasman 3rd Transformer	Do nothing Shift 11kV load by changing Network open points. Install third 15/23 MVA transformer Construct new zone substation for Rotokauri growth cell area	Install third 15/23 MVA transformer	Increase capacity of site Increase security level of site Cater for load growth in Rotokauri growth cell	3,608

Category	Project Description	Options	Preferred Option	Justifications	Budget ($000)
Customer Driven	UFB Roll-out make ready works for overhead fibre deployment	Do nothing Underground network Upgrade network to allow for fibre installation	Upgrade network to allow for fibre installation	Provide space on the overhead network to accommodate fibre installation.	950
Security	Forest Lake 33kV Switching Station	Do nothing. Install new circuits from Avalon to Latham Establish Forest Lake 33kV switching station Install cable circuits from Te Kowhai to Latham	Establish Forest Lake 33kV switching station	Increase security level of existing sites. Increase sub-transmission load transfer capability Optimise existing assets and established sites Gain ability to switch zone substations between GXP's	1,781
Security	Te Uku Substation Upgrade	Do nothing Upgrade Te Uku	Upgrade Te Uku	Increase security level of existing sites. Optimise existing assets and established sites	1,500
Security	Ruakura Zone Substation Construction	Do nothing Install 3rd 220/33kV transformer at HAM or 110/33kV transformer at HAM Install 33/11kV Zone substation at Ruakura	Install 33/11kV Zone substation at Ruakura while Transpower invests for 3rd transformer Investment planned to be across three years starting from 2013	Overcome HAM GXP capacity issues to satisfy n-1 security standard Remove phase shift issues	6,983
Security	Purchase of 11kV Switch Board at Hamilton POS	Do nothing Purchase the switchboard from Transpower	Purchase the Switchboard	Obtain asset ownership for better control	505

Category	Project Description	Options	Preferred Option	Justifications	Budget ($000)
Load Growth	Ruakura Inland Port Facility	New Zone – Will cater for loads around the Tainui Ruakura inland port development facility Optimize network capacity	New zone substation	Long term cost effective solution	4,000
Security	Te Kowhai – Avalon 3x 33kV cable circuits and 33kV GIS switchgear at Avalon	Install new 33kV ccts between TWH and AVA and replace AVA switchgear to GIS. Install new 33kV ccts from Forest Lake switching station to TWH and leave existing switchgear at AVA Install new 33kV ccts from LAT to TWH and leave existing switchgear at AVA	Install new 33kV ccts between TWH and AVA and replace AVA switchgear to GIS.	Network capacity upgrade Increase security during contingency event and increase transfer capacity between TWH and HAM	14,243
Security	HAM 11kV interconnection upgrade	Do nothing. Interconnection upgrade	Interconnection upgrade	Network capacity upgrade Allow non-aligned phase shifted sections of the network to be corrected and interconnected Increased 11kV level load transfer capability	1,500

Customer Driven	Simsey Place new load connection application	Do nothing. Supply from existing 11kV feeder. Upgrade network to provide for major new load connection.	Upgrade network to provide for major new load connection.	Provide for new load. Defer breach of N-1 security level for nearby zone substation. Total budget is subject to client load growth – initial load of 2MW with possible requirement for 6MW as demand grows	770
Security	Te Kowhai GXP 3rd Transformer	New GXP, Increase GXP capacity initially with new cooling equipment to existing transformer and eventually add 3rd transformer unit	Increase GXP capacity initially with new cooling equipment to existing transformer and eventually add 3rd transformer unit	Load growth Increase transfer capacity between HAM & TWH during contingency. Balance load between TWH and HAM	132
Security	Purchase of Hamilton 33kV Switchgear	Do Nothing Purchase 33kV Switchgear	Purchase 33kV Switchgear	Greater network control and stability	3,900
Security	AVA GIS 33kV swgr x5 reconfiguration	Do Nothing Reconfigure 33kV Switchgear	Reconfigure 33kV Switchgear	Increase security level of existing site	802

Long Term - Projects proposed for 2018/19 – 2022/23

The following projects are to be considered for inclusion in the period between 2018 and the end of this AMP period.

Category	**Project Description**	**Justifications**	**Budget ($000)**
Load Growth / Asset Replacement	Gordonton Substation Upgrade	Increase capacity of site Future proof for lifestyle block establishment	5,190
Security – Huntly POS	Huntly to Glasgow 33kV cable	Increase security levels	1,228
Security – Huntly POS	Huntly to Kimihia 33kV cable	Increase security levels	1,372
Security	Glasgow 33kV switchgear replacement	Connection point required for proposed new cable circuits	1,078
Security	Glasgow 2nd Transformer	Proposed load growth in the Huntly area	638
Security	Kimihia 33kV switchgear replacement	Connection point required for proposed new cable circuits	792
Security	Finlayson 33kV ring and FIN South Zone Substation	Load growth	3,630
Security	Avalon – Tasman 33kV Link	Increase security level of existing site	2,267
Security	Latham – Forest Lake – Avalon 33kV cable link	Network capacity upgrade Increase sub-transmission load transfer capability	4,244

Category	Project Description	Justifications	Budget ($000)
Load Growth	Chartwell install 3rd transformer and 11kV cabling link	Network capacity upgrade Support proposed load growth	4,656
Security	Consenting cost	Ensure compliance	1,100
Security	Crosby switching station and 3rd 33kV Circuit	Improve the security in Chartwell area	3,095
Security	Crosby 3rd 33kV Circuit from Crosby to HAM GXP	Improve the security in Chartwell, Borman and Gordonton areas	1,294
Safety and Compliance	Seismic strengthening of substations and switching stations	Protect against risk of earthquake damage. Increase security level of sites Understand level of risk and set appropriate budgets and timeframes to mitigate against the risks.	600
Security	33kV Protection Upgrade distance to differential	Better tripping discrimination for meshed 33kV Network. Reduces the risk of cross-system faults	492

Whole categories of assets proposed for 2013 – 2023

Annual allowances are made for the following items in the period for the entire period of this AMP.

Category	Project Description	Justifications	Budget in AMP Period ($000)
Communication Enhancement	SCADA Communication Enhancement	Improve speed of communications network and reliability	368
Load Growth	Discretionary fibre install budget	Opportunity to install fibre or ducting while other cabling projects are in progress to future-proof	1,650
Load Growth	Distribution Network Reinforce - Ongoing	Load Growth	3,598
Security	11kV cables zone interconnections upgrades	Network capacity upgrade Increase 11kV level load transfer capability	4,159
Load Growth	CBD & Rural LV Circuits Upgrade	LV Network capacity upgrade to avoid LV issues	12,820
Load Growth	LV Feeder Overloading Issues	LV Upgrades to eliminate overloading	4,100
Reliability	Other reliability projects	To be reviewed and implemented to gain best SAIDI impact per dollar spent	2,737
Asset Replacement	Aging asset replacements	Age profile of existing assets Condition information Risk Mitigation	106,757

Category	Project Description	Justifications	Budget in AMP Period ($000)
Safety and Compliance	Mitigation of line clashing near zone substations	Eliminate fault induced line clashing	800
Safety and Compliance	Power Quality - Works required to correct customer complaints	Investigate and correct Customer Low Voltage Complaints where proven to be WEL issue	5,000
Communication enhancement	Fibre/Routes	Allowing for greater redundancy by utilising the fibre network for Dynamic Routing	2,560
Security	Network Automation	Develop smart grid to improve customer services and network security	1,181
Customer Driven Projects	Customer Driven Projects	Respond to customer’s requests to connect to WEL Network	82,840
Undergrounding	Uneconomic undergrounding projects	Uneconomic undergrounding projects mainly from councils, road authorities, etc	10,000
Safety & Compliance	Substation Site Security Access Project	Increased security for Substations	421
Load Control and Smart Grid	Smart Box roll out project	Implementation of Smart Box project	24,000
Reliability, Safety and Environment	Voltage upgrade projects due to monitoring	Proactively addressing non-compliant voltages issues as identified by the smart meters	986

Asset Replacement and Renewal

The overall spend profile and programme for asset replacement is discussed in Section 6.4. The following projects have been identified and optimised in conjunction with asset replacement requirements and network development due to load growth. Detailed project cost and timeline information can be found in section 5.10.

Te Kauwhata transformer upgrade

The two 33/11kV transformers rated at 5MVA are to be replaced with new 10/23 MVA units that will ensure the N-1 security levels of the site are maintained with the projected load growth for the Te Kauwhata / Northern areas.

Latham Zone Substation transformer replacement

The two 33/11kV transformers rated at 15MVA are to be replaced with new 15/23 MVA units that will ensure the N-1 security levels of the site are maintained with the projected load growth for the Latham / Kahikatea Drive areas.

Peacockes Zone Substation 33kV switchgear and transformer replacement

The 1970 vintage outdoor 33kV oil filled switchgear is nearing the end of its economic life and is to be replaced with indoor 33kV GIS (Gas Insulated Switchgear). The new switchgear will allow connection of the 33kV cables for the proposed new Airport substation.

The two 33/11kV transformers rated at 10MVA are to be replaced with 15MVA units from Latham Court substation.

Weavers Zone Substation transformer replacement

The two 33/11kV transformers rated at 7.5MVA are to be replaced with 10MVA units that will ensure the N-1 security levels of the site are maintained with the projected load growth for the Weavers / Huntly West areas.

Wallace Rd Zone Substation transformer replacement

The two 33/11kV transformers rated at 10MVA are to be replaced with new 15/23 MVA units that will ensure the N-1 security levels of the site are maintained with the projected load growth for the Wallace and Western HCC areas.

Gordonton Zone Substation transformer replacement

The two 33/11kV transformers rated at 5MVA are to be replaced with new 10MVA units that will ensure the N-1 security levels of the site are maintained with the projected load growth for the rural Gordonton area.

Network Development Projects to Address System Growth

5.10.1.1. Northern Network Development Plan (NND)

There are a number of separate projects phased over the life of the AMP. Timing for these is dependent on growth and the impact of other infrastructural projects such as the Waikato Expressway.

Stage 2: Huntly to Te Kauwhata Dual 33kV Circuits is complete

This project was completed in the 2011/12 year.

Stage 3: Te Kauwhata to Meremere 33kV Line re-insulation is complete

This project was completed in the 2009/10 year.

Stage 4a: Te Kauwhata 33kV GIS switchgear installation is complete now

This project was completed in the 2012/13 year.

Stage 4b: Te Kauwhata Transformer Upgrade

The existing Te Kauwhata transformers rated at 5MVA each are to be replaced with refurbished 10MVA units to cater for voltage management, area generation and load growth.

Primary assets affected:	Protection relays, refurbish transformers
RMA Requirements:	The site is designated for electricity substation purposes, outline plan approval required for all new works
Building Act Requirements	N/A

Stage 5: Huntly - Glasgow and Huntly - Kimihia 33kV Cables

Since the gas-filled cables between Western Road and Glasgow became unserviceable and were abandoned, Glasgow was reduced to N security. Kimihia also has only one 33kV supply and is at N security.

This project is to install single 33kV cable circuits from the Huntly GXP 33kV switching station to each of the Glasgow and Kimihia substations. This will provide N-1 security to both Glasgow and Kimihia and provide capacity for future load growth in these areas. This project will be triggered by industrial load growth and the extent to which the 11kV network can be backed up under contingency conditions.

Primary assets affected:	33kV Cable
RMA Requirements:	Consultation required with Tainui, Waikato Regional Council and potentially Waikato District Council
Building Act Requirements	N/A

The following options were considered during planning for improved security to N-1 for this project:

- Several route options
- Switching through Distribution Automation

Stage 6: Glasgow Second Transformer and 33kV GIS

Glasgow zone substation currently has one 10MVA transformer and a second is required to achieve (N-1) security (Glasgow supplied load can currently be backed up through the 11kV network, this will no longer be the case as local demand increases).

Replacement of the old outdoor 33kV switchgear with indoor GIS is also required as additional circuit breakers are needed to enable connection of the 33kV cable from Huntly GXP and the second transformer.

Primary assets affected:	33kV GIS switchgear, protection relays, refurbish transformers
RMA Requirements:	Notice of requirement required to designate the site
Building Act Requirements	Building permit required for additional transformer pad and building modifications

Stage 7: Kimihia 33kV GIS

The existing outdoor oil-filled 33kV circuit breaker at Kimihia is old and nearing the end of its economic life. An additional circuit breaker is needed to enable the connection of the 33kV cable from Huntly GXP. The opportunity is to be taken to replace the outdoor 33kV switchgear with GIS and also provide N-1 security. This project will be triggered by industrial load growth factors

Primary assets affected:	33kV GIS switchgear, protection relays
RMA Requirements:	Notice of requirement required
Building Act Requirements	Building permit required for building modifications

Stage 8: Finlayson - Finlayson South Substation and 33kV Ring

The far north zone substations are fed via radial 33kV feeders and are subject to occasional failure without available alternative switching. It is planned to complete the ring between Finlayson and Te Kauwhata zones to allow mesh operation of 33kV feeds and improve security to N-1; this includes construction of a new substation. This project will be triggered by load growth in due course.

Primary assets affected:	33kV cable
RMA Requirements:	N/A
Building Act Requirements	N/A

Stage 9: Weavers Transformer Upgrade

The Weavers transformers are rated at 7.5 MVA each and are to be replaced with refurbished larger units to cater for area generation and load growth.

Primary assets affected:	Refurbish transformers

RMA Requirements:	The site is designed for electricity substation purposes, outline plan approval required for all new works
Building Act Requirements	Building consent may be required

5.10.1.2. Hoeka Rd Zone Substation

Lifestyle blocks and other residential growth in the Tauwhare, Matangi, Newstead and Eureka areas are placing increasing demand on the 11kV supply from Hamilton CB2802 and Silverdale CB4. There are voltage and loading issues which cannot be easily addressed with voltage regulators or conductor upgrades. Network loading in the area is currently at full capacity at peak times and predicted load growth will be exceeded within the next five years. Reconfiguration options for the existing network are not viable as they shift the problems elsewhere within the network. A new 33/11kV zone substation is required in this area to service the expected load growth and to ease loading issues on the existing 11kV system.

The final configuration and proposed design of the substation is still under evaluation and is subject to further feasibility, land acquisition and detailed network design studies.

Temporary work has been undertaken in the winter of 2010 involving voltage regulator installations and conductor upgrades as the first stage of the overall substation establishment process.

Primary assets affected:	33kV switchgear, 33/11kV transformer, 11kV switchgear, 33kV cable, 11kV cable, protection relays, communications equipment
RMA Requirements:	Notice of requirement and subdivision are required. Land for the new substation has been acquired, working through subdivision process currently
Building Act Requirements	Building consent required

Photo 14 Cobham Drive Substation project completed

5.10.1.3. Ruakura Zone Substation

There is increasing pressure being placed on the Hamilton GXP at both the 33 and 11kV levels. Transpower are to supply a third 220/33kV transformer to increase the supply capacity and maintain the N-1 security level. Once this is in place, a 33/11kV zone substation will be created at Ruakura with the installation of 3x 15/23MVA transformers and the procurement of the existing HAM 11kV switchboard from Transpower.

This arrangement will allow for rationalisation of the existing 11kV network in the area and the removal of the phase shift issue that presently exists between the 220/33/11kV and the 110/11kV systems at HAM GXP.

The establishment of the Hoeka Rd zone substation will mean the Ruakura substation originally planned to commence in the 2011-12 financial year, can now be deferred to commence in the 2013-14 year.

Primary assets affected:	33kV switchgear, 33/11kV transformers, 11kV switchgear, 33kV cable, 11kV cable, protection relays, communications equipment
RMA Requirements:	Notice of requirement required or alteration to Transpower's Designation
Building Act Requirements	Building consent required

Photo 15 Raglan Zone Substation project completed

5.10.1.4. Hamilton GXPs and Sub-transmission Security Projects

Load growth in the Hamilton area is such that the Hamilton GXP 33kV supply capacity has reached constraints and cannot service the projected load growth area. The operation of the GXP above the constrained limits compromises the security of supply. The preferred solution is to upgrade the capacity at the two existing GXPs with integration into an upgraded sub-transmission network.

In considering the requirements to overcome these constraints and expected demand growth, a number of options were considered to achieve the planning and business objectives. Of these; new zone substation, interconnection of 33kV sub-transmission feeders, new GXP, upgraded GXPs and embedded generation solutions were analysed both technically and commercially.

The timing, location and configuration of GXP capacity improvements will be firmed up in consultation with Transpower.

As part of this work it is expected that both Te Kowhai and Hamilton GXP will undergo replacement and upgrades for interconnection and security consolidation around the WEL 33kV supplies. These will also be developed in conjunction with Transpower.

To ensure a suitable secure and long term solution is obtained, the planning of the GXP capacity changes is aimed to align with Transpower's proposals for the region.

As part of the overall capacity upgrades at GXP level it is planned to upgrade the capacity into the western industrial/commercial areas of Te Rapa. This will support the load growth and security for the zones of Tasman, Avalon, Latham and Wallace. New sub-transmission feeders from Te Kowhai and 33kV sub-transmission feeder upgrades will be included to form 33kV improved meshing and transfer capability across Hamilton, particularly under contingency to ensure N-1 security.

5.10.1.5. 33kV Protection Upgrade Projects

WEL is experiencing rapid expansion of its network with the recent addition of several new zone substations, the wind farm and upgraded GXPs. The 33kV meshed network will become even more complex in the future.

When the capability of the 33kV protection system is exceeded there is an increased risk that for certain faults significant parts of the meshed networks will trip with a resultant widespread loss of supply.

WEL has planned to upgrade the protection of all 33kV circuits from Distance protection schemes to Unit protection schemes in the form of line current differential schemes. The Line Current Differential schemes require reliable communication between the opposite ends of the lines. These are now becoming available. The differential protection schemes will be designed so that where possible, multiple communication paths are employed to cater for situations where a communication link has failed. In all cases, the distance protection functions will be maintained as backup.

One consequence of differential protection is that the usual, automatic, time graded backup protection from upstream circuit breakers is lost. To overcome this issue busbar protection will be implemented on those 33kV switchboards that are presently not fitted with this. At the same time breaker failure protection will also be implemented. Furthermore, to minimize the risk of a circuit breaker failing to trip, trip circuit supervision will be fitted to any circuit breakers that do not already have this feature applied. It is planned to implement the changes over the next three years.

The following new 33kV circuits were fitted with line current differential protection (and back up distance protection) as part of their project construction specifications:

- Te Uku wind farm to Te Kowhai circuit
- Te Uku wind farm to Avalon circuit
- Te Uku wind farm to Whatawhata circuit
- Te Kowhai to Pukete circuit 1
- Te Kowhai to Pukete circuit 2
- Hamilton to Cobham circuit 1
- Hamilton to Cobham circuit 2

The following 33kV circuits are in the process of being upgraded:

- Te Kowhai to Horotiu circuit 1
- Te Kowhai to Horotiu circuit 2
- Pukete to Sandwich circuit 1
- Pukete to Sandwich circuit 2
- Hamilton to Avalon circuit 1
- Hamilton to Avalon circuit 2

The following 33kV circuits are yet to be done:

- Hamilton to Bryce Street circuit 1
- Hamilton to Bryce Street circuit 2
- Hamilton to Peacockes circuit 1
- Hamilton to Peacockes circuit 2
- Hamilton to Chartwell circuit 1
- Hamilton to Chartwell circuit 2
- Hamilton to Claudelands circuit 1
- Hamilton to Claudelands circuit 2
- Hamilton to Latham circuit 1

33kV switchboards that at present are not fitted with bus zone protection or breaker fail protection include Horotiu, Sandwich and Pukete. This is scheduled to be rectified within the next three years. Design work for bus zone protection or Breaker Fail protection at Sandwich has commenced.

In recent times all protection equipment has been specified to be compliant with, or upgradeable to, the IEC 61850 standard. Future protection equipment will only be accepted if it is fully compliant to ensure future proofing. However at this stage there is no intention to design or construct substation control and protection systems based on the 61850 standard.

TCP/IP communications systems have now been extended to all 26 zone substations and this allows direct communication with the SEL protection equipment from the central engineering office, provided the local substation communication processor is adequate. Where this is not the case, such as Sandwich Road Substation, they will be upgraded at minimal cost. Upgrading of the TCP/IP communications systems for the remaining substations is scheduled for the next few years (as described elsewhere in this document).

The implementation of the TCP/IP systems provides a platform for significant efficiency gains in dealing with protection issues. For SEL relays it allows direct access from the central engineering office to:

1. Interrogate relay settings
2. Interrogate relay operation
3. Interrogate events (since currents and voltages are monitored these parameters can be used for fault analysis)
4. Apply relay settings; revised or new

To date 1 to 4 have been employed for all stations where the TCP/IP systems have been applied.

The above applies to protection equipment both at the 33kV and 11kV levels but only for SEL relays at present.

Photo 16 **500kVA Groundmount Transformer being moved in the Distribution Centre**

5.10.1.6. Existing Substation Works

Designating Existing Substation Retrospectively

Over three financial years (2012/2013, 2013/2014 and 2014/2015) it is proposed to designate all of WEL's substations and switching stations retrospectively. Designating these sites will ensure that this essential public network utility is protected from incompatible development which may have adverse effects on the operation of the site. Furthermore designating the site will provide for upgrades to accommodate increases in electricity demand as a result of further development and avoid the need to create further network utility sites or obtain multiple resource consents. To date Te Kauwhata, Kent, Peacockes, Avalon, Latham, Claudelands, Te Uku, Weavers and Horotiu substations have been designated non-notified. Wallace, Sandwich and Chartwell substations are currently being processed by Council.

Tasman Zone Substation

Tasman 33/11kV zone substation capacity will need to be upgraded with a third 33/11kV 15/23MVA transformer within four years to service both the immediate load growth at Te Rapa and the expected load growth resulting from the Rotokauri District Plan establishment.

New meshed 33kV feeders and associated switchgear and communications are planned from Tasman to Avalon substations.

Primary assets affected:	33kV switchgear, 1 of 33/11kV transformer, 11kV switchgear, 33kV cable, protection relays, and communications
RMA Requirements:	Alteration to designation is required. Waiting on Tainui to confirm whether WEL can lease additional land to the south of the substation
Building Act Requirements	Building consent is required for building extension

The following options were considered during planning for improved security to N-1 for this project

- Other possible sites
- Type and equipment arrangements to meet requirements of the District Plan
- Extension of the 33/11kV network
- Building options for acceptance by the local community
- Increased capacity of surrounding zone substations

Chartwell Zone Substation

Chartwell 33/11kV zone substation capacity will need to be upgraded with a third 33/11kV 15/23MVA transformer within six years to service the expected load growth resulting from the District Plan growth predictions and commercial shopping mall improvements.

New meshed and rationalised 33kV feeders and associated switchgear and communications are planned from Puketaha to Chartwell substation to support the Chartwell upgrade.

Primary assets affected:	33kV switchgear, 1 of 33/11kV transformer, 11kV switchgear, 33kV cable, protection relays, and communications
RMA Requirements:	Notice of requirement is required. Writing on Council approval as per section 176 of the RMA
Building Act Requirements	Building consent may be required for any structures to contain the transformer

The following options were considered during planning for improved security to N-1 for this project

- Type and equipment arrangements to meet requirements of the District Plan
- Extension of the 33/11kV network
- Building options for acceptance by the local community
- Increased capacity of surrounding zone substations.

Wallace Road Zone Substation Upgrade

A WEL standard 33/11kV dual 15/23MVA transformer replacement and upgrade is planned for this substation to accommodate load growth. During the 11kV switchgear replacement project in 2007/08, the first runs of all feeder cables were replaced from the switchgear to the line termination points. Checks should now be done to identify what sections of overhead conductor need to be upgraded to increase the feeder ratings in line with the Protection Based Feeder Upgrade Project.

Load partially shifted to Whatawhata, hence the deferral.

Primary assets affected:	15 / 23 MVA 33/11kV transformers
RMA Requirements:	Notice of requirement is required. A NOR has been lodged with Council who have requested written approval from the neighbours for the noise. Consultation is currently being undertaken
Building Act Requirements	Building consent may be required for any structures to contain the transformer

Peacockes 33kV GIS Switchgear Installation, 11kV Switchboard and Transformer Replacement

The 33kV outdoor lattice steel structure, oil-filled circuit breakers, and air-break switches at Peacockes Substation, are nearing the end of their economic life. The existing 33kV outdoor switchgear will be replaced with new indoor GIS switchgear complete with new protection relays. A new 33kV switchroom has already been completed in 12/13 financial year as part of the building seismic strengthening project. The new 33kV GIS switchgear will enable the 33kV differential protection upgrade programme to maintain and improve the security of the sub-transmission network. New transformer protection scheme will also be implemented to replace the current outdated scheme. Also the removal of the existing outdoor structure will make space available for the construction of a new 11kV switchroom and zone transformer replacement in the 14/15 year.

To cater for the foreseeable load growth in both Airport and the general Peacockes areas, the existing 10MVA zone transformers will be replaced with new 15/23MVA units. The aging 11kV switchboard will also be replaced to allow for the higher transformer capacity.

The zone transformer and 11kV switchboard replacement will supersede the originally proposed new Airport zone substation project.

Primary assets affected:	33kV switchgear, refurbished transformers, 11kV switchgear, protection relays
RMA Requirements:	The site is designated for electricity substation purposes, outline plan approval required for all new works. Outline Plan has been lodged for the seismic strengthening works.
Building Act Requirements	Building consent may be required for any structures to contain the switchgear

The following options were considered during planning for improved security to N-1 for this project

- Use of new or refurbished equipment

Gordonton Zone Substation Upgrade

A WEL standard 33/11kV dual 15/23MVA transformer upgrade is planned for this substation to accommodate load growth. Appropriate communication upgrades will also be carried out during this upgrade.

Primary assets affected:	33kV switchgear, 15/23 MVA 33/11kV transformers, 11kV switchgear, protection relays
RMA Requirements:	Notice of requirement is required
Building Act Requirements	Building consent may be required for any structures to contain the transformer

The following options were considered during planning for improved security to N-1 for this project

- Use of new or refurbished equipment

Te Uku Substation Upgrade

The existing 1970 vintage outdoor 33kV oil filled switchgear is nearing the end of its economic life and does not meet the security standard of N-1 for the area. In addition as part of the wind farm development and connection in the area there is a requirement to upgrade the protection schemes and generation control. The existing switchgear is to be replaced with indoor 33kV GIS (Gas Insulated Switchgear).

Primary assets affected:	33kV switchgear, 11kV switchgear, protection relays
RMA Requirements:	The site is designated for electricity substation purposes, outline plan approval required for all new works
Building Act Requirements	Building consent may be required

5.10.1.7. Distribution Network Upgrade and Optimisation

11kV Feeder Upgrades

Loads on 11kV feeders are constantly monitored to ensure overloading does not occur and solutions to prevent overloading are evaluated. These are usually a combination of network configuration changes, upgrades of feeder conductors, and construction of new feeders and feeder links as required. Each year the top ten 60% plus loaded 11kV feeders are identified and plans are put in place to alleviate any issues that exist.

- Upgrade SANCB1 to provide security – necessary to increase capacity and provide N-1 security to SANCB2, SANCB5, SANCB6 and SANCB7.
- Upgrade AVACB1 to provide security – necessary to increase capacity and provide N-1 security to AVACB4, AVACB8, X92 and X91.
- Upgrade 16 mm² Cu OH on Duke St to mitigate risk of overloading and provide security – This project will increase capacity and provide strong link between LATCB3 and LATCB8.
- Utilize redundant 33kV OH line to offload WALCB2 and HORCB5– this will utilize redundant 33kV OH lines to replace existing 16 mm² and 25 mm² OH conductor to offload WALCB2 and HORCB5 to WHACB3.

5.10.1.8. LV Network Upgrade and Optimisation

To date 246 data loggers were installed as part of the LV monitoring program. The and design standard is to install data loggers on new transformers 200kVA and above.

Data from the loggers indicate that some distribution transformers and associated LV circuits are highly loaded and upgrading should take place. This project is for the replacement of three identified overloaded distribution transformers and LV circuits in the current financial year while a further three transformers and LV circuits will be upgraded in subsequent years.

This project also provides for the replacement of old and unreliable LV maximum demand indicators with new data loggers. These will be placed at various locations with selection based on known loading or service issues. The number of loggers to be installed is 45 for this financial year and 45 units for succeeding two financial years to cover all the CBD transformers. These loggers will make significant amounts of additional data available for proactive management of the network and maintenance of service standards.

New load applications are being assessed to network capacity. If necessary network upgrade will be implemented. This is to make sure new connections will not contribute to transformer overloading or low voltage problems.

5.10.1.9. Load Control and Advanced Infrastructure

Relocate Ripple Plant from Hamilton GXP to Weavers

A spare static 33kV ripple plant located at Hamilton GXP has been moved to Weavers zone substation located in the northern area of the network. This move will allow the existing 11kV 500Hz rotary ripple plants in the northern area to be removed as they are old and have become unreliable. The new ripple plant operates at 283Hz which will require all ripple relays in the northern area to be replaced.

The completion of this move would immediately allow for the transfer of Ngaruawahia substation to Huntly GXP as all relays at Ngaruawahia have already been upgraded to 283Hz. This is an important part of the necessary future load transfer from Hamilton to Te Kowhai and from Te Kowhai to Huntly in order to balance load between GXPs and avoid overloading during peak times.

A project started in 2011/12 to install Smart Boxes which have built in ripple relay functions. These functions include fast under frequency load shed capability which will enable WEL to include the northern network into the reserves market.

There are sites where the Smart Boxes will not be installed or will not provide for ripple control. 283 Hz relays removed from sites in the Hamilton and Raglan areas will be reprogrammed and installed at these sites. These relays will be installed as part of the Smart Box programme.

Photo 17 Smart Box relay prior to being installed on a pole

Reliability, Safety and Environment

5.10.1.10. Reliability Improvement Projects

In the past few years there has been a focus on improving reliability by:

- Automating 11kV air break switches
- Installing new reclosers
- Fusing 11kV spur lines

Strategic asset replacement/upgrades will be undertaken on the worst performing feeders to reduce repeated customer outages. The focus is on 16mm conductor, aging poles, crossarms and insulators on rural feeders such as Weavers and Te Uku.

Asset replacement projects will be compiled to maximize reliability at lowest cost. This is done through strategic analysis of feeders to assess asset age and condition in order to put together projects that have the greatest impact on reliability.

5.10.1.11. SCADA Communication Network

As substation and field protection, monitoring and control technologies have developed, there has been a need to increase the speed and capacity of data communications to and from these sites.

A study was undertaken in 2005 to determine the adequacy of the WEL communications network and to assess requirements and technologies for the future support of the network. As a result of the study a staged development was approved for the construction of an IP addressable communications network using data transfer technology based on ethernet physical media with both digital serial data and IP data superimposed on this media using TCP/IP data protocols, i.e. DNP3 over IP. The data over radio links and fibre optic cables is designed to support WEL's main operational VLANs carrying:

- SCADA- RTU VLAN
- Poletop Radio network
- Smart Metering Data Backhaul
- Network Management
- IED Engineering
- IT Business Devices & VOIP

The project over the last 6 years has progressed to provide the infrastructure for:

- IP communications to 43 of the 51 substations, GXPs, ripple plants and switching stations
- The installation of five new radio repeaters and refurbishment of two existing repeaters
- Installation of 35 radio links and 14 fibre optic links
- Installation of a low band serial point to multipoint poletop radio network

The IP communications network is designed to provide high availability and reliability and cater for expected growth in TCP/IP devices as well as supporting future smart grid initiatives.

The infrastructure provides a range of functionality for simultaneous data traffic, diverse communication routes, deterministic data transfer and consistent data traffic latency.

To provide for this range of functionality a system of VLANs was implemented. This was to allow for segregation of traffic types into virtual networks each with their own controlled capacity and co-existing on the same physical media. This was achieved by utilising layer two industrial IP switches relying on layer three routers to cater for the management of diverse communication routes.

With using a 10 year horizon the expected capacity for a substation with a converged TCP/IP network is 320k/ps. This is made up as follows:

- 64kb/s for protection devices
- 64kb/s for SCADA connected devices (SCADA & SEL communication processor)
- 128kb/s for 10 year expansion of IEDs
- 64kb/s for Substations with Smart Metering Access Points
- 32kb/s for VOIP

The use of TCP/IP for protection is not suitable due to the non-deterministic nature of the data transfer protocol, i.e. it is not possible to guarantee the delivery time of data packets. To overcome this, the TCP/IP network includes multiplexers to divide off capacity for dedicated serial protection services independent of the IP equipment.

As the network has developed and more fibre routes have been established, more opportunities have emerged for routed diverse backups than originally planned. An example of this is at the Hamilton GXP (which was originally designed as part of the radial radio network from the Te Uku repeater) now has fibre which could be used as part of an alternate route. To set up for dynamic routing a router would have to be set up and changes made to the setting on all other switches on the route. The fibre into HAM also goes on the provide comms to COB, STE and HOS.

Studies are underway to design changes in the routing schemes to provide higher levels of redundancy in the system. This would require the installation of more layer 3 routers in place of some of the present layer 2 IP switches.

The WEL IP communications network has been designed to allocate separate VLANs to the various types of traffic and functions. The allocation of Quality of Service (QOS) is based on the following priority order

1. SCADA- RTU VLAN
2. Pole Top Radio IP network
3. IT Business Devices & VOIP
4. Smart Metering Data Backhaul
5. Network Management
6. IED Engineering

Efforts have been made to safeguard against unauthorized access to the substations and there is encryption of data to protect against cyber attacks. A project is underway to provide a higher level of site security at the substations. Allowance has been made to carry out an extensive study of the best cyber security enhancement options for the control system communications network.

The allocation of bandwidth is based on a percentage of the total bandwidth of the comms path e.g. 1Mb/s for copper pilots, up to 8Mb/s for radio, up to 100Mb/s for fibre.

WEL has had a practice over many years of installing fibre optic cables along with the running of new 33kV sub transmission underground network cables. The earlier fibre cables were not installed in ducts and contained only 12 cores of single mode fibre. With the increased use of these fibres for

SCADA, protection signaling, internet and LAN connections and the need for diverse backup paths for protection signaling for the wind farm the number of cores available in the 12 core fibres was quickly depleted. Multiplexing technologies on the existing 12 core fibre cables has been used to allow for multiple uses of single pairs. The Multiplexors also allow for protection serial data to be transmitted over the same media, fibre or radio, without being affected by the non-deterministic IP traffic.

Multiplexors will be applied to the 12 core fibres at SAN, KEN and CRA to allow for the differential protection project.

The communications to substations and 11kV switching stations in the Hamilton central city area are presently provided by analogue Conitel protocol over ageing multi-core copper pilots. This technology has been appropriate for the predominantly electromechanical protection devices at these sites. The Conitel protocol is no longer common in new equipment and the medium and long term plan for these sites is to upgrade the RTUs and protection over the 12 year period to 2022. In the latest plan these have been bought forward to be completed in a shorter time frame. To speed up the phasing out of the Conitel communications protocol, the communication to these sites will be upgraded to IP firstly over the copper pilot network using DSL technologies, and as more fibre becomes available as city network cables are upgraded, fibre optic will be run to increase the bandwidth capability to these sites. This work is funded to be completed by the end of 2015.

WEL has 140 remote pole top sites on the network which were SCADA controlled from the old WEL House in London St and via various repeater sites. With the progression of the network automation program over several years these channels became overloaded. This overloading caused a slowdown in critical control and monitoring communications to the state where a signal may have taken over a minute to be processed and acknowledged by the system.

A project is almost completed to install 8 new pole top base channels at existing repeater sites using 4RF Aprisa SR 12.5kHz radios operating in the 420 - 450MHz range. These channels are set up in the point to multipoint mode using one radio spectrum license for each channel. The radios are designed to operate serial communications as well as providing 2x Ethernet IP ports which will allow us to migrate to IP comms in the future with the advantage of no degradation in service through increased usage.

The future trend for the pole top network on the ten year horizon is for the RTUs to evolve to IP based devices, however with the small amount of data transported to and from each pole top RTU, the short to medium term plan is for low bandwidth digital communications to remain as the primary method for small or remote communications.

The pole top network utilises the main bearer links between major communications sites to link the digital network and to integrate the pole top back to back repeaters within the overall telecommunications network. The capacity catered for by the digital pole top channels over the next 5 years is 4800Bb. Eventually we see this system aligned or integrated with the WELconnect mesh communications.

Although the height and location of the old WEL building in London Street is ideal for line of site radio communications to the east, south and central city areas as well as connection to the copper pilot network, the long term plan is to reduce the reliance on WEL House London Street as a major communication node. One stage of this process is to move the main substation and pole top radio channels out to the communications nodes at the major repeater sites. This stage will be mostly completed by the end of the 2014 year. As WEL still has some serial communications links out of WEL House it will mean that the downgrading of the building as a major communications site will take some time to complete. Examples of these are Silverdale and University switching stations. The reliance on Conitel protocol over copper pilot cables in the majority of City switching stations will stay until the end of 2015 as the IP conversions at these sites are programmed as identified in the Asset Replacement section of this Plan.

Network based data communications from WEL Maui Street office are served by utilizing 6 cores of a 12 core fibre optic cable which runs from Tasman to Pukete substations and other parts of the communications network. The SCADA Wide Area Network (WAN) uses 2 cores of this fibre.

This WAN is backed up by a lower baud rate radio link via Te Uku and Te Puroa radio repeaters. Serial based protection signaling between substations is also multiplexed over these fibres. Two of the other 4 cores of this fibre cable are used for the WAN extension for communications served out of London Street comms hub and the other two are used for the SCADA and Corporate LAN extensions between the Maui St office and the DR site. The office internet connection also uses these fibres to connect into the Velocity fibre network; this will soon be taken over by UFF services.

Because the backup radio network lacks sufficient bandwidth for the SCADA and office LANs these services can only be backed up by alternative fibre connections. There is an alternative (backup) fibre circuit, leased from Velocity, between Tasman substation and London St. An alternative (backup) link, owned by WEL, between Maui St and Avalon substation via Pukete and Te Kowhai requires physical patching and disconnection of other services to achieve. The most vulnerable risk for LAN communications is the fibre between Maui St and Tasman substation.

There is a project planned (PDD 538003) for the installation of an 11kV feeder cable and a 96 core fibre cable from Tasman substation to a site in Te Rapa. It is proposed that the fibre is extended the extra 900 metres to Maui Street office to provide a more secure backup fibre link between Maui and Tasman.

There is a general philosophy in WEL to provide alternative means of communications to main bearers and substations on the network, particularly where the comms is used for protection signaling. This is achieved on those points fed by single radio or fibre routes that fibre is installed on a diverse path to act as a backup with routers used to automatically change paths in case of failure.

One opportunity to achieve this is by installing fibre optic ducts whenever the ground is opened or drilled to install electricity cables consideration is given to the installation of ducts at the same time. This policy put in to place over the years has worked well with many complete paths and fibre installed. It has also meant that there are sections of duct which go part way between destinations. It is proposed that the gaps be filled by projects based on timing requirements for the protection upgrade project and the requirement for redundant paths. There are projects planned in the AMP where cable work is planned and it is proposed to take advantage of these when filling these gaps.

The most important and urgent of these is around the leased Velocity circuits which WEL does not control or backup.

Install a WEL owned fibre between the WEL London Street site and Claudelands substation, and another from Claudelands to Transpower Hamilton Substation to gain better security over the fibre circuits leased from Velocity. These sites are presently served by 2 core leased fibres which WEL does not have a high level of security over and no backup. This proposal is to install WEL owned fibre as the main communications route and Velocity fibre as the backup.

Install WEL owned fibre from WEL London Street site to Bryce substation and another from Bryce to Kent substation to get better security over the Velocity Leased Fibre Circuits and copper pilots. Kent is presently served by 2 core Velocity leased fibres from WEL London St and Bryce is on part of the old copper pilot network. This proposal is to install WEL owned fibre as the main communications route and Velocity fibre as the backup. KEN – BRY - WEL

Other links are

PUK – SAN

CHA- BOR

HAM – SIL

PUK - HOR

BOR – PUK

HAM – CRO – CHA

HOR – NGA

Some parts of these projects may be superseded by other cable work between sites which may reduce the costs.

The following communications network projects are planned over the next 10 years:

- Multiplexors will be applied to the 12 core fibres at SAN, KEN and CRA to allow for the planned differential protection project
- Install IP phones using VOIP at all substations
- Continuation of the Pole Top Radio upgrade project by conversion of remaining Conitel pole top sites. This work includes replacement of the old Conitel RTUs and installation of 4RF Aprisa SR Radios.
- Complete fibre circuit to BRY using Velocity network/ducts. New ducts to be laid over the Tristram Street rail bridge. This work involves 130m of fibre and duct drilled from BRY to Velocity duct then in duct to connection point to Velocity Dark Fibre
- Install Routers for HAM Fibre LAN. This work includes a new router at HAM and Avalon Substations
- Install a Router at Te Kauwhata substation to allow for the use of the fibre cable connection between TEK and Huntly to be used a backup for the Taupiri to Te Kauwhata radio link.
- Install a Router at Springhill repeater along with a new point to point radio link between Otorohaea and Springhill repeaters to act as backups to Taupiri Repeater to the north.
- Complete the fibre circuits from HOS to LAT using ducts between LAT and Allison Street laid last year and install new ducts from Allison Street to HOS.
- Run new fibre link from Steel Park switching station to Hamilton Gardens pavilion building and install a microwave link across river to Peacockes Substation to allow for protection circuits and backup communications to PEA, AIR, HOS and, COB. This work includes STE to Hamilton Gardens duct and fibre of 2km plus Microwave link over river to PEA. Alternatives to this are also being considered.
- Install a fibre optic cable link between Claudelands substation and Steel Park switching station when the new 11kV trunk circuit is run in 2013/14 year. This will allow for backup to Claudelands.

- Routers and IP Switches for City Fibre LAN.
- Communications required to cater for the 33kV Protection Upgrade from distance protection to differential protection.
- Conversion of the remaining city based copper pilot connected switching stations to I/P There are 10 switching stations left to convert. They are CIV, RUR, BAR, WHI, PCH, ALE, MAS, ANG, STE and FLD. The work involves fitting wall mounted comms panels and I/P switches with copper interfaces. These have been catered for in the Asset Replacement Programme identified in the 12 year asset replacement budget.
- Replacement of the existing copper communications pilots will be catered for as various trunk cables are upgraded through the city. An allowance should be made in these projects to install fibre at the same time as the cables are replaced.
- UFF is installing fibre reticulation around the city and will migrate Velocity customers on to this new network. Negotiations have started to allow WEL Networks communication network to utilise the redundant Velocity fibre and/or ducts for SCADA comms purposes around the city
- Install a WEL owned fibre between the WEL, CLA, HAM to gain better security over the Fibre Circuits leased from Velocity. These sites are presently served by 2 core leased fibres which WEL does not have a high level of security over and no backup. This proposal is to install WEL owned fibre as the main communications route and Velocity fibre as the backup
- Install WEL owned fibre from WEL, BRY, KEN to get better security over the Velocity Leased Fibre Circuits and copper pilots. KEN is presently served by 2 core Velocity leased fibres from WEL and BRY is on part of the old copper pilot network. This proposal is to install WEL owned fibre as the main communications route and Velocity fibre as the backup
- Pukete to Sandwich substation fibre Links. Run a new UG fibre cable from Sandwich substation to Pukete substation
- BOR-PUK via RMZ900 - Resolution-Discovery- TeHuia. Cable and duct already installed TeHuia - Pukete Rd by sewage plant. Pukete Rd - PUK
- CHA- BOR via Z900 BOR to RMZ900 already installed. This may be superseded by a planned 33kV cable link between CHA – BOR some time.
- HAM – SIL. Silverdale was built in a valley with poor radio reception. This may be superseded by an 11kV trunk feed between planned Hoeka substation and Silverdale.
- HAM - CHA Fibre ducting and cabling allowed for in Crosby Project 2018/19. Crosby to CHA allowed for in CHA 3rd TX project 2020/21 1
- PUK to HOR already UG with duct for Northgate UG

Mitigation of line clashing near zone substations

Overhead lines near zone substations are more liable to clash under fault conditions, as a result of rising fault levels. This project provides for further work around the Peacockes, Whatawhata and Raglan zone substations. Mitigation work will entail a combination of correcting line tensions, conversion to delta configuration, installation of inter-span spacers, installation of wider cross-arms and re-conductoring as required. Conductor and crossarms in poor condition will be replaced.

Installation of Arc Flash protection on existing switchboards

Hazards from Arc Flash incidents have always existed to a greater or lesser extent but have recently gained additional prominence because of EEA's involvement. EEA have recently decreed that Arc Flash must be classified as a significant hazard under the Health and Safety Act and must be addressed according to the hierarchy of the Act, i.e.

Eliminated, or

If it cannot be eliminated, then isolated, or

If it cannot be isolated, then minimised and PPR gear provided

Legislative requirements are that an assessment of all assets shall be completed no later than 31/12/2013. For metal clad switchgear this has already been completed. This has identified that there are 3 33kV switchboards and 25 11kV switchboards where the Arc Flash levels exceed the allowable limits. (Switchboards purchased in recent years are all Arc Flash proof.) It is planned to eliminate or reduce the Arc Flash hazards to acceptable levels by fitting Arc Flash protection relays. In addition, in a number of cases where this is possible, existing front panel doors will replaced by Arc Proof doors. The upgrading is planned to be completed by the end of the 2013 financial year.

Power Quality - works required to correct customer complaints

WEL investigates power quality issues raised by customer complaints and enquiries. Power quality issues include:

- Low or excessive voltage
- Harmonic interference
- Electrical noise
- Audible noise
- Stray voltage
- Power factor

Investigations into supply quality issues are logged, investigated, corrected, recorded and reported to management on a monthly basis.

Seismic strengthening Bryce Street, Glasgow Rd and old Avalon 11kV substation buildings

The Bryce Street substation, Glasgow Rd substation and the old Avalon 11kV switch room buildings were identified as needing strengthening work to meet current seismic strength regulations.

This Bryce St work was completed in the 2012-13 year.

At Glasgow Rd, the work involves the installation of steel framing to the interior of the buildings to provide the required structural strength.

The work on the Avalon substation building involves the installation of minor steel reinforcing braces to existing steel beams and the removal of some large windows.

The Glasgow and Avalon work is scheduled for the 2012-13 financial year.

Customer Connections

Annually around 900 new residential sections and 240 new infill connections are required to be reticulated to meet customer demand. Additionally, around 3MVA of commercial capacity is connected annually. This often requires network augmentation. A significant investment is made annually to provide for these new developments.

Asset Relocation

Relocation

Demand is driven by a number of council road realignment and relocation projects.

Information on future work volume is provided by the Waikato District and Hamilton City councils. These indicate that the level of road realignment and relocation requirements will continue, in future supported by the WEL Energy Trust commitment to part fund selected uneconomic undergrounding work.

Uneconomic Undergrounding Projects

Typical undergrounding projects fall into two categories, either overhead to underground conversions or asset relocations. WEL receives numerous requests each year from other parties to either relocate overhead lines, cables or equipment, or to convert existing overhead lines to underground cables. These third parties include Transit NZ, Hamilton CC, Waikato DC, Waipa DC, subdivision developers, and private landowners.

Requests from roading authorities are usually for construction of a new road or alteration to an existing road as described above in relocation. Developers and landowners request relocation or undergrounding in order to clear a site for development or construction of buildings, or to improve the aesthetics of the area. This is a requirement under local planning criteria.

WEL does not have its own undergrounding or relocation program. The uneconomic undergrounding programme is partially supported by the WEL Energy Trust commitment and requester’s contribution.

5.11 Projects Under Investigation for Short and Medium Term Consideration

An updated analysis of Grid Exit Point (GXP) capacities to provide a secure supply for the Hamilton area shows that a need for an additional GXP or upgraded GXP capacity will arise as early as 2015. WEL intends to defer the proposed GXP investment as long as possible, and seeks to develop a regional solution with Transpower and possibly with neighbouring lines companies. The following stages and projects are under investigation, subject to optimisation and integration into a least cost regional solution. A total investment of $40M has been included in the plan.

Stage 1: Hamilton 33kV Outdoor to Indoor Conversion Project is complete

Stage 2: HAM 33kV GXP Changes

The loading of the Hamilton 33kV GXP has exceeded the constrained limit for secure operation. In addition, HAM11kV GXP has a 30 degree phase shift does not allow for load to be transferred to adjacent networks without the loss of supply to customers. HAM11 load is projected to exceed the constrained limit by 2016. Under investigation is the addition of a third 120MVA transformer to provide additional capacity and security to mitigate post contingency limit and to incorporate the HAM11kV loads to mitigate the phase shift issue, cater for the projected load growth and allows for the transfer of the HAM 11kV loads to an alternate supply in the event of a major contingency. Transpower has installed a new 120MVA transformer to replace an old 100MVA transformer and plans to replace the other 100MVA transformer. These developments are Transpower's activities together with the addition of a third 120MVA transformer.

Stage 3: Hoeka Rd and Ruakura Zone Substation

As well as a 30 degree phase shift with other 11kV networks. HAM 11 also operates with highly loaded feeders and high customer numbers per feeder. In addition, loss of the 11kV bus under contingency cannot be served by other zones. Two new zone substations are proposed.

Refer to Section 5.10.1.2

Stage 4: Puketaha / Crosby Zone Land and Substation

Puketaha / Crosby Road is a strategic point for network connection of 33kV sub-transmission circuits, zone transformer feeders and a possible future northern GXP development. As such it is planned to develop a 33kV switching station initially as a transfer point and protection segregation hub. Additional capacity for zone transformer connection as load in the area demands is planned for this point or consideration of a 3rd transformer at Chartwell.

Te Kowhai – Hamilton Transfer Capacity Enhancement

Under the 2010 planning studies it has been identified that the security across the two Hamilton GXPs is inadequate particularly under contingent events. To overcome this insecurity it is planned to enhance the transfer capacity across the two GXPs by increasing the sub-transmission capacity and installing switching stations to achieve flexibility in switching. Further studies are in progress to enable a final decision to be made.

Load Growth Te Rapa / Rotokauri

Council plans have indicated an increase in residential, commercial and industrial activities in the Te Rapa and Rotokauri areas. Tasman and Avalon zone substations do not have the capacity to service the load growth in the area. A third transformer in Tasman is planned in order to service immediate and future load growth.

Tasman to Avalon Cabling

The meshing of the sub-transmission network between Tasman and Avalon is under investigation for load growth and security. This can be achieved by installing a circuit between Tasman and Avalon.

Latham to Avalon Cabling

The meshing of the sub-transmission network between Latham and Avalon is under investigation for load growth and security. This can be achieved by installing a circuit between Latham and Avalon.

Te Kowhai to Avalon Cabling

The meshing of the sub-transmission network between Te Kowhai and Avalon is under investigation for load growth and security. This can be achieved by installing circuits between Te Kowhai and Avalon.

Sub-transmission Reinforcement

Load flow studies have identified various sections of the sub-transmission networks as constraining. These sections are to be upgraded to ensure continuity and security of supply. They are under consideration of overall optimisation of sub-transmission networks.

- Wallace to Latham
- Latham to Peacockes
- Hamilton to Peacockes

The last few years have seen consistent and significant growth. As a result, WEL's focus continues to be on development projects around GXPs, sub-transmission, zone substations and switching stations to ensure robustness, security, reliability, growth and specific customer needs. With the exception of the Hamilton GXP's capacity improvements these issues have been largely addressed and the next levels of assets are being considered for development.

5.12 Ongoing Projects Under Investigation

A number of projects continue to be planned and are under investigation for ongoing consideration. These projects are categorised as:

- Low voltage cable augmentation for high load growth areas
- High voltage cable augmentation for high load growth areas
- High voltage cabling links for zone interconnection

- High load zone and feeder balancing
- Reliability improvements
- Potential safety and compliance issues
- Customer driven specific projects
- Line upgrades for capacity and security improvement
- Distributed generation opportunities

Photo 18 Live Line Replacement of HV Insulators 2012

5.13 **Capital** Expenditure Projections

Table 13 and Figure 67 below show the Capital Expenditure Projection for the AMP period, including current year forecasting.

Capital Expenditure	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**	**17/18**	**18/19**	**19/20**	**20/21**	**21/22**	**22/23**
Customer Connection	8,197	8,155	6,957	6,957	7,207	7,157	6,657	6,400	6,400	6,400	6,400
System Growth	10,906	24,826	25,676	12,009	21,420	17,590	12,327	9,787	10,264	4,325	3,978
Reliability, Safety and Environment	3,685	4,819	1,487	1,500	1,794	1,335	1,483	1,292	1,259	1,050	993
Asset Replacement and Renewal	8,465	12,404	11,431	11,435	11,550	10,835	12,740	10,320	10,900	9,793	8,630
Asset Relocations	3,685	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600
Total Capital Expenditure	**34,939**	**52,804**	**48,151**	**34,500**	**44,570**	**39,517**	**35,806**	**30,399**	**31,423**	**24,168**	**22,601**

Table 13 Capital Expenditure Projection for AMP period

*Note 1: Asset Replacement includes capitalised maintenance

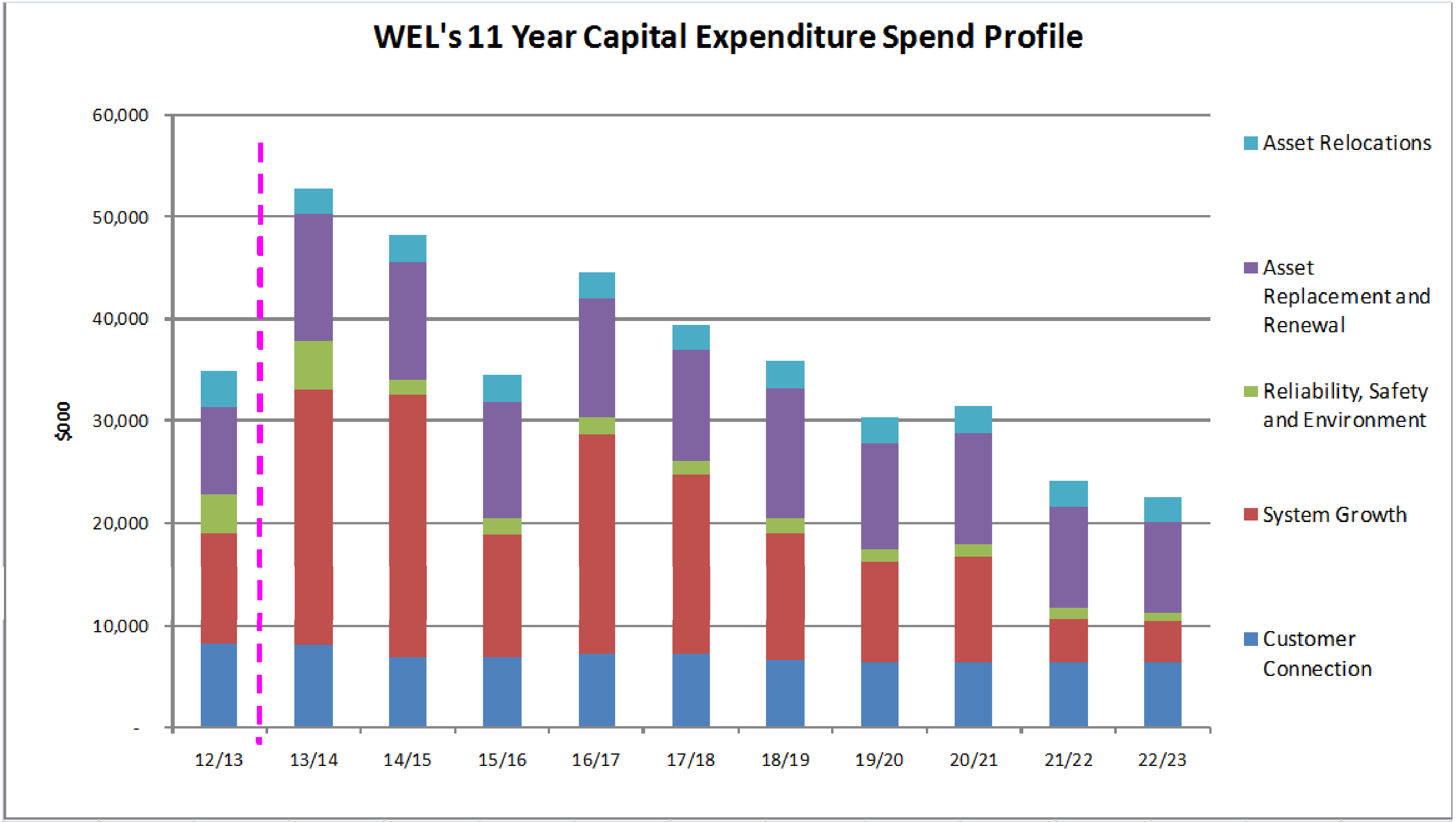


Figure 67. Capital Expenditure Projection for AMP period

6. LIFE-CYCLE ASSET MANAGEMENT PLANNING

6.1. Maintenance Planning Criteria

Drivers and Strategy

At WEL, maintenance is applied as a technique to address risk (reliability, financial, safety etc). (The risk management process is addressed in Section 8)

The following asset maintenance drivers are applied:

- Ensure continued safe operation to address the safety of the consumers, the public and the field staff
- Improve present network reliability. The main maintenance focus being on total outage numbers and number of repeat outages for customer classes
- Ensure cost effective maintenance
- Minimise asset life-cycle costs through optimal planning, design, operation and maintenance, renewal and replacement

Several maintenance strategy options have been adopted, each applied in accordance with the drivers above.

- **Preventative Maintenance *(scheduled)***

  Periodic maintenance where maintenance occurs at a frequency dependent on manufacturer's recommendations or company experience

- **Predictive Maintenance *(condition based)***

  Maintenance is determined by inspections and condition monitoring techniques. This identifies immediate defects and also allows candidates to be identified for replacement programs

- **Reliability Centred Maintenance *(RCM)***

  Maintenance taking into account plant performance, failure modes and function rather than the asset itself

- **Reactive Maintenance *(fix when failed)***

  Do nothing until failure occurs *(with identified limitations)*

  The management and operation of a distribution network requires that failure of assets in service be minimised. In this case, "operate until it fails" strategy is applied to assets where the consequences of failure are not major and where costs of ongoing condition-based regimes outweigh the costs of possible failures. WEL has identified that "run to failure" should not be applicable for assets that:

  - are critical to secure bulk power to customers,
  - have potential safety and environmental consequences on failure, and
  - have long repair or replacement times

Other techniques employed to achieve world class maintenance practice include Condition Based Risk Management (CBRM), Root Cause Analysis (RCA) and Failure Mode Effects and Criticality Analysis (FMECA).

An optimal balance between the above options is required and this depends on the type of asset, its condition and the consequence of failure.

Optimisation Process

WEL selects the type and level of maintenance which results in minimal overall costs, this being the point where the sum of the maintenance costs and the risk of failure costs are at a minimum while achieving the desired level of network performance.

A formal Maintenance Optimisation process has been developed, as shown below.

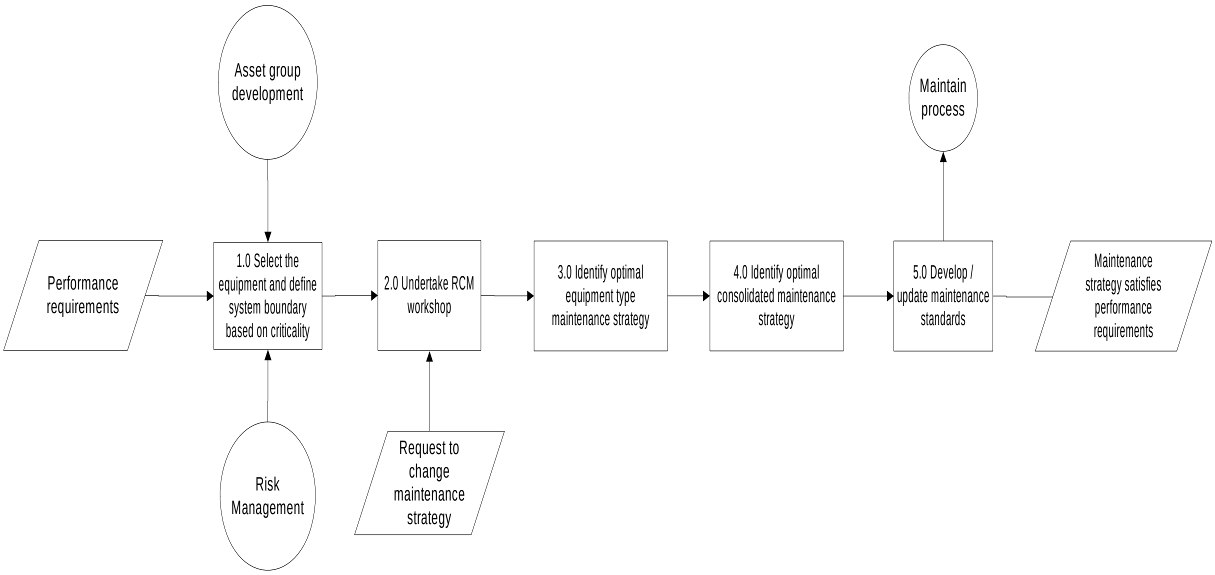


Figure 68. Maintenance Optimisation Process

In addition WEL has implemented a Computerised Maintenance Management System (CMMS) through SAP. This software combined with the formal optimisation process, described above, aims to deliver a maintenance process which is more efficient and effective. Features of CMMS include:

- List of network equipment
- Criticality assessment of equipment and location
- List of maintenance tasks and inspections that reflect the maintenance strategy for that class of equipment
- History of work performed and costs incurred against equipment
- History of condition assessments obtained from maintenance tasks and inspections
- History of “failures” on a particular asset
- Overall condition of the asset (SAP-coded) based from the maintenance tasks and inspections

6.2. Maintenance Programme and Expenditure by Asset Category Projections

Programme

For a description of the maintenance programme for each asset category refer to Section 3.3.

Expenditure Projections

Maintenance spend increases and then is expected to remain relatively flat over the reporting period. The main drivers are:

- A significant part of the capital spend in the last few years has been for additional assets. The creation of additional assets will result in an increase in the total amount of maintenance required. The new wind farm related assets (a switching station, new Raglan zone substation and 33kV circuits) and a newly upgraded zone substation (Te Kauwhata 33kV Indoor GIS) have been added. Provision was also made in the 2012/13 year for maintenance costs associated with the planned rollout of smart meters
- Routine inspections are still needed, even on new equipment
- Increasing demand for the gathering of network data and asset data validation

The next 10 years' total network maintenance expenditure projection including the current year is summarised in Table 14.

2013 AMP WEL's 11 Year Maintenance Expenditure Spend Profile ($000)											
Maintenance	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**	**17/18**	**18/19**	**19/20**	**20/21**	**21/22**	**22/23**
Faults	2,664	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Distribution Lines	2,134	2,548	2,548	2,548	2,548	2,548	2,548	2,548	2,548	2,548	2,548
Vegetation Management	1,150	1,431	1,270	1,270	1,270	1,270	1,150	1,150	1,150	1,150	1,150
Zone Substations	633	780	779	779	779	779	779	779	779	779	779
SCADA (COMMS)	93	119	119	119	119	119	200	200	200	200	200
Faults External Subdivision	35	40	40	40	40	40	40	40	40	40	40
Project Driven Maintenance Expenditure	235	283	270	270	270	270	270	270	270	270	270
Wind Farm Line Maintenance	12	35	51	51	51	51	51	51	51	51	51
Smart Meter Maintenance	10	25	50	60	100	100	100	100	100	180	180
Total	**6,965**	**7,662**	**7,527**	**7,537**	**7,577**	**7,577**	**7,538**	**7,538**	**7,538**	**7,618**	**7,618**

Table 14 Maintenance Expenditure Projection for AMP Period ($000)

Assumptions for the maintenance expenditure profile are provided below.

Faults

It is assumed that the level of fault activity will remain fairly steady. The number of fault jobs per period has tracked quite consistently over the last few years. Approximately 2/3 of fault costs are incurred on the LV network and are of a low cost/high volume nature with more than 90% being less than $500. However, costs have increased due to higher levels of traffic management required and more frequent use of generators to improve customer satisfaction.

Description	% Number Jobs	% Cost
HV Lines	13%	28%
HV Cables	0%	0%
LV Lines	70%	62%
LV Cables	0%	1%
Poles and crossarms	1%	2%
Others	16%	7%
Total	**100%**	**100%**

Table 15 Approx 71% of maintenance fault costs relate to LV problems.

Relocation Related Maintenance Work

This category relates to the situation where additional maintenance is carried out where an existing asset is moved to a new location. It is assumed that this need will continue at the current level of activity, and is mainly customer driven.

SCADA and External Subdivision Faults

The spend has increased significantly because of a greater emphasis on planned maintenance. Offsetting this is an expectation that the number of externally owned subdivisions will reduce over time.

Vegetation

The expenditure in this area has historically been below optimum. Bringing the vegetation work in-house and the application of better systems and equipment has improved efficiency. It is expected that more trees will be able to be cut with the same amount of money. However, further analysis of the quantity of high priority (P1) sites indicates that these sites are not reducing as expected (see below graph). Additional budget is therefore required to ensure a downward trend.

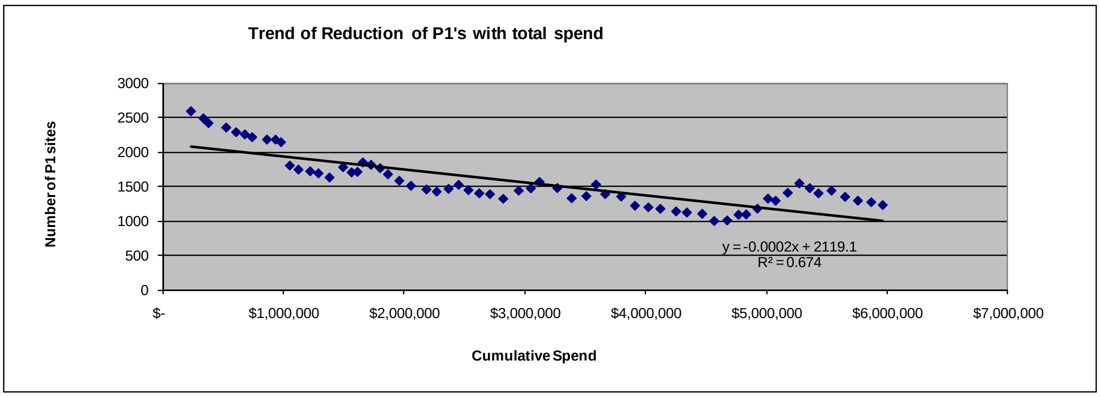


Table 16 Trend of Reduction of P1s with total spend

Photo 19 Vegetation removal by WEL crew

Zone Substations

The trend is expected to remain relatively flat once the identified zone substations that have been built or upgraded. There are variations in costs from year to year as major corrective works such as building maintenance or zone transformer refurbishment becomes due.

Ring Main Units

Oil filled ring main units (RMUs) are gradually being replaced with low maintenance alternatives. A two year project was initiated in November 2008 to inspect and service all oil filled units and to ensure correct alignment and operation of the switchers. A higher priority has been given to older units and those susceptible to contact misalignment. The project has now been completed and RMUs will now be inspected every four years with full maintenance carried out on the oil type RMUs on an eight year cycle.

Distribution Maintenance

This spend covers all non substation assets and primarily covers preventative maintenance, inspections, condition assessments and corrective maintenance. Provision is also made for costs related to the gathering of asset related data, investigations and changes to network configuration and protection. It is anticipated that the overall spend will reduce slightly due to results from better inspection data which has enabled an understanding of the contingency funds required for remedial work.

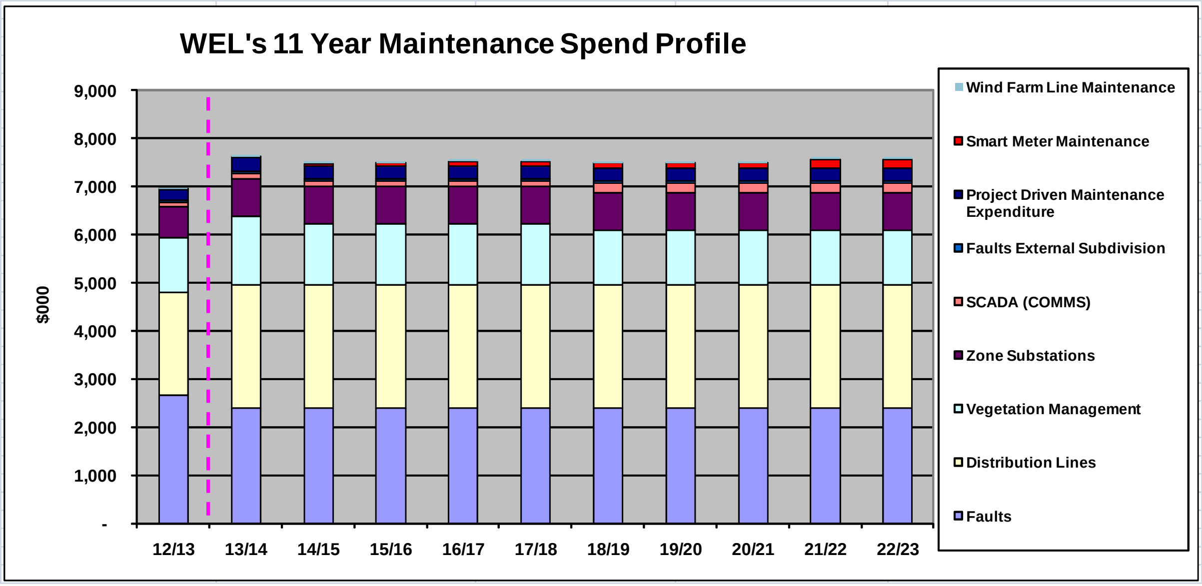


Figure 69. Maintenance Expenditure Projection for AMP period including current year forecasting

6.3. Asset Renewal Policy

Network assets have a finite life. To ensure assets provide an acceptable level of service throughout their life system assets must be renewed over the course of time. Renewal expenditure makes up about 30% of WEL's overall capital expenditure programme.

An asset renewal plan has been developed to ensure assets maintain acceptable performance throughout their life and to ensure optimal return for the investment in the asset. This plan provides decision points for replacement or refurbishment of each class of asset.

Some network assets such as overhead lines or zone substations are comprised of separately identifiable items. Restoring such composite assets to an acceptable condition often requires only replacement of some components rather than replacement of the whole asset (for example crossarms vs. poles). The extent of the replacement work is determined from regular condition assessments.

Asset replacement involves replacement of the whole of the asset, which has reached or exceeded its reasonable service life. In the WEL model assets are itemised as identifiable items hence all expenditure on assets is considered to be replacement, rather than refurbishment. The exception to this is zone transformers and switchgear, where refurbishment does take place.

Refurbishment will extend the life of assets at a substantially lower cost than replacement. For example, new zone transformers are considered to have an economic life of 45 years. However, mid-life refurbishment at a cost of less than 10% of replacement will extend the life by over 30% to 60 years.

WEL's strategies and focus for cost effective asset renewal are:

- Asset replacement requirements by age
- Asset replacement requirements by condition
- Potential risk to the reliability and security of the network of alternative replacement scenarios

- The various technical drivers for asset replacement
- An existing asset database which provides age profiles
- Condition assessment and monitoring of critical asset types which provides fault/failure data
- A policy which defines standard engineering lives and economic working lives of assets
- Comparison of long-term operating costs (maintenance, spares holdings, system losses) against capital cost of replacement
- Assessment of the expected contribution to improvement in network performance
- Resource and financial ceilings and desirability of smoothing resource requirements and expenditure on a year on year basis

The decision to undertake to renew an asset is based on age plus the following factors:

- Performance requirements
- Asset condition monitoring
- Level of refurbishment, maintenance and operating costs
- Historical failure statistics
- A risk assessment associated with deferring asset replacement expenditure
- The economic cost/benefit of continued repair versus the cost of replacement

The methodology employed for forecasting future capital resource requirements for the replacement of system assets relies on:

- The age profiles for the various types of assets in the network
- An estimation of the remaining service life of the assets from expected economic working life or standard engineering life
- The modern replacement cost of assets
- Condition assessment data

A forecasting model has been populated with existing asset classes, quantities and age profiles to arrive at an estimate of the spend profile.

A "Risk Limit" is introduced to mitigate the risk of all assets in an asset category reaching the end of their life at the same time; use of the "Risk Limit" factor also avoids over-investment in an asset category.

The benefits of the asset replacement approach described in this Plan are that it:

- Provides a consistent, long-term asset replacement strategy which allows real investment requirements to be forecast
- Results in a reduction in volatility of the total resource (financial and manpower) requirements year on year
- Reduces risk of assets failing by avoiding the position where large quantities of assets reach the end of their expected life over a short period of time

6.4. Asset Renewal Programme, Inspections and Maintenance Plan

The age profiles of the asset classes are shown in 3.3. The age profiles have been updated as a result of a major effort to improve asset data in preparation for entry into the financial asset register. The age profiles adjusted by survey derived condition information drive the asset renewal programme. Other smoothing has been made to reflect funding constraints and the timing of major projects.

Table 17 and Figure 70 summarises the total expenditure by Asset Category.

For many asset classes comprising smaller discrete assets (e.g. poles, crossarms, 11kV overhead switches, ring main units, distribution transformers and 11kV EDOs) the renewal programmes consist of ongoing replacements indicated by the spend profile below. Lists of specific assets are accumulated and assigned to specific future years as identified from inspection and condition assessment activities.

For more substantial assets (such as switchgear and power transformers) renewal projects are planned and these are also discussed below. The time frames for these projects are indicated in the sections below.

WEL's 11 Year Asset Renewal Capital Projection ($000)

Asset replacement Category ($000)	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
11kV Circuit Breaker (Upgrade)	-	250	-	300	-	-	-	-	300	150	-
11kV Ring Main unit	500	500	500	400	400	400	400	300	300	500	500
11kV Switching Station/Zone Sub	119	200	60	200	500	75	200	150	300	150	150
11kV Air Break Switch	260	400	700	700	800	800	800	500	300	300	300
11kV Reclosers and Sectionalisers	41	85	85	85	-	-	-	-	30	30	60
33kV Circuit Breaker	-	1,445	246	-	-	-	-	-	-	-	
33kV Overhead Lines	-	-	-	-	-	-	-	-	-	-	
33kV Sub-transmission UG cable	-	-	-	-	-	-	-	-	-	-	
Distribution 11kV OH Lines	507	1,316	1,500	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450
Distribution 11kV UG cables	75	-	-	-	-	-	-	-	-	-	-
Protection Relays	100	500	300	200	350	200	200	250	250	100	110
Poles-	1,149	1,100	1,100	900	800	800	500	500	500	400	400
Crossarms	1,100	1,100	1,200	1,400	1,400	1,400	1,400	1,400	1,800	1,500	1,000
Distribution Transformers(11kV/400V)	500	700	1,000	1,400	1,500	1,500	1,500	1,500	1,500	1,003	500
Fuse 11kV	200	200	200	100	100	100	100	100	50	50	50
LV Overhead Reticulation	48	-	-	-	-	-	-	-	-	-	-
LV Underground cables	23	-	-	-	-	-	-	-	-	-	-
SCADA & Comms	24	558	450	210	160	100	380	160	100	160	110
Zone Substation Transformer	-	-	-	-	-		1,800		-	-	
Service and Dist Pillars	350	450	480	480	480	400	400	400	400	400	400
Capitalised faults	1,636	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Unplanned Maintenance	1,383	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Medium mixed projects	450	800	810	810	810	810	810	810	820	800	800
Total	**8,465**	**12,404**	**11,431**	**11,435**	**11,550**	**10,835**	**12,740**	**10,320**	**10,900**	**9,793**	**8,630**

Table 17 Asset Renewal Expenditure Projection by Asset Category for the AMP Period

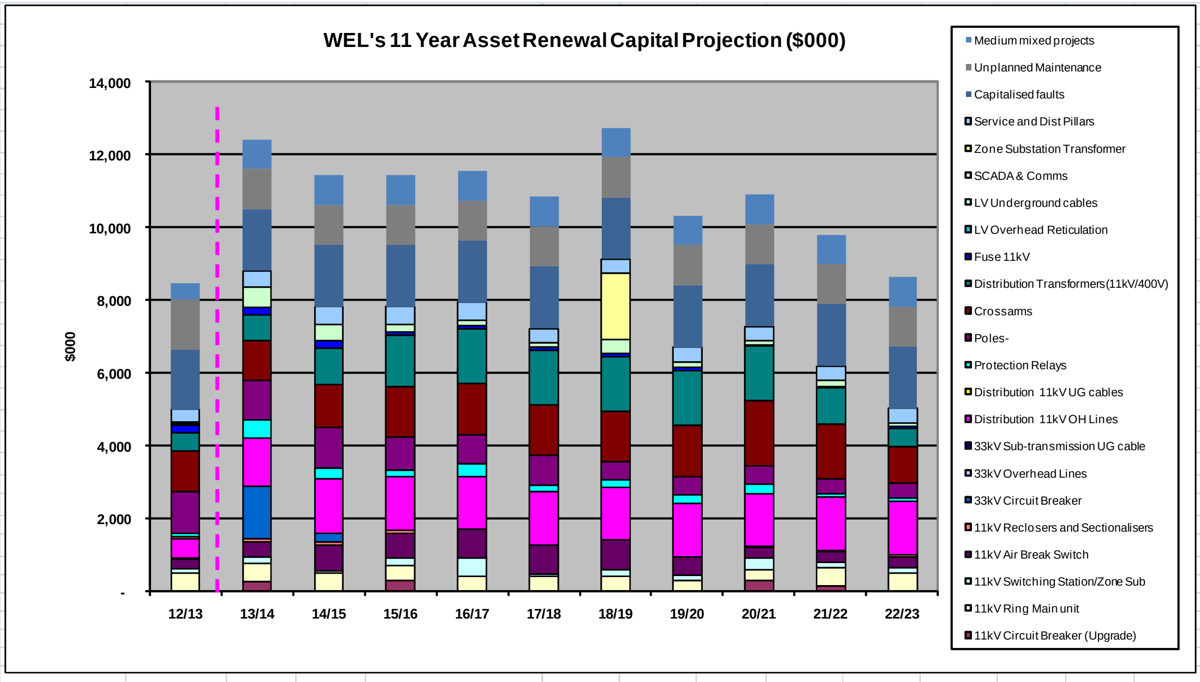


Figure 70. Asset Renewal Expenditure Projection by Asset Category for AMP Period

The above presentation includes provision for capital fault asset replacement and urgent replacement based on the likelihood of imminent failure. It also includes a category for provision of medium sized projects where a group of assets are replaced at the same time and not necessarily replaced with the same asset type. An example of this would be undergrounding of a cluster of wooden poles around an intersection.

The above projections are generally based on standard replacement costs. One exception is the replacement of wooden poles. These remaining poles are typically in complex or difficult situations so their replacement costs are expected to be significantly higher than a standard situation. Contingency amounts may be requested where there are significant additional costs identified such as unusual access difficulties, major traffic management or when significant temporary generation during changeover of the asset is required.

Asset renewal and replacement for critical assets such as circuit breakers and zone transformers were driven by the age profile and condition monitoring regimes which focuses on the asset's reliability (risks).

33kV Sub-Transmission Underground Cables

The older 33kV cable circuits are the paper insulated solid type. All gas insulated cables have been removed from service.

33kV circuits which are part of WEL's 33kV mesh/ring were identified. Selected critical circuits will be subjected to partial discharge testing with the routine frequency specified on the maintenance plan.

33kV Overhead Lines

Existing lines through residential areas are being under-grounded as city development takes place. For new (rural) construction and reconstruction work, conductor sizes have been rationalised and butterfly is now the standard. Crossarms are usually replaced and the construction configuration changed to delta if this is cost effective to do at the same time.

Maintenance takes cognisance of the meshed nature of the 33kV system. That is, some maintenance is reduced because of the built in redundancy. For example bird-be-gone is no longer replaced on mesh circuits.

The maintenance programme includes an annual drive-by of the network assets through which the state of the lines is monitored and assessed for appropriate action.

After faults it is common practice to carry out thermal imaging to ensure conductors, terminations and connections are performing satisfactorily.

In addition, an intermediate six-monthly inspection is performed on the spur sections of 33kV line. The inspection is to identify obvious defects that might affect network reliability within the next two years.

33kV Overhead Lines

SF_6 and vacuum circuit breakers are maintained at intervals not exceeding three years between services. This interval is reduced if multiple or high fault level trips have occurred.

The inspections include checking at least one breaker at every location for dust accumulation, gas pressure alarm integrity checks, trip timing checks, trip circuit integrity checks, SCADA alarm, and control checks and contact maintenance according to manufacturer recommendations. If needed, dust is removed using live line techniques. Partial discharge tests will be carried out in conjunction with the underground cable tests on selected 33kV circuits.

The oil circuit breaker maintenance programme includes partial discharge testing as determined appropriate, contact and turbulator erosion checks, oil change if required, trip timing checks, trip circuit integrity checks, SCADA alarm and control checks.

The 33kV circuit breakers at Peacockes will be replaced with an indoor board in 2014/15 as part of the substation upgrade and breakers at Te Uku will be replaced as a result of an upgrade and interconnection to the wind farm circuits.

Wallace 33kV outdoor circuit breaker replacement was brought forward to 2013/14 to address asset age, condition and noise concerns and will be in conjunction with the transformer replacement on that site. 33kV indoor GIS will replace the existing outdoor gear.

Zone Substation Transformers

These assets are given a visual inspection bi-monthly as part of the substation inspection. DGA oil tests are carried out annually or more frequently if required. Minor inspection and maintenance is carried out every three years and major maintenance and service every six years. All zone transformers are fitted with silica gel breathers to minimise moisture ingress, which are inspected regularly. Where necessary oil has been dried out and de-acidified.

Where testing shows oil condition is outside acceptable values the oil is reconditioned with the transformer in service. Zone transformers undergo a mid-life refurbishment to extend their life. This work requires removing (detanking) the core, an internal inspection, dry out, testing and repairs as required. The remaining life is assessed at this time though it is expected that well maintained transformers with mid-life refurbishment will have a life exceeding 60 years.

No zone transformers will exceed their nominal lives within the planning period. However due to condition and load growth requirements, two transformers at Gordonton will be replaced in the 2017/18 financial year in conjunction with the zone substation upgrade. Additionally, two zone transformers at Latham Court have been replaced with new transformers with higher capacity to accommodate load growth in that area. Existing Latham transformers will be used to replace the two transformers at Peacockes that are over 45 years of age and have never been refurbished. Transformers at WEL are usually run well within normal ratings and furans analysis shows their remaining useful lives are better than or consistent with their ages.

A number of unbunded transformers at our zone substations were identified. Most of these were part of the "old" installations which reflects the design standards at the time of their construction. Bunding of these transformers are included on the plan which focuses on zone transformers situated in rural environment where oil leakage will have a greater impact compared to urban locations. Some will be undertaken in conjunction with proposed development projects and installations.

Zone Substation	In-Service PTX	Spare PTX	Financial Year on AMP
AVA	0	3	21/22
GLA	1	0	18/19
*GOR	2	0	17/18
TEU	2	0	15/16
KEN	2	1	19/20
*CLA	0	2	16/17
*WEA	2	0	17/18
*PEA	2	0	14/15
*WAL	2	0	14/15
TOTAL	13	6	
Overall	19		
**Note: In conjunction with proposed upgrade/project on AMP*			

Table 18 Zone substations with unbunded Power Transformers

11kV Switching Stations/Zone Substations Switchgear and Protection

11kV circuit breakers and switchgear are serviced at three yearly intervals. This interval is reduced where multiple trips have occurred or where trips have involved high fault levels. Major services are performed every six years. Periodic inspection and condition monitoring techniques such as partial discharge tests are carried out and the insulating oil in oil filled circuit breakers is changed at regular intervals. The maintenance programme also includes contact and turbulator erosion checks, trip-timing tests, trip circuit integrity checks, close circuit integrity checks, SCADA alarm and control checks.

A number of replacements have been made in recent years and replacement of the Horotiu 11kV board was completed in 2011 as it had reached end of life and other capacity upgrades at the site were also completed.

Circuit breakers at the following sites will exceed the normal life expectancy in the planning period. Provision is made to replace these in a staged manner from 2013 onwards, Alexandra St (2013/14), Massey St (2015/16), Claudelands (2016/17), Civic Car Park and Findlay (2020/21) and Barton St (2021/22). The existing 11kV circuit breakers are of the withdrawable oil filled type. New switchboards are likely to consist of the fixed pattern types which have reduced maintenance requirements.

Original electromechanical relays at these sites will be replaced with modern electronic devices at the same time the switchgear is replaced. This defers the expenditure on relay replacement from what is suggested by the replacement model.

SCADA/Comms, charger and battery banks will also be replaced or upgraded whenever deemed necessary to accommodate changes due to switchgear and protection replacements. The battery and charger replacement program is being driven by the asset's nominal life and condition. A two yearly discharge test will be carried out on all zone substation and switching station battery banks to ensure that the battery performance is up to standard. Impedance tests on smaller batteries and chargers are being carried out in conjunction with inspection routines to ensure the battery performance. These are normally used to provide DC supply on communication and automation devices commonly installed on poles. Proactive replacement is being done to all batteries that failed on the discharge and impedance tests.

11kV Switching Stations

All substation equipment items are subject to regular, documented maintenance regimes. The 11kV switching station maintenance programme includes bi-monthly visits where building condition and building security, grounds and fence security are checked and maintained. For switchgear, SCADA equipment and communications equipment, regular routine maintenance is carried at defined intervals. 11kV buses are inspected every nine years and cleaned as required. Thermo vision and ultrasonic inspections are carried out on most HV equipment on an annual basis, or when problems are suspected. Partial discharge tests are carried out on 11kV switchgear and underground cable as part of reactive maintenance. These checks can detect unusually high levels of temperature or electrical discharges.

Distribution 11kV Underground Cables

There is no routine maintenance regime as such in place for the 11kV cables.

Ad hoc maintenance consists mostly of repair of cables damaged by external sources. When there is a reason for the cables to be repaired, samples are taken and examined to assess the internal condition of the cable.

Most PILC cable is still well below expected life though an increasing amount of XLPE cable with a lower than expected life is anticipated to become an issue towards the end of the planning period. Sections of cable of both types are being replaced where capacity constraints are identified, load requirements are increasing or deterioration has a result of high load factors has occurred. Where failures occur samples of cable are being retrieved to assess the internal condition of the cable. Provision is made for situations where a fault occurs and it is found the cable condition is such that a larger section needs to be replaced.

6.4.8 Distribution 11kV Overhead Lines

RCM based maintenance is applied with an inspection regime similar to that used for the 33kV lines.

A drive by inspection of the critical sections of the overhead network is carried out annually. Each year 20% of the network is given a detailed condition assessment inspection. This inspection includes poles, crossarms, DDOs, air break switches, conductors, surge arrestors and transformers. Thermal imaging and ultrasound testing is used annually on each of the overhead feeders with emphasis on the first protection zone out from the substation. Thermal imaging is also used after major faults occur to check the conductor and joint integrity. Corona discharge inspection is being used on feeders where there are higher incidences of insulator failure. The condition of the line equipment is recorded in the maintenance records database and is regularly analysed.

Although the asset replacement model suggests that little conductor replacement is required, there is an ongoing programme to replace 16mm2 Cu conductors with Iodine (AAAC). This replacement is predominantly in coastal areas where conductor ageing is accelerated by corrosion. In other areas conductor damage as a result of line clashing has been identified.

Where conductor replacement is performed the crossarms are replaced in a delta construction. As a result of the number of zone substations being installed in previously rural or end of feeder areas, fault levels have risen and conductor construction configuration and rating are no longer appropriate. These sections of conductor are being upgraded as part of the zone substation projects.

Wooden Poles

About 10% of the poles are wooden and most of these will require replacing within the 10 year planning period. Visual pole inspections are carried out on a periodic basis (generally as part of the five year assessment). Where practical any refurbishment is coordinated with the undergrounding plans to avoid unnecessary replacement of overhead lines. Because of the difficulty of making objective assessments of wooden poles a new technology was used to cover the entire population of wooden poles. This involved the use of radiation backscattering to measure wood density and remaining pole strength. The objective was to classify all of these poles and assign a replacement date based on priority. Costs for the replacement of these poles is expected to be higher than standard as they are usually in difficult and/or complex situations.

Where wood pole lines are to be replaced with concrete pole lines, the crossarms and hardware are all replaced as well.

Concrete Poles

Concrete poles are visually inspected as part of the five yearly condition assessments of overhead assets. Those given a poor assessment are then tagged for replacement in the following period's capital programme. The projected spend on this asset class is minimal over the 10 year planning period.

Crossarms

We are entering a period when the number of crossarms expected to require replacement increases significantly. The standard life of crossarms has been decreased to 35 years and where crossarms are replaced insulators are also replaced and the 33kV or 11kV configuration is generally changed to delta with a raised centre conductor. Candidates are identified from inspection and prioritised for ongoing replacement.

11kV Ring Main Units

Whilst age is a major factor in replacing assets, it is not the sole determinant and there have been programs in the past where issues with particular makes or models have been identified.

Each year 20% of the ring main population is maintained by carrying out visual inspections and condition reports, earth testing, vegetation control, oil level checks or SF_6 gas pressure checks, and through-fault indicator checks. At the same time checks are made on the operating handles, earthing conductor ratings, tank condition, pitch box leaks, panel steelwork, labels and warning signs. For ring main units over 15 years old oil samples are taken. Where these test results indicate a problem an internal inspection is performed. Due to problems encountered with particular models of oil filled ring main units, all oil filled RMUs were internally inspected and the oil changed. This programme was completed at the end of the 2011 financial year.

For ring main units with bus extension units, partial discharge testing is carried out and visual inspection of bus boxes is performed.

The age profile shows that over the next 10 year period significant numbers of ring main units are reaching end of life reflecting an increasing spend projected for this asset type. The condition can vary considerably with the make/model and the environmental exposure being the key factors having an influence. Replacement costs can also be greater due to the need to keep power on for customers and because of physical constraints at existing sites.

Oil filled switches are being replaced with SF_6 insulated types.

Further assessment of this asset class will be undertaken using Condition Based Risk Management (CBRM) modelling.

11kV Air Break Switches

Many air break switches have only infrequent operation, usually associated with network faults. Hence they are quite critical in the performance of the network. RCM studies have been carried out to determine an optimum maintenance regime.

Details of the maintenance programme include:

- Five yearly visual inspections: insulators, arc horns/chutes, contacts, handles, earthing conductor rating and steelwork
- Five yearly earth tests
- Five yearly condition monitoring through thermal vision tests in the urban area, including automated ABSs in rural areas
- Contact and alignment maintenance, exercise, lubricate and adjust using live line and jumper techniques on a planned maintenance basis driven by condition monitoring
- Analysis of the switch to see if it can be moved or removed (including position, accessibility, necessity for the switch, network switch ability, reliability and speedy restoration)
- Automated remotely operated ABSs undergo a five yearly operational verification of the line recloser operation as well as SCADA and communications signalling
- Testing of Through Fault Indicators (TFI)

WEL continues to use SF_6 gas-insulated switches instead of traditional air break switches for new installations. Though similarly priced, the gas switches are more reliable, lower maintenance requirements and have a longer operating life. A programme has been initiated to replace a number each year over the next 10 year budget period. Many ABS associated with 2 pole transformer structures are being removed completely and in other situations cable end switches are being replaced with solid isolating links rather than switches.

Table 19 shows an indicative number of Air Break Switch (ABS) replacements over the next 10 years of the plan. Replacement is being prioritised by network criticality, fault rating, asset condition and age (Figure 28). ABS replacement will be progressively replaced on the identified “critical” feeders (Figure 29) as the programme’s priority.

Financial Year	No. of units allotted on the budget	11kV-ABS (units)	33kV-ABS (units)
13/14	26	16	10
14/15	46	37	9
15/16	46	22	24
16/17	53	44	9
17/18	53	53	0
18/19	53	47	6
19/20	33	32	1
20/21	20	20	0
21/22	20	19	1
22/23	20	20	0
TOTAL	370	310	60

Table 19 Indicative number of Air Break Switch Replacement

11kV Reclosers and Sectionalisers

Maintenance is programmed and consists of the following activities:

- Five yearly visual inspection and report on condition of insulators, handles, earthing conductor rating and steelwork
- Five yearly operational verification of line recloser SCADA and communications signalling.
- Five yearly earth test, thermal vision, ultrasound tests and reporting of results

The removal of the line recloser from service on the network when maintenance is recommended based on condition monitoring. Workshop based maintenance and testing including:

- Recording all nameplate data and as found conditions
- All tests required to verify protection trip, close, reclose, lockout integrity indications and unit is fit for purpose
- Measure vacuum contact wear
- Test oil dielectric breakdown

- Check oil level
- Test remote digital and analogue signalling and SCADA operations
- Test power supply battery and charger
- Check tank and cabinets for cracks, rust and leaks and maintain as required
- Check and clean bushings
- Clean and paint tank and cabinets as required

A large number of reclosers were installed in 2004 and 2005, which will not require replacement within the 10 year period. A smaller number of older reclosers are of the oil filled hydraulic type which are difficult to co-ordinate with electronic protection relays at the feeder circuit breakers. These units are not repaired but replaced with the newer types. A regular programme of replacing two units per year is envisaged. Some problems have been experienced with drop out sectionalisers that were installed relatively recently. It is expected that these will be progressively replaced over the first five years of the plan.

Distribution Transformers

All transformers (pole mounted and ground based) with the exception of the CBD (ex HCC network) and transformers >= 750kVA are inspected on a five yearly cycle, timed to coincide with the overhead feeder inspections.

The CBD transformers and other transformers >= 750kVA are inspected on a yearly basis.

Transformers 100kVA and under are driven to failure or to the point before they become an environmental or safety hazard.

In addition pad-mounted transformers are checked for security, external panel deterioration or damage, vegetation control and access and to perform cleaning of HV and LV cubicles and thermal imaging of connections and bus bars.

For larger ground based city and industrial distribution transformers the maintenance programme includes:

- Annual inspection of ground based transformers and city distribution substations
- Thermal imaging inspections of all links, bus bars and connections
- Maintenance checks on tank and cubicles
- Cleaning equipment and building internal areas
- Oil tests conducted on a condition basis for transformers 750kVA and above
- Reading of maximum demand indicators (MDIs) at six monthly intervals, timed to occur at peak load times

WEL has had new data loggers developed that are fitted to all new ground mounted transformers 300kVA and over. Furthermore loggers have been retrofitted to existing transformers each year. These loggers replace the traditional MDI units and log three phase voltage, transformer temperature, three phase transformer currents and one phase of outgoing circuit current. This data will enable much more accurate evaluation of transformer loading over time.

Provided that the tanks and oil are well maintained, transformers may be kept in service for up to 55 years. The majority of distribution transformer faults are caused by lightning damage. Failed units are refurbished if economically viable.

Asset's Age	Indicative no. of units	Year of Replacement on AMP
45 yrs old	49	21/22
46 yrs old	31	20/21
47 and 51 yrs old	33	19/20
48-50 yrs old	49	18/19
51-54 yrs old	55	17/18
55-59 yrs old	42	16/17
60-67 yrs old	38	15/16
68-74 yrs old	25	13/14 -14/15
>= 75 yrs old	7	13/14
TOTAL	***329***	

Table 20 Distribution Transformer Replacement based on Age

Table 20 shows the number of transformers to be replaced based on age, and Table 21 shows the transformer replacements based on condition assessment. Our plan is to replace a combination of transformers based both on age and condition. The main focus will be on distribution transformers of 55 years of age and above that have a poor condition assessment.

Condition	Indicative no. of units	Number of Replacement Units within 2013-2023 Financial Years 13/14 (units)	14/15 (units)	15/16 (units)	16/17 (units)	17/18 (units)	18/19 (units)	19/20 (units)	20/21 (units)	21/22 (units)	22/23 (units)	*TOTAL*
1	195	20	43	50	46	33	3					***195***
2	286						36	55	57	10	29	***187***
3	584											
												382

Table 21 Distribution Transformer Replacement based on Condition and Critical Feeders

LV Underground Reticulation

There is currently no routine maintenance performed on LV cables but allowance has been made in the asset replacement budget to replace LV cabling of the earlier vintage paper based types that are reaching their nominal design life. This is not a clearly defined age but is evidenced by situations where patterns of faults begin to appear in certain localised areas. As well, there is a programme to replace service pillar boxes of a particular design (concrete/fibrolite and fibreglass) where failures are occurring due to brittleness and disintegration.

A program was initiated to inspect service pillars to identify safety issues particularly in regard to damaged or insecure lids and this program was completed at the end of the 2011/12 financial year.

LV Overhead Reticulation

Many of the LV lines are under built on the same poles as the 11kV and hence inspection of the LV lines is carried out at the same time as the 11kV lines. The maintenance policy is similar to the previously mentioned 11kV policy and is mainly RCM based with an inspection regime from which the asset condition determines the actual maintenance.

Many of the LV lines are under built on the 11kV or 33kV circuits and will be replaced along with these higher voltage lines. Condition assessments and inspections are used to determine when wood or concrete poles need replacement. Crossarms and fittings are replaced at the same time as poles. There are a growing number of instances where concrete poles are in satisfactory condition but crossarms and fittings need replacing. If more than one crossarm/pole is replaced in a line section, our policy is that the conductor be changed to Aerial Bundled Conductor and therefore crossarms are not required.

The number of LV (and 11kV) crossarms needing replacement is expected to become significant so increased provision has been made for replacement during the next 10 years.

LV Service and Distribution Pillars

LV pillar inspections are now being carried out on a three yearly interval. A substantial number of ageing distribution pillars will be progressively replaced over the next ten years on the plan. LV service pillars with outstanding notifications are to be replaced regardless of the age and pillar type.

Financial Year	No. of Units for replacements from Notifications	No. of LV Service Pillars for Replacement based on AGE	No. of LV Distribution Pillars for Replacement based on AGE	Estimated Cost $000	Budget alloted on AMP $000
13/14	260			442	450
14/15		60	25	477	480
*15/16		60	25	477	480
16/17	**150		15	480	480
17/18			26	390	400
*18/19		50	21	400	400
19/20	**120	10	12	401	400
20/21		10	25	392	400
*21/22		10	25	392	400
22/23	**100		15	395	400
TOTAL	260	200	189	4246	**4290**

**Scheduled inspection; **Estimated number of units for replacement from previous inspections*

Table 22 LV Service and Distribution Pillar Capital Replacement

SCADA: Communications and Control Equipment

Planned maintenance consists of four monthly and 12 monthly inspections and tests on all remote station equipment including:

- Visual inspections, dusting, cleaning and minor repairs
- Operational checks and measurements
- Testing, calibration checks and adjustments
- Meter reading and downloading of data
- Checking and reporting status indications and software error logs
- Maintenance of database related to the location, maintenance history and status of all equipment and the filing of test sheets and reports

Other SCADA indication testing is done in co-ordination with circuit breaker and protection testing.

In recent years the Remote Terminal Unit (RTU) function is typically being performed by SEL- series 20XX devices that act as data concentrators and protocol converters.

SCADA and RTU replacement will typically be in conjunction with switchgear and protection upgrades when deemed required due to additional requirements. Some other SCADA and Communication devices will be replaced based on age, condition and limitations (risks).

Remaining RTUs with Conitel Protocol will be proactively replaced with DNP-IP RTUs over the next five years on the plan.

The SCADA master station and data storage system was replaced in 2011/12 financial year.

Protection Relays

Electromechanical protection relays will be progressively replaced over the coming 10 years with modern numerical relays. This work will typically be done in conjunction with other upgrade work at the zone substation or switching station. The electromechanical relays that are still serviceable though past their nominal life, lack the more complex protection functions that are increasingly required, and are unable to provide other detailed information such as power measurement and fault event downloads.

The program priority focuses on the CBD area where a substantial number of electromechanical relays are still operational on critical zone substation. Some of these assets were “re-used” when their corresponding switchgear or circuit breakers were upgraded from the past *(e.g. Bryce and Kent Tx diff’l electromechanical relays)*. The aim of the program is to replace most of these identified assets within the 2013-23 financial years, some in conjunction with Asset Renewal and Replacement programmes for switchgear and circuit breakers.

Existing 11kV trunk feeders with Solkor pilot wire protection will be replaced with numerical line differential relays. Fibre and patch panel will be installed on these sites to cater for new differential communication requirements.

Functional Location	Protection Upgrade due to aging Electromechanical Relays	RTU Upgrade	SCADA/COMMS Upgrade	Fiber and Patch panel Installation (Trunk Fdrs)	Trunk Circuit Functional Location	Financial Year	Comments
ALE		X	X	X	ALE-ANG	13/14	Work will be done in conjunction with proposed 11Kv switchgear upgrade on AMP (13/14)
WAL		X				13/14	Work will be done in conjunction with proposed switchgear upgrade (indoor GIS) on AMP (13/14)
ANG			X			13/14	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
STE			X			13/14	Budget included on Protection and SCADA upgrade Programme on AMP (Asset Renewal and Replacement)
CLA			X			13/14	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
PEA		X	X			14/15	Work will be done in conjunction with proposed switchgear upgrade (indoor GIS) on AMP (14/15)
BAR			X			14/15	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
WHI			X			14/15	Budget included on Protection and SCADA upgrade Programme on AMP (Asset Renewal and Replacement)
MAS		X	X	X	MAS-KIL	15/16	Work will be done in conjunction with proposed 11Kv switchgear upgrade on AMP (15/16)
RUR			X			14/15	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
CLA		X		X	CLA-RUR	16/17	Work will be done in conjunction with proposed 11Kv switchgear upgrade on AMP (16/17)
PCH			X			14/15	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
CIV			X			14/15	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
CIV		X				20/21	Work will be done in conjunction with proposed 11Kv switchgear upgrade on AMP (20/21)
FDL			X			14/15	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
FDL		X				20/21	Work will be done in conjunction with proposed 11Kv switchgear upgrade on AMP (20/21)
BAR		X				21/22	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
BAR-BRY				X	BAR-BRY	21/22	Work will be done in conjunction with proposed 11Kv switchgear upgrade on AMP (20/21)
WHI-BRY				X	WHI-BRY	22/23	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
KEN	TX Protection Upgrade	X				14/15	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
GLA	11kV Protection Upgrade	X	X			17/18	Work will be done in conjunction with proposed upgrade on AMP (17/18 33kv Indoor GIS)
AVA-FOR	11kV Trunk Protection Upgrade	X		X	AVA-FOR	18/19	2 sets of Trunk feeders (4 relays); Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
TEK	Transformer Protection (RegD)	X				13/14	2 RegD voltage regulator relay upgrade in conjunction with TEK Tx upgrade; Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal*
BRY	BRYCB1-KENCB6 trunk feeder			X	BRY-KEN	19/20	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
	BRYCB6-GARCB2 (CARO)			*Dependent on CARO Switching Station Installation*			Work will be done in conjunction with proposed upgrade on AMP (CARO Sw.Station)
	BRYCB7-RURCB3 BRYCB11-RURCB8			X	RUR-BRY	18/19	work will be done in conjunction with proposed upgrade on AMP (RUR upgrade)
	BRYCB13-KENCB10					19/20	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
	BRYCB14-BARCB1					21/22	work will be done in conjunction with proposed upgrade on AMP 2011-2021 (BAR upgrade)
	BRYCB2-WHICB2					18/19	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
	BRYCB5-GARCB8 (CARO)			*Dependent on CARO Switching Station Installation*			Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
	BRYCB9-COBCB1					18/19	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*
CLA-PCH				X	CLA-PCH	18/19	Budget included on Protection and SCADA upgrade Programme on AMP (Asset Renewal and Replacement)
PCH	11kV and Trunk Protection Upgrade	X				19/20	Budget included on Protection and SCADA upgrade Programme on AMP *(Asset Renewal and Replacement)*

Note: Red font - In conjunction with proposed development project on AMP

Table 23 Protection, SCADA/COMMS and Fibre Installation Replacement Programme

Load Control Equipment

Currently a condition driven approach is followed by an annual inspection and test run of plant prior to winter around March/April. This involves visual checks, a test run of plant, signal strength tests and production of reports. Thermal imaging supports this process. Additionally each year the static plants undergo a condition assessment performed by the supplier.

The smaller original static injection plant from the Hamilton point of supply has been moved to Weavers in order to enable the injection of a 283Hz signal into this northern area. This will enable the replacement of old obsolete relays and allow parts of the Te Kowhai point of supply to be fed from Weavers under contingency conditions while still maintaining control of relays. Field located ripple relays will be replaced as their economic life is reached. Currently new technology options are under investigation for the future transmission of load control signals in the Meremere and Huntly point of supply area.

Photo 20 RF Mesh relay installed on a Pole

7. RISK MANAGEMENT

WEL recognises risk management to be critical in the achievement of its Vision statement. WEL has a clearly defined Risk Management Policy. This Policy and supporting procedure identifies risk management as a core management responsibility and outlines in broad terms the emphasis given to this in both the day-to-day and longer-term facets of managing its assets and overall business.

The Policy shows risk management to be an integral part of the management (including asset management) and operating structure designed to improve decision-making, leading to minimisation of losses and maximisation of opportunities.

WEL has developed and maintains a "risk aware" culture with employees empowered and enabled to identify all relevant risks and has in place processes to evaluate, prioritise and manage the risks with the appropriate balance of costs versus consequences and likelihood.

This is achieved by systematic application of processes to identify, analyse, evaluate, prioritise, treat and monitor any situations where undesired or unexpected outcomes could be significant or where opportunities could ensue.

WEL has adopted the new risk management standard, ISO 31000, which is used as a framework for guiding our risk management practices.

7.1. Risk Analysis

WEL has adopted a systematic approach to risk analysis. The Quantate Risk Management application, a software-based process that is compliant with the standard ISO 31000 has been implemented. This ensures a structured approach to the entire process of risk management and has proven to be more efficient and effective than paper based programmes. The application is made up of the following components.

Identifying Risks

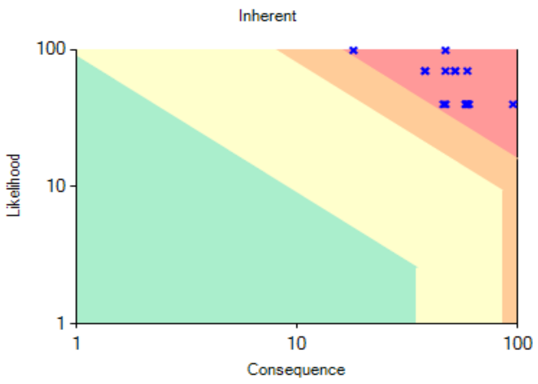
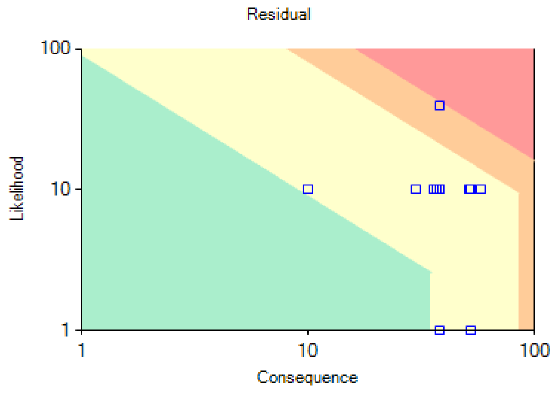
Any staff member is able to identify a risk and have that risk added to the Risk Management Database. The staff member identifying the risk will work with the Risk and Regulatory Manager to input the risk collaboratively. The new risk will then be assessed and ratified by the Risk and Audit Management Committee.

Risks are also identified via the hazard identification process where any hazard scoring above the designated threshold will be submitted to the Risk and Audit Management Committee for review. The WEL Board is also asked to consider strategic risk on a regular basis.

Operational Risks

Risk management identification processes apply to all categories of risk, whether they are strategic, commercial, corporate or operational. The following table lists the top 10 operational risks that have an inherent risk classification of "Class 4, Intolerable"; all of these risks have controls in place that bring their residual classification to "Class 2, Tolerable".

Table 24 Risk Evaluation Table

Rank	Uncontrolled Risk Risk Description	Risk with active controls in place Risk Controls
		
1	Widespread damage to network and prolonged outages due to Major (Bola type) cyclone.	• CG 106 Disruption Recovery Business Continuity Plan • Insurance • OR 100 Storm - Civil Defence Emergency Procedure • OR 102 Communication Process for Major Unplanned Outages • Ensure adequate resources are available to complete work on the network • Establish reciprocal resource arrangements with other line companies • Back-up supply available for critical customers • Smartrack monitoring of driver speed and performance
2	Staff and/or contractors working live line on our network are harmed.	• Induction training • Technical qualifications • Health and safety training • CG 101 Health and Safety Standards for Personnel Working on WEL's Network • Equipment operating training • Equipment operating manual • OR 101 Network Outage and Management Permits and Switching • Work method statements • Live line manual • Personal Protective Equipment (PPE) • Annual assessment of competency by external assessor. • FS-WC-03 Field Services Work Compliance
3	Harm occurs to a contractor due to the incorrect operation of equipment because the contractor is not sufficiently familiar with WEL's equipment.	• Induction training • Technical qualifications • Equipment operating manual • OR 101 Network Outage and Management Permits and Switching • Personal Protective Equipment (PPE)
4	Harm to staff or members of the public or to property as a result of the failure of network	• Health and safety training • OR 101 Network Outage and Management

	equipment due to not following accepted maintenance programmes and processes.	Permits and Switching • Work quality auditing • WEL Maintenance Manual • SAP - Maintenance • Maintenance works delivery plan • Personal Protective Equipment (PPE) • Signoff sheet to be completed by Field Services staff for work completed
5	Serious harm to staff member or contractor or member of public in the distribution centre or depot e.g. due to incorrect operation of machinery that is used for moving stores	• Induction training • Technical qualifications • Health and safety training • Equipment operating training • Personal Protective Equipment (PPE) • Forkhoist Code of Practice • Safe job procedure - loading and unloading of trucks (DOL Certificate) • Holding the NZQA qualification
6	Injury caused to member of the public when they deliberately come into contact with electrical equipment (not an inadvertent action).	• Network design and construction standards DCM 01/02/03/04/05 • AIS 104 Substation Fences and Physical Barriers • Maintenance works delivery plan
7	Someone is harmed and/or there is a SAIDI minute loss due to defective work being carried out or failure to test.	• Induction training • Technical qualifications • Health and safety training • CG 101 Health and Safety Standards for Personnel Working on WEL's Network • Equipment operating training • Network design and construction standards DCM 01/02/03/04/05 • Work method statements • Work quality auditing • Control of Test and Inspection Equipment requiring calibration • FS-WC-03 Field Services Work Compliance • OR 105 Limited Induction for Contractors Working on WEL's Network
8	Harm to a member of the staff or of the public due to inadequate earthing installed on an item of equipment, or theft of earthing.	• Network design and construction standards DCM 01/02/03/04/05 • Work quality auditing • Maintenance works delivery plan • Personal Protective Equipment (PPE) • Physical inspection of lines • AIS 110 Asset Commissioning and Decommissioning process • WD 03 Works Delivery - Construction • Routine reporting of materials theft to the police
9	Safety equipment or associated equipment fails and causes harm.	• Induction training • CG 101 Health and Safety Standards for Personnel Working on WEL's Network • SAP - Maintenance • Control of Test and Inspection Equipment requiring calibration • Pre-start hazard assessment • FS-WC-03 Field Services Work Compliance • Purchasing the correct category of equipment

10	Injury to staff and destruction of equipment due to failure of ring main units when closing on a fault as a result of internal damage or defective internal state.	• Equipment operating training • Personal Protective Equipment (PPE) • Purchasing policy for RMU type
11	Injury and reliability impact if there is misalignment between syscon SCADA data and actual network status as a result of no or poor commissioning procedure.	• Equipment operating training • Network design and construction standards DCM 01/02/03/04/05 • OR 101 Network Outage and Management Permits and Switching • AIS 108 As-Builting Procedure (Asset Database) • Personal Protective Equipment (PPE) • AIS 110 Asset Commissioning and Decommissioning Process • NMS - PowerOn

7.2. Evaluating Risk

Each risk is analysed and evaluated by measurement against established criteria to determine the degree of acceptability. The criteria include:

Likelihood

History, empirical and/or relevant epidemiological data is considered in determination of likelihood.

Consequences

Three categories of risk are considered. They are:

1. Health & Safety

   - Is there a risk of single or multiple fatalities, serious harm or minor injury?

2. Financial impact

   - Estimated costs brackets from $0 to > $100,000,000 are included.

3. Reputation

   - Choices of likely effects on WEL's reputation, from loss of confidence and widespread national condemnation to no significant impact, are given.

Ranking of Risk

In considering each risk, the 'inherent risk', (which includes the consequences if no mitigation existed for the risk or if mitigations failed) is considered first. Any existing procedures or actions that mitigate the likelihood and consequences are then added and the risk is re-evaluated in light of these. This indicates the 'residual risk'. The larger the 'gap' the more effective the mitigation actions are considered to be. However, the importance of this gap depends on where the risk lies on the Risk Acceptability table.

Each option in the ranges of consequence descriptors has been given a value according to the potential impact on the business. The scores are calculated in the database and a graph (shown in Figure 71) indicates where the risk lies regarding acceptability.

Assumptions made or further explanation as to the rationale for identification of the issue as a risk, are entered in text boxes provided. Provision is made for the employee to indicate the degree of confidence in the information provided so as not to discourage those who believe a risk exists, but may need more qualified or experienced help to determine the real significance of the risk.

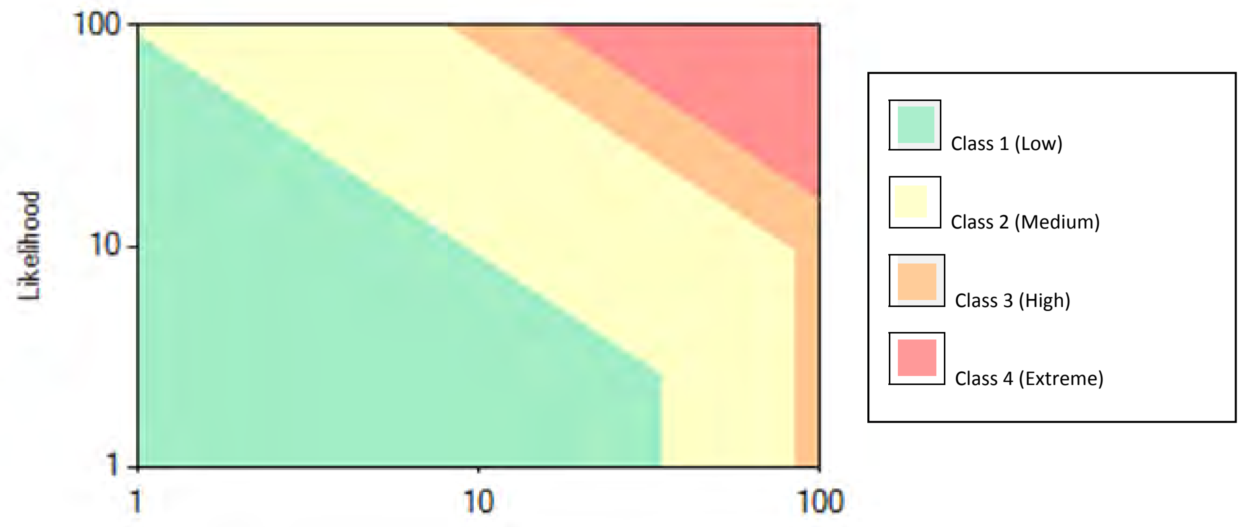


Figure 71. Risk Acceptability Chart

Acceptability Benchmarking

The Risk Acceptability Chart contains four classes or levels of risk (as shown in Figure 71) described as follows:

- Class 4 (Extreme) risks are considered intolerable. Risk reduction actions must be applied to reduce the level or consequences of the risk.
- Class 3 (High) risks are unacceptable without further controls unless the cost of such controls outweighs the benefits.
- Class 2 (Medium) risks are tolerable but undesirable. Higher consequences (those further over to the right hand side of the chart) are less desirable. Low cost mitigation may be justified unless the cost of such controls outweighs the benefits.

- Class 1 (Low) risks are acceptable.

The Risk Acceptability Chart 'bands' have been set to reflect WEL's requirements. These settings were determined once 80 risks had been identified and each one reviewed to establish the potential impact and degree of acceptability to WEL.

Decisions were made as to where each risk should sit on the Risk Acceptability Chart. If a risk was clearly acceptable, or if mitigation costs outweighed any advantages that could be accrued through Risk Treatment Options identified, it was used as a benchmark to indicate the class of risk. In this manner, the bands or classes of risk acceptability were adjusted and finalised to reflect WEL's appetite for risk.

Treatment Options

Wherever practicable, options to provide improved mitigation are entered. The costs (both initial and ongoing) of the proposed options are estimated. The risk is then re-evaluated and the position of the options is shown relative to the 'inherent' risk. Once again, the 'gap' indicates the effectiveness of the option.

The Risk and Audit Management Committee

The Risk and Audit Management Committee (RAMC) comprises a mix of managers including the Chief Executive, GM Operations and Fibre, GM Asset Management, GM Commercial, the GM Corporate Services, the Risk and Regulatory Manager, the Risk and Quality Auditor, and senior operational and health and safety managers. The RAMC therefore contains a wealth of experience and in-depth knowledge of WEL and the electrical industry as a whole.

It is the task of the RAMC to review all risks entered in the risk database to validate the data and determine the classification of the risks according to WEL's appetite for risk. This is accomplished at quarterly meetings (more frequently when necessary) to critically review the risks entered. Assumptions are challenged and clarification/additional information sought where necessary to enable accurate evaluation of the risk. Changes are made where required to realign the risk with the RAMC's collective judgement and *decisions.*

Prioritisation

Once risks are reviewed, treatment action programmes are prepared. Actions required are included in business plans and budgets where necessary. Priorities are set and timeframes for actions are agreed with the relevant personnel.

Monitoring

The Risk Management application and processes are monitored by the Risk and Regulatory Manager. Risk actions are assigned and their progress monitored on a regular basis using the Quantate system.

7.3. Network Risks

Network risks are identified by real-time and planning staff. This may occur in response to a network event, as part of an investigation or planning study, or during the course of routine monitoring. In addition to the software indicated in 7.2 there are other avenues available for reporting the risk. If the risk has been identified from a network event, a Root Cause Analysis meeting will be held. The underlying problem is identified and recommendations for alterations to the maintenance programme and/or capital works programme will be suggested. The recommendations are evaluated by an appropriate specialist and risk mitigation actions and/or strategies developed. The associated cost is also estimated. Periodically the complete list of risk mitigation actions or strategies are compared and subsequently ranked. Those items above a budget cut-off mark will be included in the respective budget. However, where the risk identified is assessed as requiring urgent attention, current priorities may be reassessed and the action performed without going through the ranking process.

In addition to adjustments to maintenance and/or capital programmes, network risks can often be mitigated by the development of a contingency plan.

7.4. Emergency Response and Contingency Planning

The following operational contingency plans are in place:

Lifelines

WEL as a lifelines utility has a significant Civil Defence Emergency Management (CDEM) role to play in New Zealand and has an obligation under section 60 of the CDEM Act 2002 to:

- Function at the fullest possible extent during and after an emergency
- Have plant for such functioning
- Participate in CDEM planning at national and regional levels
- Provide technical advice on CDEM issues where required

WEL is a participating member of Waikato Engineering Lifelines Group (WELG) which has overall goals to:

- Assist members to meet their obligations under the CDEM Act
- Co-ordinate and work to progress the completion of projects which benefit lifeline organisations in their region
- Strive to ensure that member organisations get value for money through their participation
- Endeavour to meet ever increasing customer expectations that Lifeline Utilities will deliver secure services

Lifeline utilities are responsible for strengthening relationships within and across sectors, and individually committing to actions that ensure continuity of operation and delivery of service.

Through its membership in WELG, WEL has access to regional and national studies carried out on natural, technological and biological hazards. From these WEL has identified the top hazards and developed a comprehensive vulnerability assessment which identifies the risks in terms of importance, vulnerability, resilience, and impact of each major asset on the network.

Routine Emergency Response

WEL responds regularly to routine emergencies such as network system outages. The methodologies and procedures devised for these are used as the basis for the planning of large scale emergencies.

The Storm- Civil Defence Emergency Procedure outlines the actions to be taken to:

- Prepare for impending storms that have been forecast.
- Manage increased or increasing numbers of faults due to storm conditions.
- Respond to Civil Defence requirements such as priority for restoration of supply.
- Liaise with Civil Defence in the event of a Civil Defence Emergency being declared.

This procedure is applicable when events e.g. weather, flood and/or earthquake have a major impact on the ability of the WEL network to supply electricity or when a Civil Defence Emergency is declared.

This procedure is designed for escalating situations that require resources beyond the normally rostered and on call resources.

WEL has a Communications Process for Major Unplanned Outages which identifies the process for external communications during an event.

Where the Chief Executive declares a major event triggered by a Civil Defence Emergency or serious effect on the public or the Company, escalation to the Disruption Recovery/Business Continuity Plan will occur.

Network Contingency Plans

WEL has developed general contingency plans for loss of significant assets or groups of assets. Further development of specific plans for zone substations and critical 33kV circuits is ongoing.

WEL's contingency plans include switching processes to ensure essential services, as much as is practicable, are able to continue to receive supply in the event of a major outage. WEL has also entered into arrangements to gain priority access to emergency generation.

Transpower

WEL and Transpower interact on an operational basis as below:

- Planned releases of equipment (both for Transpower and for WEL sourced requests)
- Unplanned releases of equipment and restoration of supply
- Co-ordination and impact
- Liaison with Civil Defence authorities

Automatic Load Shedding

WEL is contracted to provide automatic under frequency load shedding (AUFLS) of minimum 2x16 % total load of each GXP under certain frequency conditions. The same circuits would also be utilised as the first stage of manual load shedding.

The System Operator (Transpower) is revising the current AUFLS regime and has been conducting seminars on the proposed changes.

Alternative Control Centre

WEL operates its control centre from its Maui Street premises. When this is not available for whatever reason, there is a standby facility at WEL's disaster recovery site from which SCADA and control operation can be carried out. A simulated emergency exercise was carried out on the 7th July

2009 which demonstrated that the stand-by facility is fully functional and available on an immediate basis when required.

Emergency Exercises

Regular full scale simulated emergency exercises are carried out to test the emergency procedures and methodologies and determine scope for improvement. Typically these have involved full scale alarms being initiated with only a selection of staff having knowledge of the timing of the exercise.

Photo 21 WEL Office Building, Maui St

8. PERFORMANCE EVALUATION

8.1. Capital Expenditure

Actual capital expenditure for the 2011/12 financial year was $9,499k less than the value forecast in the 2010 AMP (difference of 24%). Table 25 gives the reasons for key differences.

Forecasted Capital Expenditure in 2010 AMP compared with Actual Spend for the Period from April 2011 to March 2012				
Total Network Capital Expenditure	**11/12 Actual ($000)**	**2010 AMP Indicated ($000)**	**Variance (%) (actual/AMP forecasted – 1)**	**Comments**
Customer Connection	6,698	6,380	5%	Slightly more customer connections were completed than expected.
System Growth	8,965	19,616	-54%	Mainly due to the delay of $10million spent on the Smart Box installation project.
Reliability, Safety and Environment	1,653	1,348	23%	Over $300k spent on low voltage complaints issues.
Asset Replacement and Renewal	9,626	8,601	12%	Asset replacement projects were modified as better information became available.
Asset Relocations	3,502	4,000	-12%	Asset relocations projects were lower than expected due to slower roading work requirements.
Total Capital Expenditure	30,445	39,944	-24%	

Table 25 2011/2012 Capital Expenditure: Actual versus Budget

The current year's (2012/13) forecasting is reported in Schedule 11a. Actual performance against the AMP indication will be disclosed within five months of the end of the financial year.

8.2. Network Development Programme

The following tables show that the physical progress of 2012/13 listed capital projects with an associated description. Most of the capital works programme has been completed except the seventeen projects shown in Table 27

Completed Capital Projects during 2012/2013
Poles Replacement Programme
Cross Arm Replacement Programme
11kV Conductor Replace OH Lines
Replace SILCBX1 Reclosers with RMU's
Mitigation of line clashing near Raglan zone substation
33kV Protection Upgrade project – Te Kowhai / Horotiu / Ngaruawahia circuit
Seismic Strengthening of Bryce St substation
Relocate Hamilton 33kV Ripple Plant to Weavers
Hoeka Rd Substation – stage 1
Huntly to Te Kauwhata 33kV dual cable circuits
Raglan Zone Sub Construction & 33kV/11kV cabling
Install LV transformer load monitoring devices
LV Feeder Overloading Issues
Replacement of LV Conductors
Te Kauwhata replace outdoor 33kV with GIS
Latham-Peacockes Cable overlay of overhead
Vickery St 11kV reconfiguration
11kV cables zone interconnections upgrades
Horotiu Transformer Upgrade
Latham Transformers upgrade to new 2x15/23MVA
Mid-feeder Sectos switch installation - Stage 2

Completed Capital Projects during 2012/2013
Knighton Rd / Clyde St pole replacements
Hetherington Rd pole replacements
Horotiu Security Fence Replacement
Dey St pole replacements
Dannemora subdivision remedial works – stage 1
Upgrade SANCB4 to resolve loading issues
Distribution 11kV UG cables
Air Break Switches
Concrete LV Service Pillars
Distribution Transformer replacement
11kV EDO Replacement
Transpower Conceptual Design Report for WEL's GXP Upgrade
Replacement of RMU's
Asset replacement small projects
HCC Rind Rd project to Peachgrove Rd
Designate existing zone substation
11kV Switching Station / Zone Sub
Smart box Project – stage 1
CHA CB6 offload to Borman substation
Pole top channel install Stage 3
Seismic strengthening of Peacockes Substation
Protection Relays
LV Underground cables
Voltage upgrade projects due to monitoring
UFB Fibre roll out - make ready works for the overhead fibre deployment

Completed Capital Projects during 2012/2013
Comms - for subtransmission network upgrade projects
Multiplexing of Fibre Circuits Outside Wind Farm
Simsey Place new customer load exclusive of 3rd 33kV cct PUK-TAS
Reliability project to improve rural customer reliability

Table 26 Completed Projects

Capital Projects in Progress as at 31 January 2013		
Project description	**% completed**	**Comments**
Distribution transformer upgrade	48%	One is schedule in Feb, two next year
Arc Flash protection installation	57%	Material not arrive until march; PUK outage in June
Pukete Substation 33kV cable terminations	50%	PUK outage in June due to client request.
33kv Protection	50%	Awaiting on design finalisation
CLA-STE Trunk feeder	56%	Thrusting underway, F/S to decide if they can do it or not.
Te Uku to Cogswell road fibre install	0%	Awaiting for approval
Glasgow/Avalon Drive- Seismic strengthening	18%	Awaiting design finalisation
Simsey - Maui Fibre project	2%	Starting a new negotiation for easement with new landowners
DR Site at Avalon	30%	XFR & RMU ordered, Building alterations, Gen & Container design not yet completed.
TAS CB5 11kV extension	76%	Delay due to contractor's work in hand
Temple view pole removal	76%	Work scheduled for late March with contractor
Findlay Rd reconductoring	91%	Scheduled in Feb
Weavers Sub via resonant earthing (Ground fault neutralizer)	11%	Delay due to technology re-assessment
Peacockes Transformers replacement with ex LAT units	0%	This project was cancelled as result of construction issues. After option analysis, bring Peakcockes GIS Conversion from 2014/15 to

		2013/2014.
Network Automation. Resolution Drive RMU automation and fibre from BOR.	77%	Parts not here from States till March. Fibre portion can be done this year
Caro St 11kV switching station	0%	Carry over to 2013/14 year due to customer's decision
Latham-Peacockes Cable overlay of overhead	0%	Ground condition was worse than expected, project was on hold, and reassessment completed. Carry over to 2013/14 year

Table 27 Capital Projects in Progress

Maintenance Expenditure

Actual versus budgeted maintenance expenditure for the 2011/12 year is shown in Table 28 below.

Forecasted Maintenance Expenditure in 2011 AMP compared with Actual Spend for the Period from April 2011 to March 2012				
Operational Expenditure	**11/12 Actual ($000)**	**2010 AMP Indicated ($000)**	**Variance (%)**	**Comments**
Routine and Preventative Maintenance	2,857	3,068	-6.89%	Decreased on Feeder Remedial Repairs
Refurbishment and Renewal Maintenance	1,540	1,648	-6.56%	Less corrective work required that budgeted
Fault and Emergency Maintenance	2,650	2,425	9.28%	Increased Service costs (traffic management & generator hire)
Total Operational Expenditure	**7,047**	**7,141**	**-1.32%**	

Table 28 2011/12 Maintenance Expenditure- Actual versus budget.

The current year's forecasting is reported in Schedule 11b. The actual performance against the AMP indications will be disclosed within five months of the end of the financial year.

8.3. Evaluation and Comparison of Actual Performance Against Targeted Performance Objectives

Safety

There was one serious harm injury during the period 1 April 2012 to 28 February 2013.

Health and safety statistics since April 2009 are shown in Appendix 5.

Reliability

WEL's performance for the year 1 April 2011 to 31 March 2012 compared to target is shown in the table below.

Performance Measures	Target 2011/12	Actual 2011/12	Variance
WEL Networks unplanned 33kV	6	2	-4
WEL Networks unplanned 11kV	269	431	162
WEL Networks planned	30	283	253
Total interruptions - unplanned	**275**	**433**	**158**
WEL Networks planned SAIDI	3.00	8.78	5.78
WEL Networks unplanned SAIDI	69.00	60.24	-8.76
WEL Networks planned SAIFI	0.02	0.10	0.07
WEL Networks unplanned SAIFI	1.15	0.95	-0.20
WEL Networks planned CAIDI	130.00	91.19	-38.81
WEL Networks unplanned CAIDI	60.00	63.26	3.26
WEL Networks Total SAIDI	**72.00**	**69.01**	**-2.99**
WEL Networks Total SAIFI	**1.17**	**1.05**	**-0.12**
WEL Networks Total CAIDI	**61.38**	**65.82**	**4.45**
33kV Faults/100km	1.43	0.48	-0.95
11kV Faults/100km	10.60	28.13	17.53

Table 29 Performance Measures for Reliability

There were no Transpower outages over the last year. Excluding any Transpower impact, the SAIDI performance for the year ending March 2012 was 69.01 minutes compared to a target of 72, SAIFI was 1.05 compared to a target of 1.17, and CAIDI 65.82 minutes compared to a target of 61.38.

The current year's reliability forecasting is 70 minutes compared to a target of 70 minutes which is reported in Schedule 12d. The actual performance against the AMP indications will be disclosed within five months of the end of the financial year.

The following table shows the breakdown of outage causes for the year.

Controllable / Uncontrollable Category	Outage Numbers	Customer Count	SAIDI Minutes	% SAIDI	SAIFI	CAIDI
Controllable Events						
Equipment Failure	239	41,323	32.43	47.0%	0.48	67.06
Planned Shutdowns	283	7,848	8.00	11.6%	0.09	87.12
Trees	12	1,645	1.59	2.3%	0.02	82.78
Total Controllable Events	**534**	**50,816**	**42.03**	**60.9%**	**0.59**	**70.67**
Uncontrollable Events						
Adverse Weather	20	5,950	2.71	3.9%	0.07	38.90
Vehicle Accidents	38	12,250	15.67	22.7%	0.14	109.29
Diggers v Cables	2	242	0.68	1.0%	0.00	238.64
Birds	38	7,835	3.38	4.9%	0.09	36.86
Others	86	12,490	4.55	6.6%	0.15	31.11
Total Uncontrollable Events	**184**	**38,767**	**26.98**	**39.1%**	**0.45**	**59.47**

Table 30 Outage Statistics for 2011/2012 Financial Year

Note: The outage number here means the number of 11kV feeder trips. One 33kV outage could result in more than one 11kV feeder outage.

Controllable events contributed to the majority of outage time and customers affected. Planned shutdown work included maintenance activities and capital projects.

Of the unplanned controllable outages, broken lines on 35 feeders were a major fault cause. This was mainly due to broken 16mm^2 copper (C_U) conductors. The 2013 AMP includes a significant increase ($12M in total) for identified 16mm^2 copper (C_U) conductor replacements to improve rural reliability including repeated interruption reduction. There are 474kms of 16mm^2 copper conductors in WEL's network. The increased $12M funding only represents 17% of total 16mm^2 Cu conductors.

Repeated Customer Interruptions

Customers' perception of the standard of service provided by WEL is strongly linked to the number of interruptions in supply that affect the customer. WEL measures the minimum standard of service to urban and rural customers, based on the number of repeated interruptions that affect them in a year.

Rural Customers

The 12 month rolling average for repeated interruptions for rural customers with ≤4 outages as at 28 February 2013 is 72% with a target of 80%. Last year's performance was 82%. Figure 72 below shows the spread of customers against the number of outages they experienced.

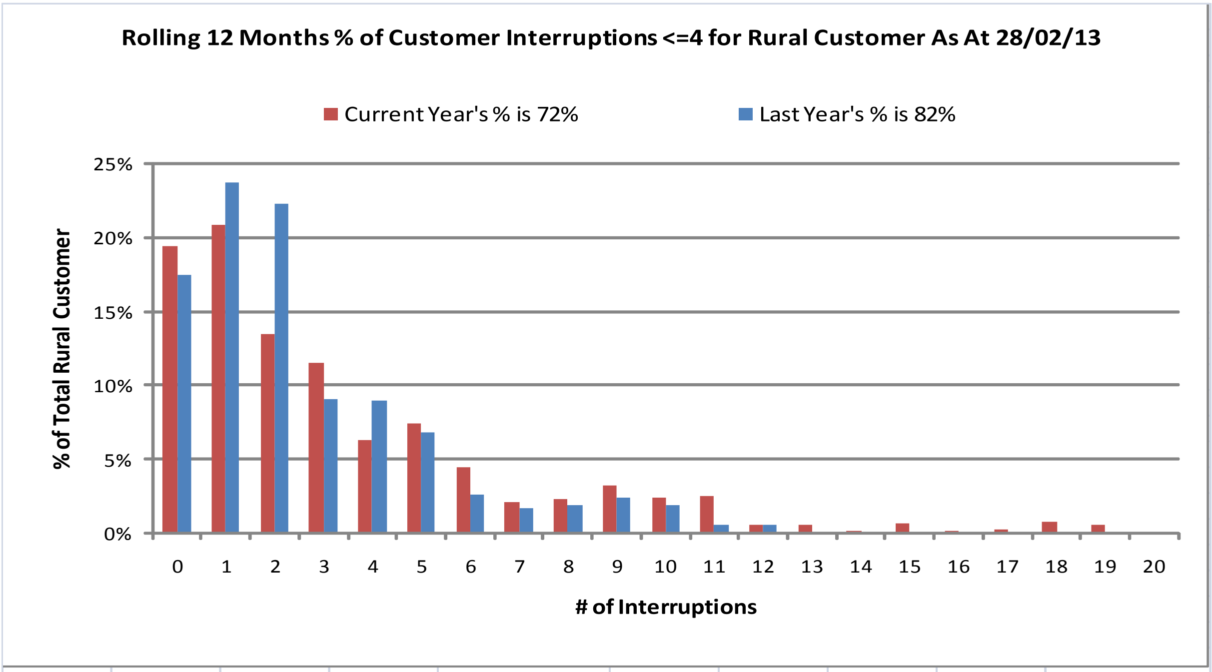


Figure 72. Rural customers against number of outages experienced.

We are aiming to bring rural customers with greater than eight interruptions back to less than eight interruptions per year. There were 2,109 rural customers who have experienced more than eight outages per year compared with 1,127 last year.

Urban Customers

The 12 month rolling average for repeated interruptions for urban customers with ≤2 interruptions as at 28/2/2013 is 94% with a target of 90%. Last year's performance was 97%. We are aiming to bring customers with greater than 4 interruptions back to less than 4 interruptions per year. There were 702 urban customers who have experienced more than four interruptions per year compared with 340 last year.

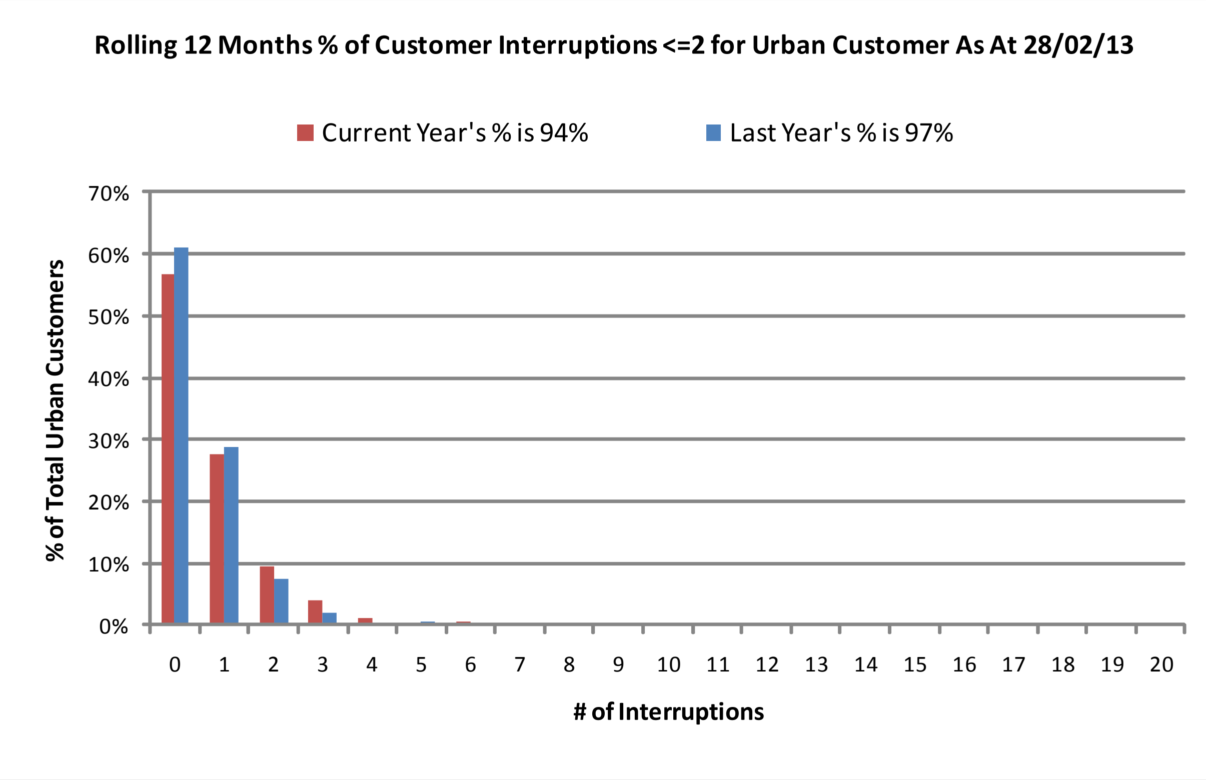


Figure 73. Urban customers against number of outages experienced.

Forward Focus

$1.1M was approved for 2012/13 year to replace and or upgrade worst performing feeders at Weavers and Raglan areas to reduce repeated customer outages. The focus is on 16mm^2 conductor, aging poles, crossarms and insulators.

$0.63M was proposed for a trial of enhanced earth fault protection via resonant earthing (Ground fault neutralizer) at Weavers Zone Substation.

The 2013 AMP includes a significant increase ($11.1M in total) for identified 16mm^2 copper (Cu) conductor replacements to improve rural reliability including repeated interruption reduction. There are 474km of 16mm^2 Cu conductor in WEL's network. The increased $11.1M funding only represents 17% of total 16mm^2 Cu conductor. The following graph shows the previous 12 months repeated interruption performance and proposed actions in the 2013 AMP.

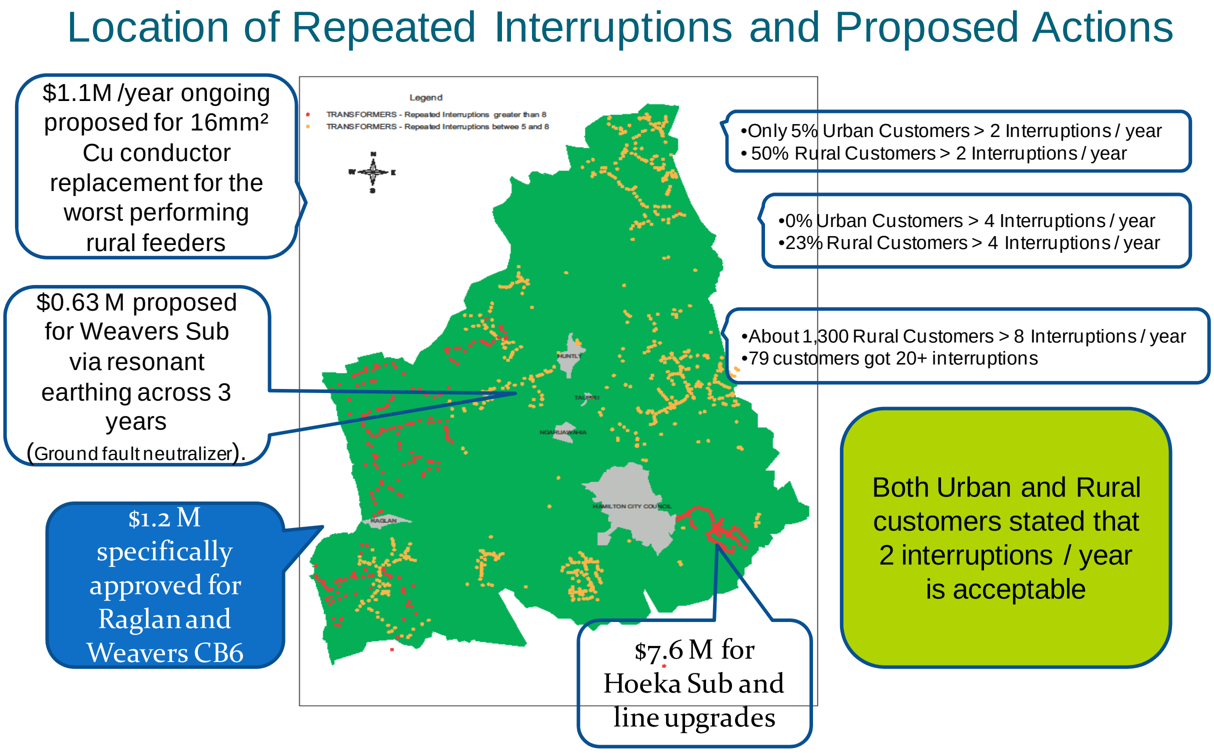


Figure 74. Location of repeated interruptions and proposed actions

WEL is developing a Condition Base Risk Management (CBRM) model for RMU and 11kV Conductor and its associated poles and crossarms. Most of the controllable interruption events were due to broken 16mm² Cu conductor in conjunction with adverse weather. It is expected that the detailed conductor replacement programme will be prioritised according to the CBRM results.

WEL trends reliability performance for total network, urban and rural customers including repeat outages and has set targets for rural and urban areas in relation to the number of outages on a rolling 12 month basis and its SAIDI performance for urban and rural respectively.

Secondary Customer Services Level

WEL has implemented a customer complaint and compliment process to improve the secondary customer service level performance.

The following graph shows the overall customer complaints and compliments for the period from 1 March 2012 to 28 February 2013. WEL has received far more customer compliments than complaints. Follow up actions resolved within 10 working days have been improved.

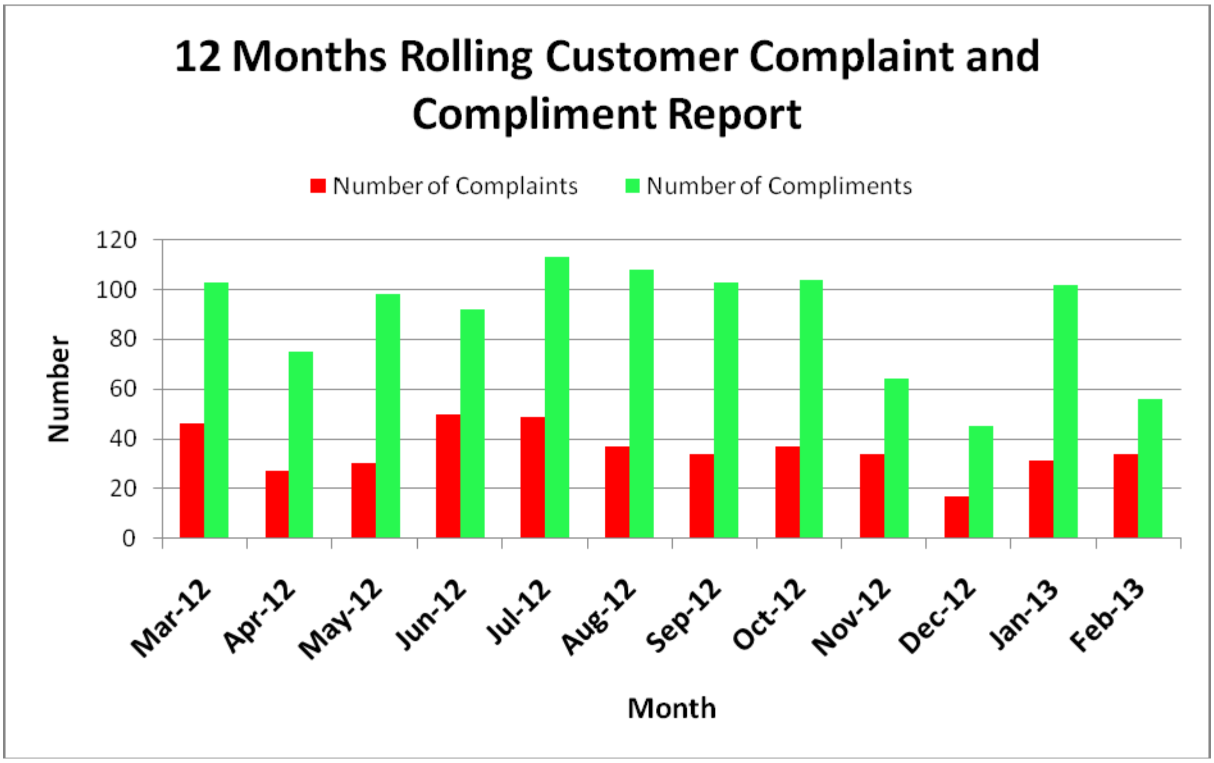


Figure 75. Monthly Customer Complaints and Compliments

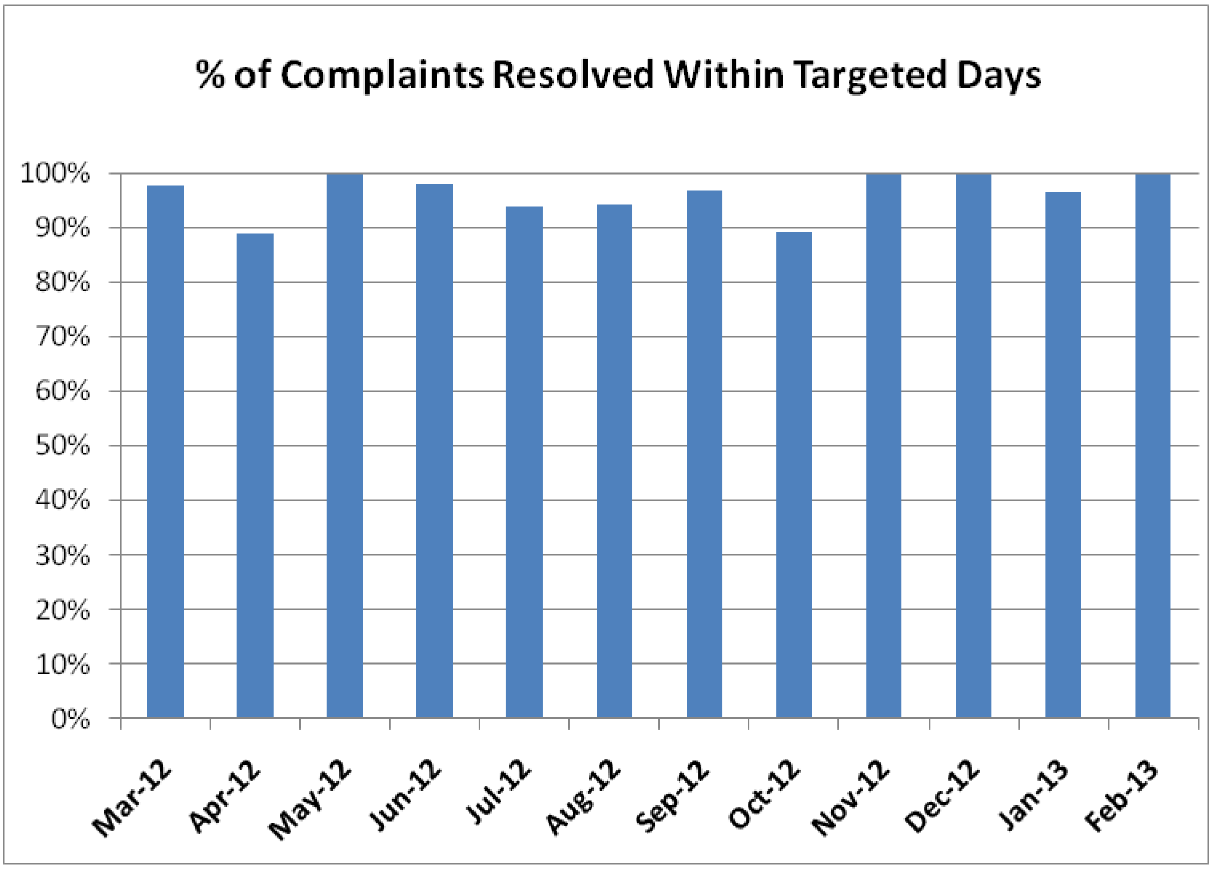


Figure 76. % of complaints resolved within targeted days

Operating Efficiency – Cost per Customer

Cost per Customer performance for the year 1 April 2011 to 31 March 2012 was $211 compared to a target of $217. Forecast cost per customer performance for the year 1 April 2012 to 31 March 2013 is $230 compared to a target of $232.

Delivery Efficiency – Billability and Productivity

Billability performance for the year 1 April 2011 to 31 March 2012 was 83% compared to a target of 80%. Forecast billability performance for the year 1 April 2012 to 31 March 2013 is 80% compared to a target of 80%.

Productivity performance for the year 1 April 2011 to 31 March 2012 was 94% compared to a target of 95%. Forecast productivity performance for the year 1 April 2012 to 31 March 2013 is 98% compared to a target of 95%.

Asset Efficiency – Load Factor

The top 100 peaks have been used for the following load factor graphs. The load factor for each GXP for the period from 1 April to 31 August 2012 including combined HAM is shown below:

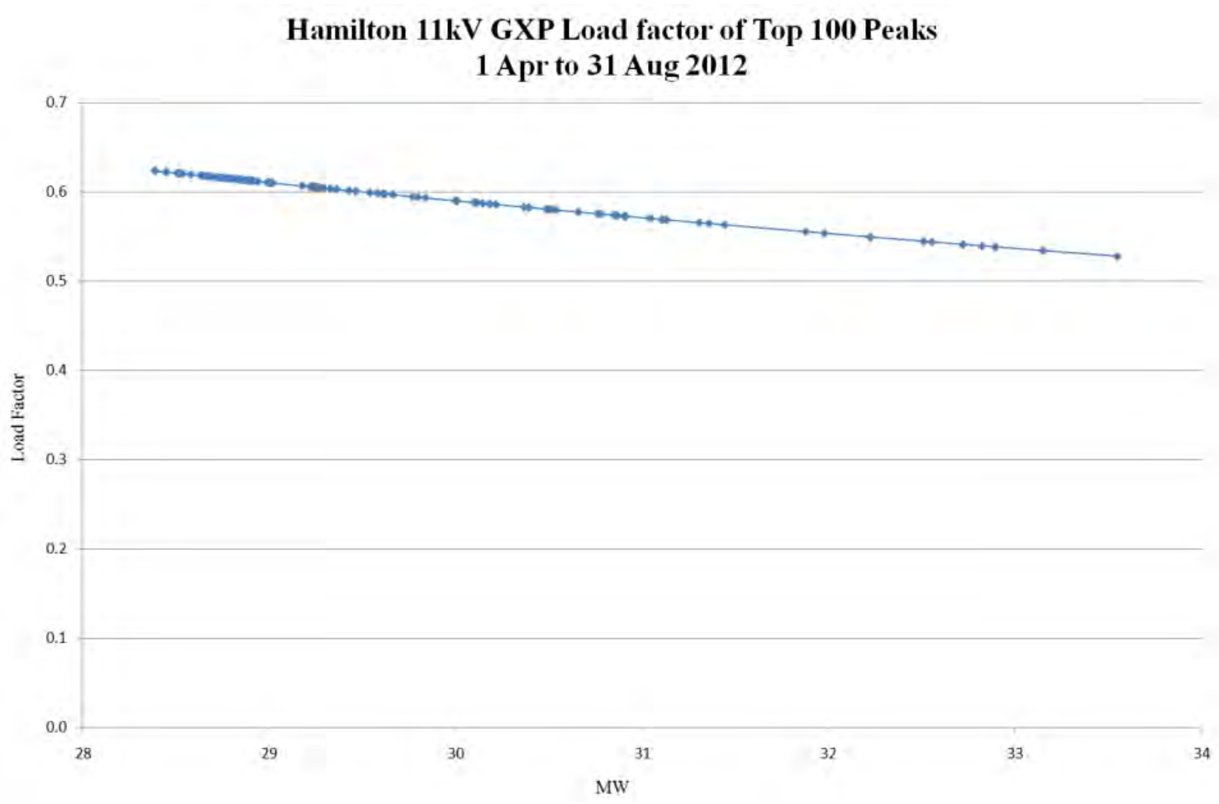


Figure 77. Hamilton 11kV load factor of Top 100 peaks

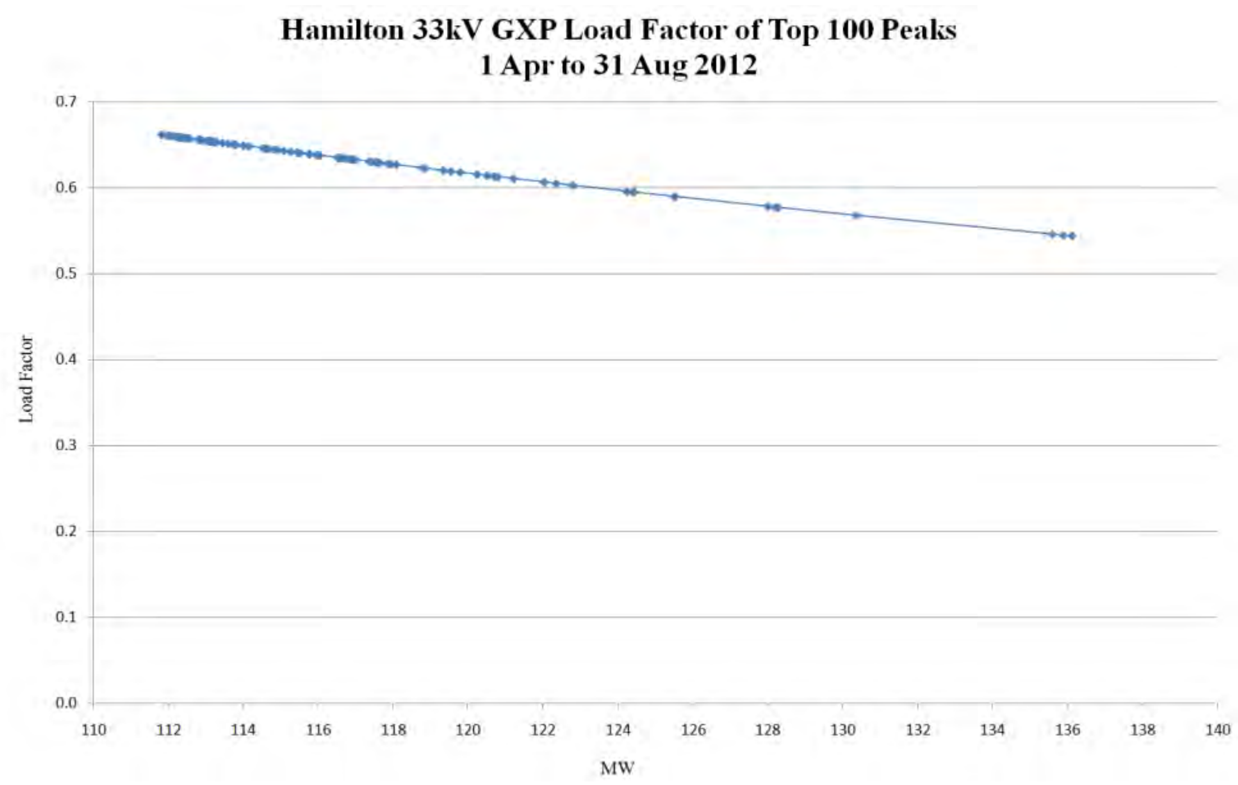


Figure 78. Hamilton 33kV load factor of top 100 peaks

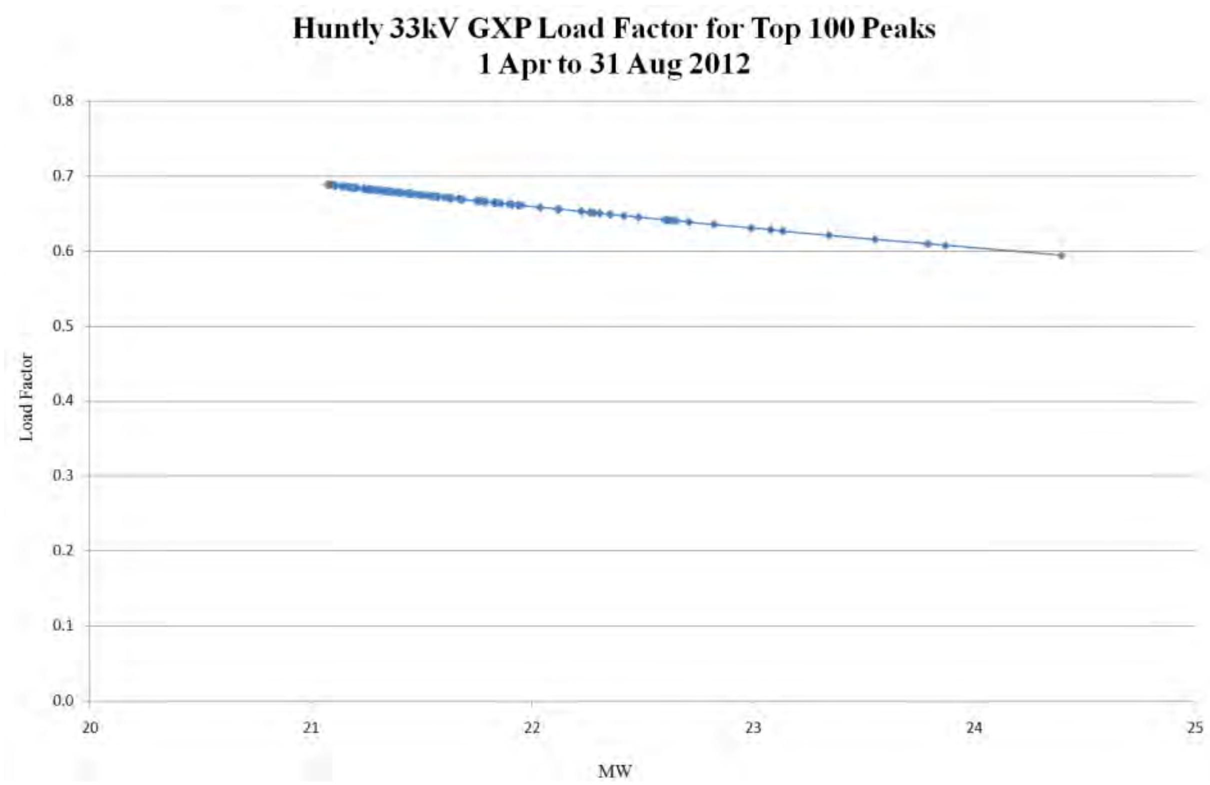


Figure 79. Huntly 33kV load factor of top 100 peaks

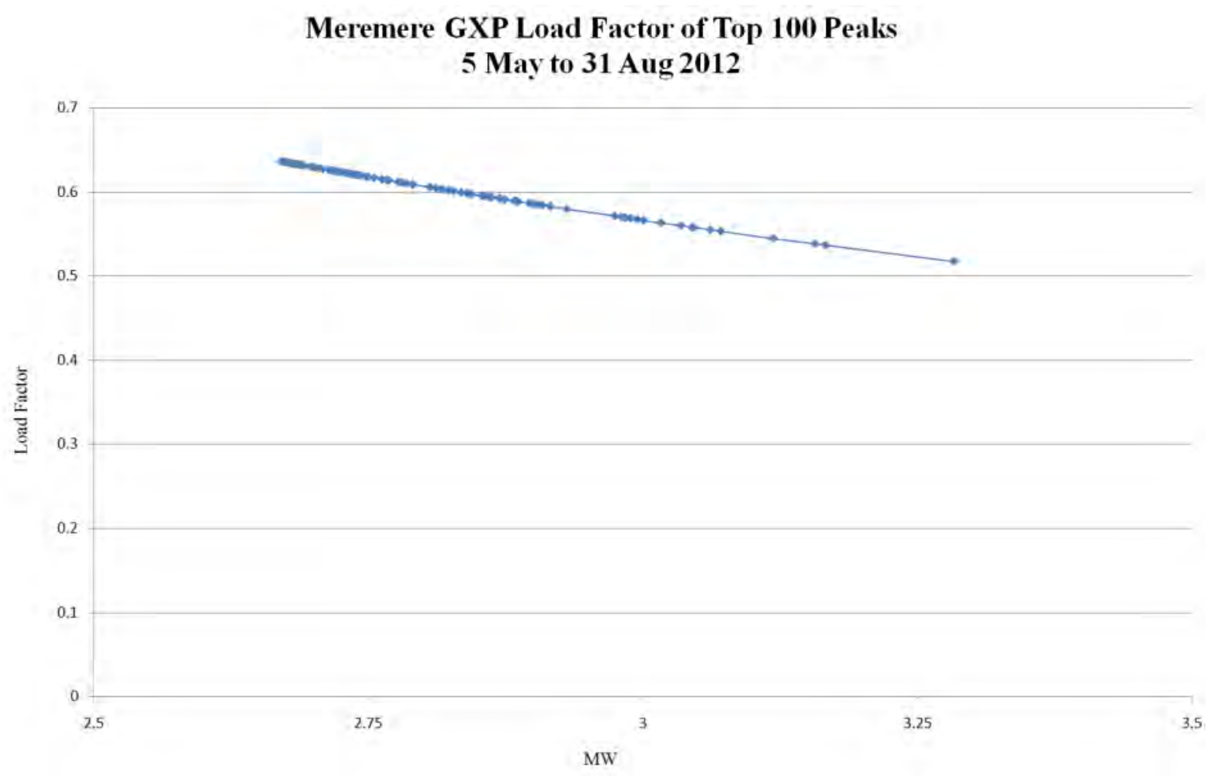


Figure 80. Meremere 33kV load factor of top 100 peaks

Note: Two substations where transferred to Huntly from Meremere between 1 April and 4 May 2012. This period was not considered in the computation of load factors.

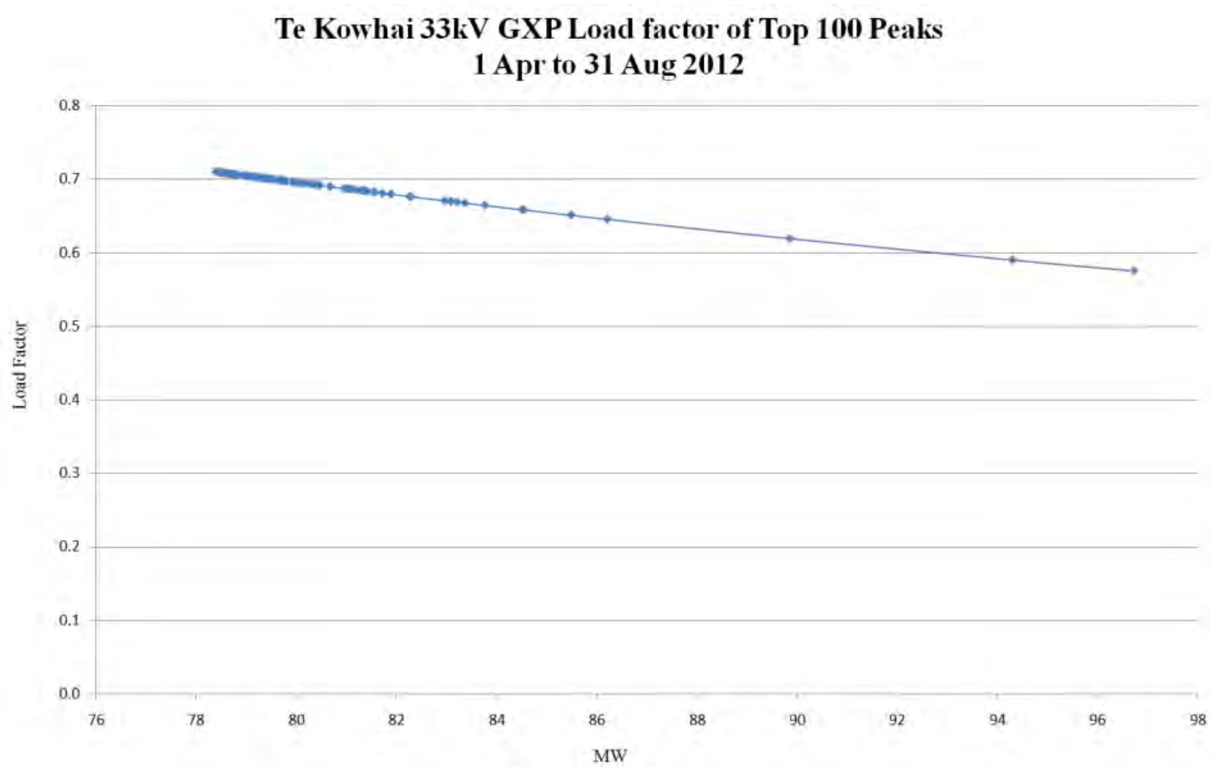


Figure 81. Te Kowhai 33kV load factor of top 100 peaks

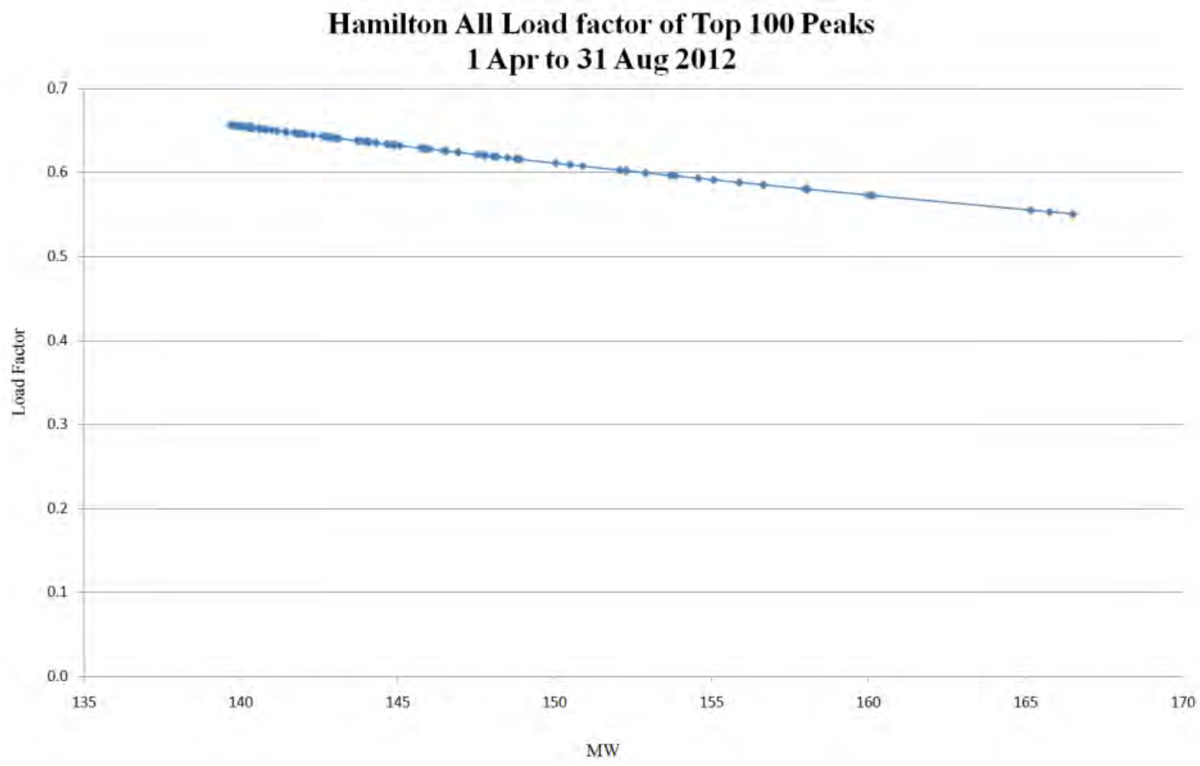


Figure 82. Combined Hamilton load factor of top 100 peaks

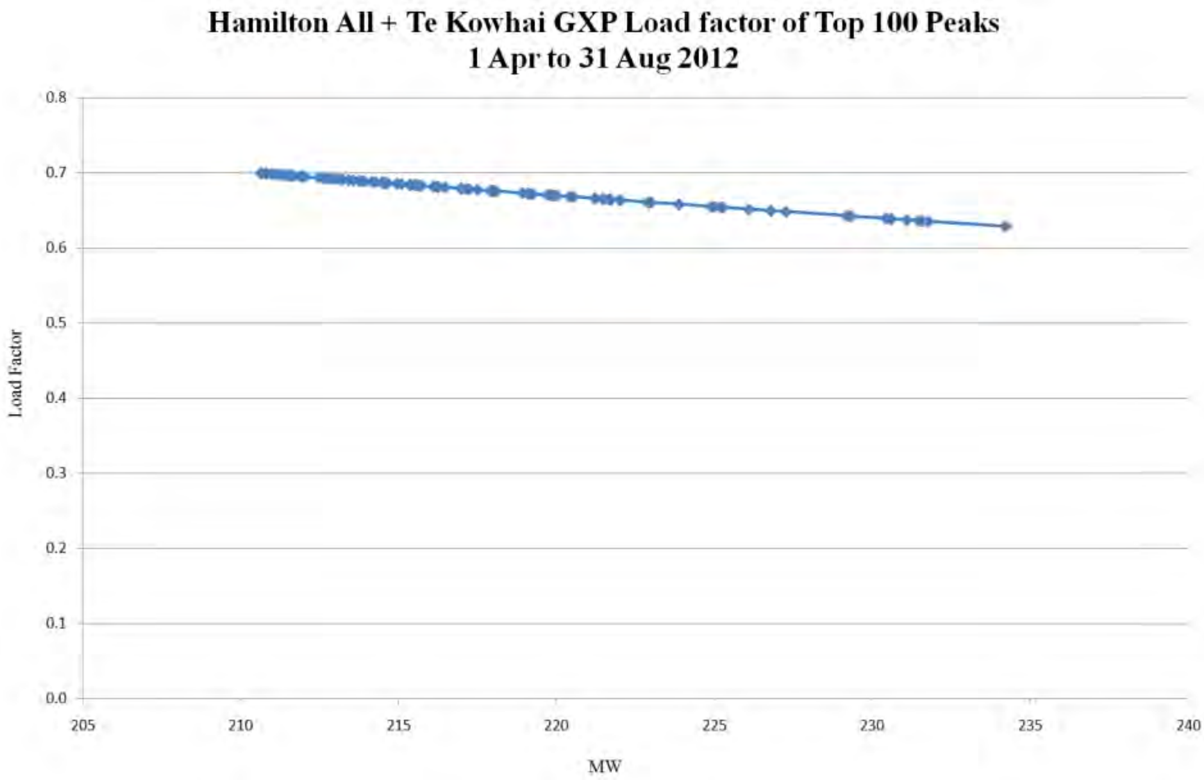


Figure 83. Combined Hamilton and Te Kowhai load factor of top 100 peaks

Asset Efficiency – Capacity Utilisation

WEL's utilisation is 32.9% for the year ended March 2012 against an industry average of 28.8%.

Low Voltage Complaints (LVCs)

The number of LVCs received and the number proven are reported monthly for comparison with the previous year's data. Table 31 below shows the comparison between the 2011/12 year and 2010/11 year. It shows a significant increase in LVCs that have been proven to be WEL's responsibility, over the last year compared to recent years.

This result has been somewhat expected as WEL deploys more of its Smart Boxes in the rural networks; over time complaints will reduce as WEL pro-actively identifies voltage issues and corrects them.

Year Ending	Proven WEL	Proven Customer	Proven WEL & Customer	Not Proven	Total
March 2011	3	4	1	2	10
March 2012	9	10	0	4	23
February 2013	7	11	1	11	30

Table 31 Low Voltage Complaints

The "Proven WEL" low voltage complaints have increased significantly for the year. "Proven WEL" complaints were found in the main to be due to too many customers connected to a single transformer.

All "Proven Customer" complaints were caused by clearly identifiable unauthorised increases in load from customers in rural locations.

WEL is continuing to focus on quality of supply and will be gearing up to meet the demands of the increased volumes of information being received from the Smart Boxes and other monitoring devices.

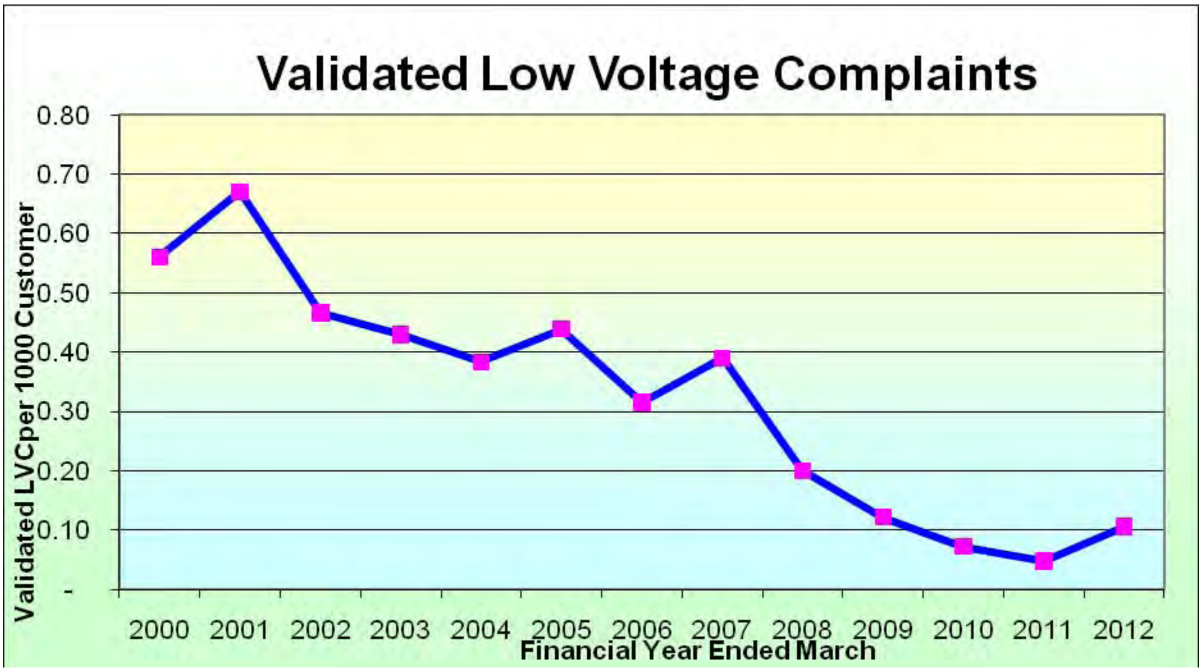


Figure 84. Validated LVC Per 1000 Customer Trending for WEL

8.4. Gap Analysis and Identification of Improvement Initiatives

Work Programme Delivery Including Capital Projects and Maintenance Programme

Capital Project Management - Physical and Financial

The following key initiatives aimed at reducing variance between the AMP and actual have been implemented during this report year:

- Implemented Prometheus scheduling model as a part of SAP implementation for daily scheduling works to ensure optimal in house resource planning for the effective and efficient delivery on maintenance and capital programmes.

The following key initiatives have been implemented in previous years:

- Established a Master Planner role to ensure optimal in-house resource planning for the effective and efficient delivery on maintenance and capital programmes.
- Formalised communication between project managers and schedulers to avoid resource conflicts and priority issues.
- Improved handover meetings from the design team to the capital project team and the works planning and scheduling team.
- More detailed design options completed before AMP approval. The first year in the AMP has been used as next year's budget with minor changes.
- Further refinement of staff structure to further enhance in-house project management capability and contractor management. More detailed resource planning before budget approval to ensure appropriate resource levels for the delivery of the approved capital programme.
- Improved handover from the Capital Project Manager back to the project owner and key stakeholders for sign off.
- Enhanced the internal review process for major capital project scope and pricing.
- Documented assumptions of key cost variables during asset management planning
- Centralised the internal design team to undertake most of the conceptual and detailed design and review and approve external design.
- Compatible Unit Estimation tool for cost estimation to help improve the productivity.
- PSS SINCAL 11kV model development to enable network optimisation and 11kV capability based protection setting, continue implementation of a combined model of 33kV and 11kV.
- Refinement of specific KPIs relating to quality and project scopes as part of the performance management system.
- Continued improvement of the GIS data collection and validation process which has ensured quality data is available in GIS for network planning, project delivery and operations.
- Network asset attributes have been validated in the field and entered into GIS and SINCAL.

- Enhanced process reporting between the Operations & Customer Delivery groups and the Asset Management group.
- Terminate major capital alliance contractors to improve contestability.
- The Works Delivery Master Process has been redesigned and implemented. The Works Delivery Master Process consists of four sub-processes: Customer Enquiries, Sizing and Design, Works Planning and Scheduling, Construction and Maintenance.
- Implementation of self audit templates to ensure onsite and offsite check lists for Maintenance, Overhead Services and Underground Services.
- Reporting - timely, high quality reports have been set up automatically for project managers to more easily gauge the financial situation. This reduces duplication and mistakes.
- KPIs have been established for project managers regarding project completion to quality standards, on time and within budget. These are assessed regularly during performance reviews.
- Asset commissioning and decommissioning processes have been implemented.

Maintenance Programme Delivery - Physical and Financial

WEL has initiated several maintenance initiatives over the last financial year. These and future initiatives are highlighted below:

- Improvements actions as identified in the Root Cause Analysis (RCA) meetings are raised in the Action Request System (AR), to ensure the identified opportunities are carried out.
- Lists of defects and poor condition assessments are being captured into the CMMS and are being programmed for corrective action based on priority. Priorities are being determined by position in the network (impact of failure) and from the condition grading (probability of failure).
- A major programme to internally inspect and change the oil of all oil filled ring main units was undertaken. This was prompted when a failure was experienced where the switch contact travel was found to have been maladjusted during manufacture.
- Inspection data is being used to target particular areas for significant upgrade.
- Corona discharge testing is being performed on feeders where there are high incidences of insulator failure.
- A new technique was used for the assessment of wooden poles. This uses radiation backscatter to measure the pole density and remaining strength.
- A full inspection of service pillars has been completed to ensure public safety.

Defect correction will target the removal of line tap connectors on overhead circuits, replacement of kidney insulators, and the change to a delta conductor configuration on a number of rural circuits. Increased frequency of inspections will give improved condition information for future asset replacement projections.

Initiatives to Improve Safety

Safety is not negotiable to WEL. WEL is committed to achieving no lost time injuries (LTIs). WEL introduced a Field Action Reporting (FAR) procedure. One of the objectives of this procedure is to identify previously unrecorded hazards for which controls currently do not exist.

WEL has undertaken four on-line safety climate surveys over two years that measured the perception of field service personnel in the following key areas:

- Know what to do (vision, values, performance expectations and accountabilities)
- Ability to do (knowledge, skills and experience)
- Equipped to do it (resource, tools, procedures and systems)
- Want to do it (personal motivation, morale, feedback and recognition)

Apart from the above, the survey also measured the perception of the field service supervisors and employees how different groups within the organisation interact with one another and also safety culture indicators.

The workshops held in the week after the surveys have revealed valuable insight into the thinking of the front line personnel. The action planning workshops, where the chief executive, senior managers and representatives from the field are present, developed several action plans that helped improve the safety climate within the organisation.

WEL intends to repeat the survey in August 2013 to measure where it stands compared to the benchmark set in the two years when the survey was undertaken.

All staff are encouraged to continually assess their working environment for the possibility of hazards. When a new hazard is identified, this is recorded on a Field Action Report. Upon receipt of a new report it is investigated. The response depends on the combined weightings of consequence and likelihood. Controls are identified and developed through a number of forums:

- Monthly Health and Safety Committee meetings
- Monthly team briefings
- Incident investigations

Once a suitable control has been established an owner is assigned to each control. The ownership responsibilities include conducting assessments to ensure the controls are still effective and appropriate. If an incident occurs, then other similar situations within the network will be checked to ensure that the incident cannot be repeated. This process satisfies the very core of the Health and Safety in Employment Act, with its proactive, responsible approach to identifying risks and implementing appropriate controls.

The resources provided include; site inductions, six monthly safety refreshers, safety equipment, operator training, active fatigue management, first-aid facilities, counselling services, and annual health assessments (including drug testing).

The health and safety process is integrated into the business management system. The business management system has been regularly audited to ISO 9001:2008. The audit periods have been steadily extended, from the initial six monthly reviews, then to nine months and now to 12 monthly intervals.

The FAR system provides feedback to senior management so that they can monitor the effects of the programmes. Health and safety performance is reviewed as follows:

- Review at the weekly executive management meetings
- Review for the adequacy and effectiveness of the hazard controls by the Health, Safety and Compliance Manager, occurs periodically and when needed
- Regular site safety audits by the Health, Safety and Compliance Manager
- Periodical risk management audit by the Risk and Quality Auditor.

These measures have resulted in very few lost time injuries while field staff numbers have increased from 63 in May 2006 to over 100 as of now.

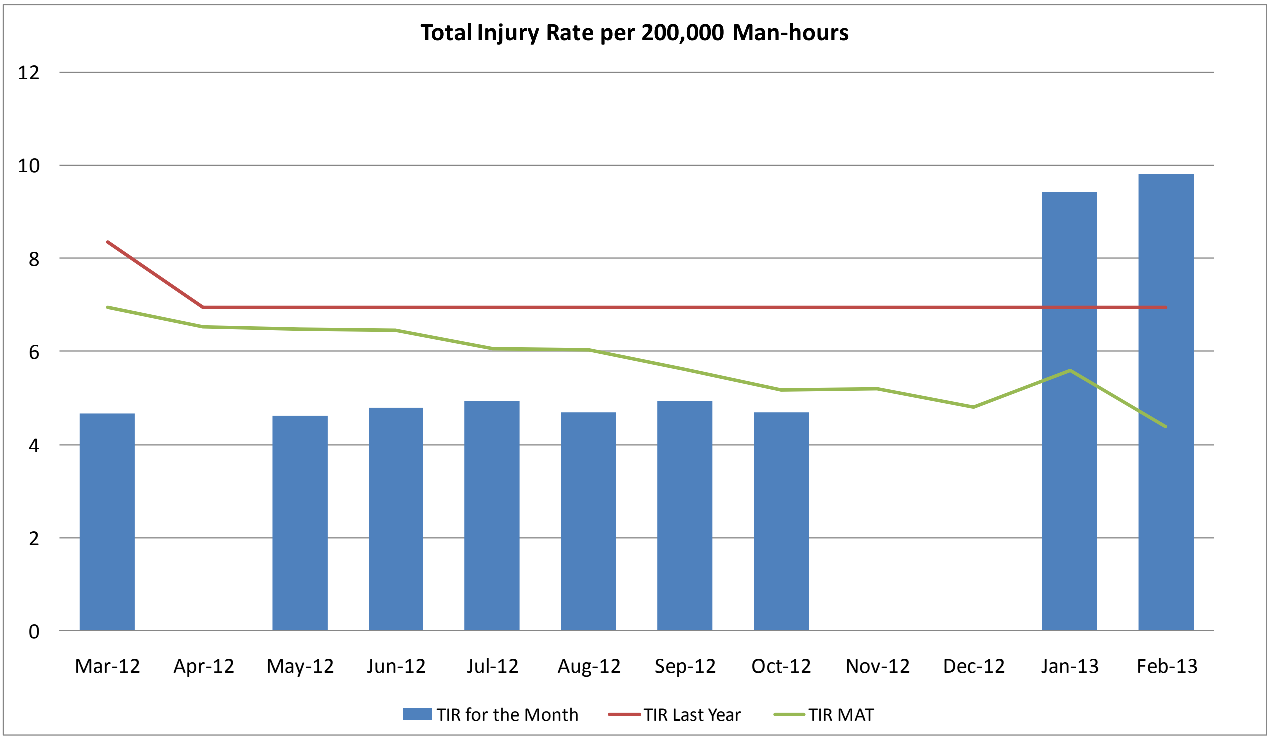


Figure 85. Total Incident Rate (TIR) 12 Month Rolling Average

The TIR (Total Incident Rate) is measured per 200,000 man hours. TIR includes both LTIs and Medical Treatment Injuries (MTIs). This is done to bring focus and attention to MTIs which are one step below the LTIs in the injury pyramid.

WEL Networks met the secondary level accreditation requirements for ACC Workplace Safety Management Practices at the initial audit in February 2008 resulting in a discount of 15% in the levies WEL pays. This was upgraded to tertiary level accreditation, which receives a discount of 20%, subsequent to a successful audit in February 2010. WEL retained its tertiary certification in the latest ACC WSMP audit in February 2012.

Initiatives to Improve Reliability

We have trended SAIDI down to the benchmark set by the top five performing companies, but are under increasing cost pressure to maintain this – e.g. traffic management, safety compliance, significant back-up generation costs, premium of live line work, and ageing assets. As the load on the network has increased and capital projects have been undertaken to accommodate the increased load, reliability issues caused by inadequate protection have been experienced. These have been addressed using the process outlined below.

- Network planning - Introduction of concept of network resilience measured by value of lost load (VOLL)

  A more robust option analysis across medium to long term network development projects has been initiated introducing resilience impact measured by value of lost load (VOLL). The process has been applied for 3rd Transformer in Tasman substation versus Rotokauri substation under different growth rate scenarios.

- Network design - Gap analysis on potential reliability impact due to historical legacy design

  The security and reliability gap analysis has identified 11kV spur cables with excessive transformer numbers connected and prioritised for remedial action.

- Review of protection philosophy

  In addition to 11kV capacity protection implementation, a further review of the protection philosophy was completed for the 33kV meshed network. WEL decided to complete a 33kV protection upgrade from distance protection to differential protection in a period of 6-8 years. WEL decided to accelerate the programme from 4 years to 2 years to mitigate identified cascade failure risks.

- Condition Based Risk Management (CBRM) asset replacement programme

  WEL is developing a Condition Base Risk Management (CBRM) model for RMU and 11kV Conductor and its associated poles and crossarms. Most of the controllable interruption events were due to broken 16mm^2 Cu conductors in conjunction with adverse weather. It is expected that the detailed conductor replacement programme will be prioritised according to the CBRM results. WEL is planning to expand the CBRM model development for other asset categories.

- LV network adjustments

  The construction of new zone substations has highlighted the need to upgrade conductor ratings for existing feeders, adjust distribution transformer voltage taps and reconstruct line configuration to prevent line clashing due to increased fault levels. Some equipment, such as reclosers, is being relocated to more effective positions.

- Continuing maintenance and defect correction

  Planned maintenance and defect correction programmes will continue into the future.

- Improvements to asset management and works delivery processes

  Structural changes have been made in the asset management and works delivery areas to better align with defined processes. A dedicated design group has been formed to provide scoping, detailed design and cost estimates for all construction work. Estimating functionality in the CMMS has been implemented to assist in this work. This will lead to better productivity, improved consistency and better adherence to the design standards. These are expected to flow through to improved reliability.

- Planned maintenance work practices

  Planned maintenance work practices have been adapted so that work orders for all planned work for the year are now being generated and scheduled in advance by the Maintenance Planning Group. A similar process is being followed for asset replacement work.

- Repeat outage performance

  WEL will continue to work to improve repeat outage performance especially in rural areas. Several reliability projects included in each year are mainly aimed at improving reliability performance in rural areas including repeat outage performance. Increased spend on vegetation management will also improve reliability.

  Particular attention will be given to reducing the number of customers who have had more than four outages in the last two years in rural areas. A comprehensive analysis on worst performing feeders of repeated outages has been completed. Many projects have been developed. Cost $ / SAIDI minute and cost $ / repeated outage reduction and variance between cost and VOLL have been developed and used for project prioritisation. About $1.1M per annum was included in 2013 AMP to undertake point to point asset replacement projects for prioritised worst performing feeders.

Photo 22 Te Uku wind farm

8.5. Ongoing Work For Reliability Improvement

Reliability improvement work and study is continuing as discussed below.

Asset failure modes and maintenance strategies

WEL continues to review asset failure modes and reassess maintenance strategies. More information is being collected and recorded about faults and the quality and accuracy of fault information improved. This will allow WEL to better identify the asset type, the failure mode and the root cause of the failure. The improved information and analysis is allowing WEL to make more accurate assessments of underlying causes which is enabling the development of improved solutions to problems. A CBRM tool to allow the statistical analysis of failure data and optimize maintenance strategies will be developed in the current period.

Root Cause Analysis (RCA) of significant events

WEL continues to apply Root Cause Analysis (RCA) of significant events to identify new failure modes and risks. This information is used immediately to identify where maintenance practices can be improved to prevent re-occurrences. All high voltage faults are being reviewed to understand whether they are preventable or can be prevented by improved maintenance planning, work practices or materials. Opportunities to minimize the impact of faults through improved network design are also considered.

Data collection

Data continues to be added to WEL's Computerised Maintenance Management System (CMMS). Over the longer term this will provide information that will allow WEL to continually improve asset replacement and maintenance strategies and therefore improve reliability and reduce costs. Significant steps have been taken over the last year to improve the accuracy and consistency of asset related data. This has involved field validation of data in many cases. A team has been set up with specific responsibility to manage the data within GIS, the CMMS and Financial Asset Register and ensure user information requirements are met.

Initiatives to Improve Secondary Customer Service Levels:

The Action Request (AR) system has been used from October 2009 to record and monitor the resolution of customer complaints/compliments. The issue of AR for customer complaints/compliments does not require prior consultation with the recipient. However, improvement on customer complaint resolution has only covered a small part of customer services improvement.

The following key initiatives aimed in improving customer services have been implemented during this report year:

- Review end to end process for customer connection jobs from customer enquiry to final completion. A customer project team was established to accelerate the quotation process.
- Timeliness measures were established to improve the timeframe from customer's enquiry to quote provided, and from quote acceptance to job completion.
- SAP system enhancement has been completed to support the above initiatives.

The following key initiatives were implemented in previous years:

- A customer service team was established to improve customer services performance including customer complaint/compliment process.
- Executive management were to ensure the process is applied in order to catch all customer complaints/compliments and register them in the AR system.
- The number of customer complaint ARs increased since October 2009. A report which shows the trend, in percentage term, of the ARs going overdue was included in the monthly report.
- The customer complaints and compliments process was amended so that the Chief Executive was also informed of any 'Public Safety – Electrical' complaints.
- Any customer complaint resolution that takes more than 10 days was included in the monthly management report.

Initiatives to Improve Operating Efficiency – Cost per Customer

WEL has implemented a very comprehensive performance management framework. Each cost item has been assigned clear management accountability in order to deliver the required business outcomes at lowest cost. Regular performance monitoring for preventative and corrective actions is in place. Effective and efficient delivery of the maintenance programme is the key driver. A continuous improvement project has been approved to identify inefficiencies and improvement opportunities.

Initiatives to Improve Delivery Efficiency – Billability and Productivity

The current billability measure as defined in Section 4.4 takes into account acceptable and measurable non productive factors such as annual leave and training time, and thus the target cannot be increased without a change in the measure itself. The monthly result may vary from the target depending on the timing of training schedules and annual leave requirements. The 80% target should therefore be viewed as an optimal point rather than a target to be improved on.

However, this measure should be monitored on a micro level by the managers responsible for the resources to ensure all staff are being utilised as efficiently as possible. As managers have the responsibility to approve time sheets, they should be immediately aware of any non productive issues that arise.

Unlike billability, continuous improvement is possible with the productivity measure. There are two sides to this measure - firstly, getting the estimate as accurate as possible in the most efficient manner, and secondly, completing the site work as efficiently as possible without compromising safety and quality.

To improve the estimated/planned costs the following areas are improvement opportunities:

- Our estimators need to gain more experience in estimating and using the systems available.
- Due to heavy workloads, sufficient time to complete "on site" scoping of the work has not always been possible, but as backlogs are addressed more site visits will improve the accuracy of planned costs.
- The accuracy and ease of using the CUE will also improve the ability to produce an accurate estimated/planned cost for the job.

To improve the onsite component of the productivity result the following areas need to be improved:

- Better job planning/scheduling with minimal disruptions to the work plan.
- Comprehensive and complete job pack information given to field staff.
- Correct and sufficient tools and plant available for the task.
- Competent and motivated staff.
- The optimum staff level to complete the task safely & efficiently.

Initiatives to Improve Asset Efficiency – Load Factor

WEL is working to improve its load factor and efficiency of the system by reducing network peak demand for electricity without sacrificing reliability and customer service. WEL has embarked on a programme of demand management. Currently, load control is performed during winter, shifting loads between the Upper and Lower North Island GXPs to minimize peak at a GXP where the other GXP has a relatively low load. By doing so, WEL also helps in reducing the regional demand for both Lower and Upper North Island.

WEL is continuing to investigate innovative ways of reducing peak demand and improving customer load factor on our network. This is achieved by firstly ensuring that connection capacity is optimised via our customer management processes and secondly by working with customers to help them reduce, shift or utilise spare capacity within their plant and facilities to achieve a win-win situation. Industrial and commercial customers and developers receive consultancy advice on load management. Peak demand reduction can be achieved through improved understanding of the WEL demand tariff. To assist with this WEL has developed a range of tools that include demand signalling and control devices for its customers within Hamilton.

We are also looking at ways to deliver greater value to residential opportunities and have trialed devices that allow non mission-critical commercial plant and appliances (dishwashers, clothes driers and washing machines etc.) to be cycled or turned off during the network demand periods. This is extending to include adjustment of heat pump temperature settings to maintain comfort during peak demand events.

An example of these services is work with primary schools which has identified significant opportunity for heating load management to improve the load factor of school facilities during the morning demand period, or getting them to shift to more energy efficient technologies like heat pumps and insulation. This work is undertaken to improve the load factor, through smarter operation of electric heaters during demand periods, as well as the learning environment for children in the WEL Network area.

Overall Quality of AMP Planning and AMP Itself

The following section summarises differences between the 2013 AMP and indexed 2011 AMP in order to highlight recent improvements.

Capital Expenditure

KEY CHANGES FROM INDEXED 2011 AMP	
Customer Connection	$10.1M increase is estimated based on updated information
System Growth	$6M increase mainly due to late start of deployment of Smart Box project, rearrangement of PEA substation project and potential purchase of Transpower's asset
Reliability, Safety and Environment	$8.3M increase wasmainly due to: • Seismic strengthening noting experience from Christchurch earthquake, • Low Voltage Complaints and voltage issues identified from Smart Box installation. • Inclusion of enhanced earth fault protection via resonant earthing (Ground fault neutralizer) at Weavers Zone Substation to improve reliability. • Ongoing development of the comms network to utilise new fibre links (i.e. connecting new 33kV Unit Protection schemes, disconnecting old copper pilot wires) and increased resilience of communication network.
Asset Replacement and Renewal	$11.0M increase mainly due to identified 16mm² copper conductor replacement to improve rural area reliability including repeated interruption reduction.
Asset Relocations	$6.5 decrease based on updated information

Table 32 Key Changes from indexed 2011 AMP for the same period

A summary of changes from the 2011 AMP for the same period from April 2012 to March 2023 is shown in the following table:

11 Year Capital Spend Profile Comparison Between 2013 AMP and indexed 2011 AMP					
Total Network Capital Expenditure	**2013 AMP**	**2011 AMP + 2.5% cost increase**	**Total Variance**	**Variance (Year 1-5)**	**Variance (Year 6-11)**
Customer Connection	76,886	66,797	(10,089)	(3,917)	(6,171)
System Growth	153,110	147,113	(5,996)	(6,901)	905
Reliability, Safety and Environment	20,695	12,427	(8,267)	(5,747)	(2,521)
Asset Replacement and Renewal	118,504	107,491	(11,012)	(3,689)	(7,323)

Asset Relocations	29,685	36,209	6,524	3,643	2,881
Total Capital Expenditure	**398,879**	**370,038**	**(28,841)**	**(16,611)**	**(12,230)**

Table 33 11 Year Capital Spend Profile Comparison Between 2013 AMP and indexed 2011 AMP

The figures from the 2011 AMP have been adjusted by 2.5% using weighted average of internal labour increase and construction PPI.

Individual project scopes and timing have been reviewed and adjusted accordingly.

Maintenance Strategy and Expenditure

Key changes from the indexed 2011 AMP for the same period are summarised below:

- An increase in faults expenditure is due to current and forecast increases in the volume of low voltage faults and increased service costs.
- A decrease in the distribution lines expenditure is due to less follow-up remedial work being required, and less maintenance required on new assets.
- The vegetation increase is due to the proposed increase in the number of inspections per month to gain a better understanding of the number of priority 1 encroachment sites. The increased inspections are likely to result in additional non complying sites and therefore a one off increase of $300K in the vegetation management budget provision for the 2013/14 year has been allowed to ensure compliance can be achieved as additional breaches are discovered. The additional information will help us gain a better understanding of tree compliance issues. This may result in an increase in the ongoing future vegetation management budget. Future budget requirements will be reviewed and incorporated in the next years AMP.
- There are no major variances in zone substations expenditure, wind farm lines & and substation maintenance and project driven OPEX.
- An increase in SCADA expenditure is due to new communications equipment being installed and requiring additional maintenance as per the asset replacement program.
- A decrease in the provision for faults external subdivisions is due to the recent sale of some external subdivisions and current historical spend requirements.
- A decrease in the provision for Smart Box and associated communications maintenance after Smart Box installation is due to slower rollout than initially budgeted and the current maintenance costs lower than expected.

Key changes from the 2011 AMP for the same period from April 2012 to March 2023 are shown in the following table:

11 Year Maintenance Spend Comparison Between 2013 AMP and Indexed 2011 AMP			
Maintenance	**2013 AMP**	**2011 AMP plus a cost index of 2.5%**	**Variance**
Faults	26,664	24,799	(1,865)
Distribution Lines	27,614	28,722	1,108
Vegetation Management	13,411	12,963	(448)
Zone Substations	8,422	8,567	145
SCADA	1,688	1,330	(358)
Faults External Subdivision	435	564	129
Project Driven Maintenance Expenditure	2,948	3,066	118
Wind Farm Maintenance	508	564	55
Smart Meter Maintenance	1,005	2,121	1,116
Total	**82,695**	**82,695**	**0**

Table 34 11 Year Maintenance Spend Profile Comparison Between 2013 AMP and indexed 2011 AMP

The figures from the 2011 AMP have been adjusted by by 2.5% using weighted average of internal labour increase and construction PPI.

There is no increase in spend over the 11 year period.

APPENDIX 1 Glossary of Terms

The following represents a list of terms encountered in the text and their associated meanings.

Term	Meaning
ABS	Air Break Switch
Annual Business Plan	The WEL plan consolidating objectives and financial expenditure for a given financial year.
Best Practice	A practice identified through international Benchmark Studies to give the most cost-effective improvement in asset management or other core business performance.
CAD	Computer Aided Drawing
CAIDI	Customer Average Interruption Duration Index is the average total duration of interruption per interrupted customer.
CB	Circuit Breaker
CBD	Central Business District
CMMS	Computerised Maintenance Management System
Connection and Disconnection	Connection/disconnection of service mains to or from overhead or underground LV networks including the removal, reinstatement or installation of neutrals.
Consumer	Refer to Electricity Act 1992. WEL use the term Customer. Refer to the definition of Customer. See also definition of User.
Continuous Improvement	Recurring activity to increase the ability to fulfil requirements.
CPC	Cost per customer – Internal measure of operating efficiency.
Customer	The end user or beneficiary or purchaser of a product or service, either internal or external to the organisation.
Defect	Substandard workmanship, product or service resulting in the non-fulfilment of intended usage requirements.
DG	Distributed Generation.
Distribution Line	[Ref NZECP 34] Means works that are owned by WEL used for the conveyance of electricity to one or more electrical installations.
Division	A WEL division or section under the control of an executive manager.
DMS	Distribution Management System, a semi-geographical operator interface linked with SCADA within NMS, to manage the distribution system.
DM	Demand Management
Equipment	Electrical apparatus, distribution or sub-transmission circuits or plant that forms part of the network. Used with the same meaning as "Fittings" as defined in the Electricity Act 1992.
Field	The location where the work is being carried out.

Fixed Asset	A purchase of >$200 with an intended life cycle of > 1 year.
FRS-3	Financial Reporting Standard – Version 3
GIS	The Geographic Information System used for electronic mapping of the Network.
Grid Exit Point (GXP)	The point at which WEL Equipment is deemed to connect to the Transpower Grid System. The term is interchangeable with POS.
High Voltage (HV)	Any voltage exceeding 1000 V a.c. or 1500 V d.c. but usually pertaining to the 11kV or 33kV distribution system.
ICP	Installation Control Point. A number that uniquely identifies each connection to an electrical lines network that is recorded in a national registry.
IHD	In home display. A display associated with Smart Boxes that allow customers to see and manage their power use.
Inherent Risk	The level of risk that exists before any risk treatment measure or control has been implemented.
Inspection	Activities such as measuring, examining, testing and gauging characteristics of a product or service.
Kaizen	A methodology used for continuous improvement.
Key Performance Indicator (KPI)	A standard unit of measure used to enable comparative analysis between organisations or within an organisation.
Lines	The LV and HV network of overhead and underground electricity conductors and cables and their associated equipment such as insulators, poles, crossarms etc.
Low Voltage (LV)	Any voltage exceeding 32 V a.c. or 115 V d.c. but not exceeding 1000 V a.c. or 1500 V d.c.
LTI	Lost Time Injury
LVCs	Low Voltage Complaints – from customers. These are investigated by WEL.
MTI	Medical Treatment Injury
N-1 security	A load is said to have N-1 security if for the loss of any one item of equipment, supply to that load is not interrupted or can be restored in the time taken to switch to alternate supplies.
Network	Utility reticulation system or asset owned by the utility Company, Trust or other body having control and/or ownership in the utility reticulation system including the land, buildings, installations, individual customer connections up to the point of supply, and other improvements on or under which the utility reticulation system is located.
NMS	Network Management System consists of SCADA, DMS, OMS, TCS, and Load Management.
ODV	Optimised Deprival Value
OMS	Outage Management System
Ownership Boundary	The boundary between the equipment owned by WEL and the equipment owned by the Customer. See also Point of Demarcation.
Point of Connection	The point at which a Customer's Equipment is deemed to connect to the Distribution System.

Point of Demarcation	The point at which a Customer assumes authorised control and maintenance of their system.
Point of Supply [POS]	In this document is defined as the point at which WEL equipment is deemed to connect to the Transpower Grid System. The term is interchangeable with GXP.
PSS SINCAL	Power flow modelling software
QMS	Quality Management System - A system that provides processes to assist achievement of the business critical success factors.
Quality	The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs, i.e. "fitness for purpose for intended use".
Quality & Safety Procedures	Detailed description of process activities, records and applicable specifications.
RC	Resource Consent
RCM	Reliability Centred Maintenance – A process to develop and optimise maintenance strategy.
RCPD	Regional Coincident Peak Demand used by Transpower for connection charges.
Reliability	The ability of an item to perform a required function under stated conditions for a stated period of time.
Residual Risk	The remaining level of risk after risk treatment measures has been taken.
Retailer	An electrical energy supplier who has a User Supply Agreement with WEL Networks.
Risk	A combination of the probability (likelihood) and consequences, positive or negative, of an event. In some situations, risk is a deviation from the expected.
Risk Management	AS/NZS 4360 defines risk management as a term applied to a logical and systematic method of identifying, analysing, evaluating, treating, monitoring and communicating risk associated with any activity, function or process in a way that enables maximisation of benefits or minimisation of losses or detrimental effects.
RMC	The Risk Management Committee comprising duly appointed managers responsible for review of WEL's risk management process.
RMD	The Risk Management Database located on InGrid, the WEL Intranet. This is the software application used to record and assist with analysis and management of risk.
RMU	Ring Main Unit
RTAP	The Risk Treatment Action Programme function that specifies what additional action is required, by whom and by when, to further mitigate a risk.
RTU	Remote Terminal Unit – Communications device used for relaying data from the field.
SAIDI	System Average Interruption Duration Index is the average total duration of interruption per connected customer.
SAIFI	System Average Interruption Frequency Index is the average number of interruptions per connected customers.
SCADA	System Control And Data Acquisition System which is part of NMS is the primary tool for monitoring, controlling and switching operations for WEL's Network.

Smart Box	An intelligent network device located at customer premises to deliver real time monitoring of power quality and consumption and to provide load management.
SR-EI	The Safety Rules Electricity Industry July 2000
Stakeholder	People and organisations who may affect, be affected by, or perceive themselves to be affected by, a decision or activity.
Standard	The document that prescribes the requirements with which the product or service has to conform. The criteria for acceptable levels of safety performance/behaviours set by WEL Networks, industry codes or relevant legislation.
Standard Operating Procedure	A locally controlled work method statement or 'desk top' file.
Supplier	Organisation that provides a service or product to the customer: – in a contractual situation the supplier may be called the contractor – the supplier may be the producer, distributor, importer, assembler or service organisation – the supplier can be internal or external to the organisation
SYSCON	The WEL Networks Ltd network system control centre and the distribution network controllers.
Territorial Authority (T/A)	The controlling authority having control and responsibility for roads and road reserves.
TIR	Total Incident Rate
Transpower	The owner and operator of the National Grid.
User	Any person or organisation using the Distribution System, but excluding Transpower. It includes all Customers, embedded generators, and where appropriate, Electricity Retailers acting on behalf of their customers.
Vegetation	Any trees or other plants threatening the WEL Networks overhead lines.
WEL	WEL Networks Ltd with its offices at Maui Street, Te Rapa.
WEL Operations	The section of WEL responsible for the day to day operations and maintenance of WEL Networks.
WIP	Work in Progress
Zone Substation	Consist of transformers, switchgear, communication equipment, protection relays and control.

Appendix 2 Forecasted Load for zone substations and each GXP

Zone Substations	ABB	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Avalon Dr	AVA	18.1	19.2	19.9	20.0	20.1	20.2	20.3	20.3	20.4	20.5	20.6
Borman	BOR	9.1	14.2	15.2	16.2	16.8	17.4	18.1	18.7	19.3	19.9	20.6
Bryce St	BRY	15.4	17.4	17.4	17.5	17.5	17.6	17.6	17.6	17.7	17.7	17.7
Chartwell	CHA	19.9	16.1	16.4	16.5	16.7	16.8	16.9	17.1	17.2	17.4	17.5
Claudelands	CLA	17.4	17.9	18.0	18.0	18.1	18.1	18.2	18.2	18.3	18.3	18.4
Cobham	COB	15.2	16.3	16.8	17.4	17.9	17.9	17.9	17.9	18.0	18.0	18.0
Finlayson Rd	FIN	3.3	3.4	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2
Glasgow St	GLA	8.1	8.3	8.5	8.7	8.9	9.1	9.3	9.6	9.8	10.1	10.3
Gordonton	GOR	6.7	6.9	7.1	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6
Hampton Downs	HPT	1.7	1.9	2.2	2.4	2.5	2.5	2.6	2.7	2.7	2.8	2.9
Horotiu	HOR	11.6	12.2	12.8	12.9	13.0	13.1	13.3	13.4	13.5	13.6	13.7
Kent St	KEN	17.1	17.3	17.5	17.6	17.8	18.0	18.2	18.4	18.5	18.7	18.9
Kimihia	KIM	3.7	4.2	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Latham Court	LAT	17.8	18.3	18.8	19.2	19.7	19.7	19.7	19.8	19.8	19.8	19.8
Hoeka Rd	HOE	-	-	-	9.0	9.5	9.9	10.4	10.9	11.5	12.1	12.7
Ngaruawahia	NGA	5.5	5.6	5.8	5.9	6.0	6.2	6.4	6.5	6.7	6.8	7.0
Peacockes Rd	PEA	15.0	15.3	15.6	16.7	17.6	18.6	19.5	20.5	21.4	22.2	22.9
Pukete - Anchor	ANC	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3
Pukete - 11kV	PUK	7.8	8.2	8.2	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
Raglan	RAG	5.4	5.6	5.7	5.9	6.0	6.2	6.3	6.5	6.6	6.8	7.0
*Ruakura(HAM 11 kV)	RUA	36.5	38.3	38.5	29.6	29.8	29.9	30.0	30.2	30.3	30.4	30.6
Sandwich Rd	SAN	21.5	21.9	22.2	22.3	22.3	22.3	22.4	22.4	22.4	22.5	22.5
Tasman	TAS	18.4	21.1	23.7	26.1	28.2	30.4	32.5	34.7	36.8	38.9	40.4
Te Kauwhata	TEK	4.4	4.5	4.6	4.7	4.9	5.0	5.1	5.2	5.4	5.5	5.6
Te Uku	TEU	1.7	1.7	1.8	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2
Wallace Rd	WAL	15.4	15.4	15.5	15.5	15.5	15.6	15.6	15.6	15.7	15.7	15.7
Weavers	WEA	9.3	9.6	9.8	10.1	10.3	10.6	10.8	11.1	11.4	11.7	12.0
Whatawhata	WHA	2.9	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6

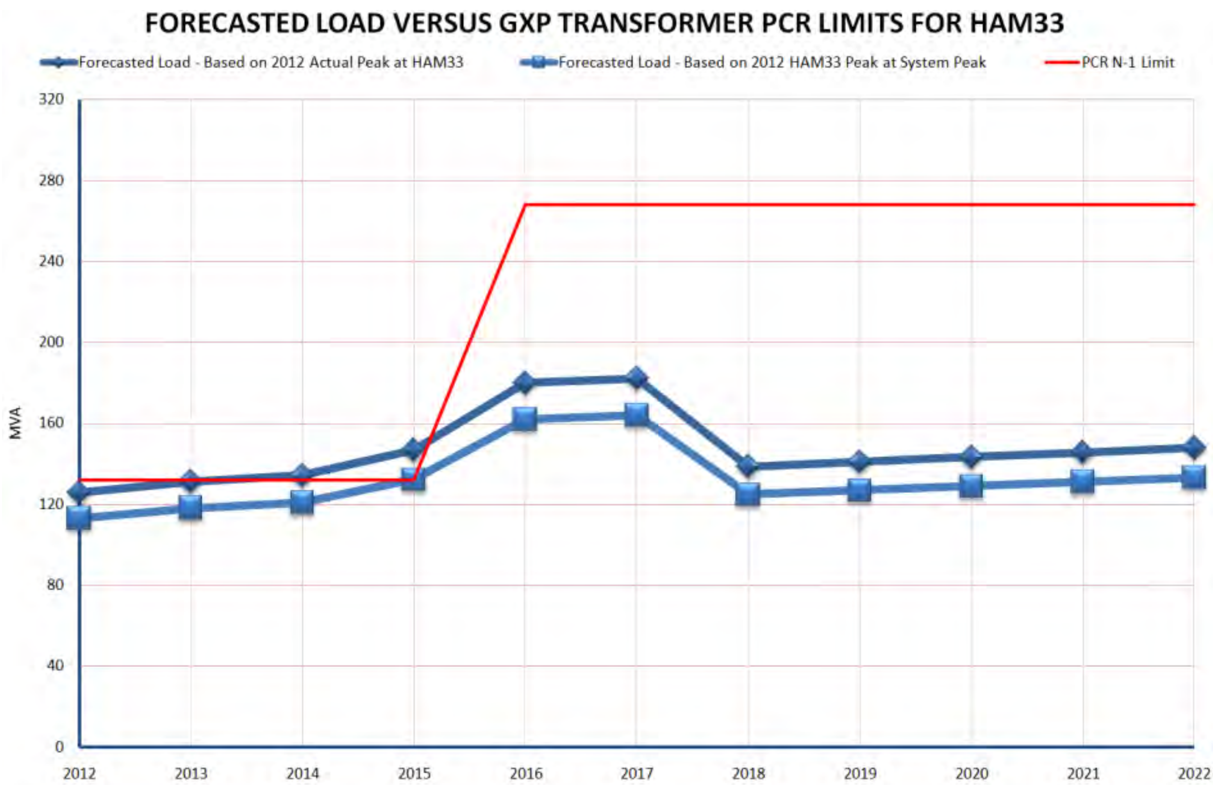
Table 35 * Proposed new zone substation

The preceding table shows zone substation capacities, predicted loads and indicative time for remedial action to be taken, and is intended as a visual planning tool.

Cells in the table are colour coded for clarity and show the normal operating safe region in green, contingency operation in yellow and emergency operation in red.

Installed capacity, (N-1) firm capacity, and short term overload capacity of transformers and where applicable the sub-transmission feeder capacities or 11kV feeder capacities are taken into account. Existing loads are inserted and load predictions applied over the planning period. In some zones, planned transformer capacity upgrades and sufficient off loading during contingency can be affected and this is taken into account for remedial action planning purposes.

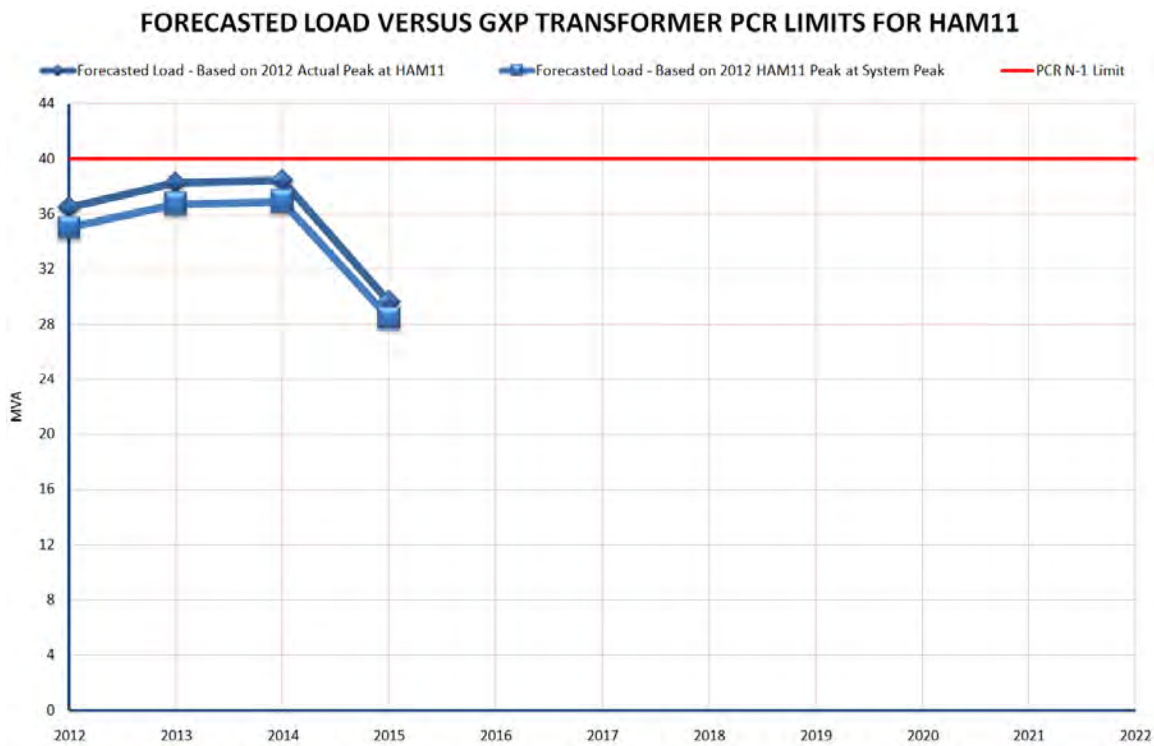
The following figures (from Figure 86 to Figure 92) show the forecasted loads for each GXP.



NOTE: HAM11 load will be transferred to HAM33 by 2016

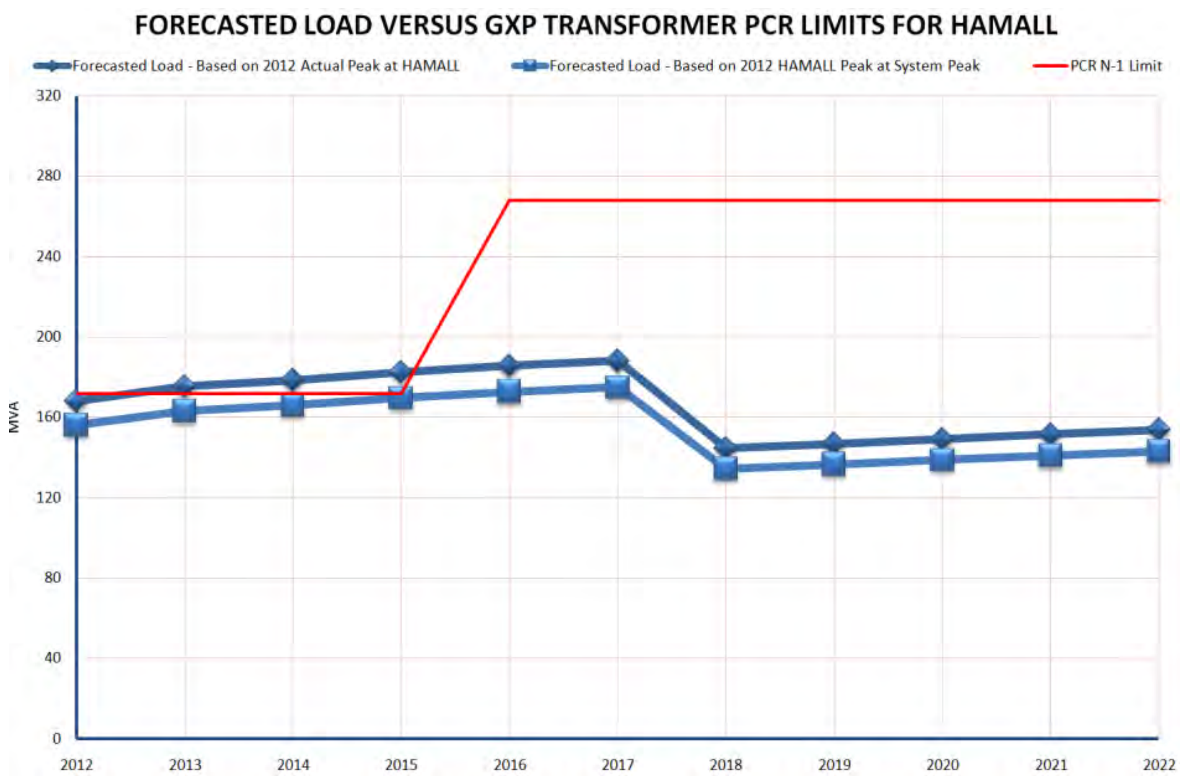
LAT, WAL and AVA will be transferred to TWH by 2018

Figure 86. Forecasted ADPCD Loading for HAM33kV



NOTE: HAM11 load will be transferred to HAM33 by 2016

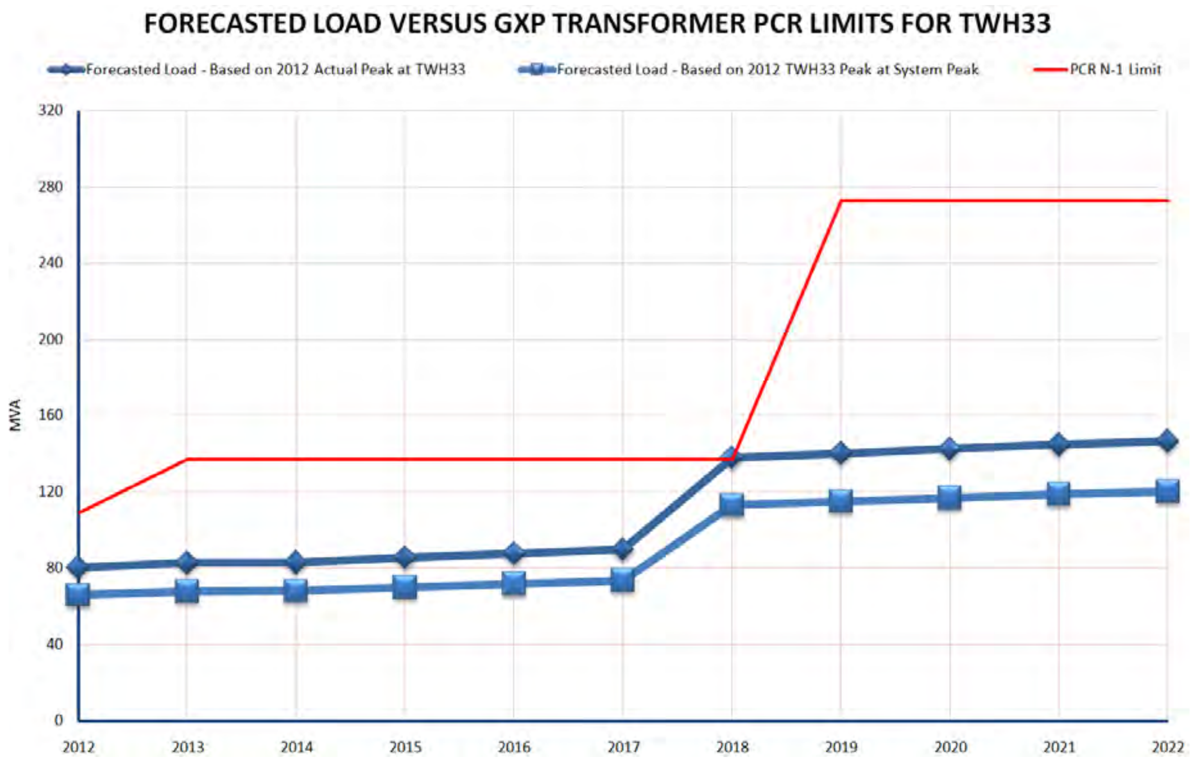
Figure 87. Forecasted ADPCD Loading for HAM11kV



NOTE: HAM11 load will be transferred to HAM33 by 2016

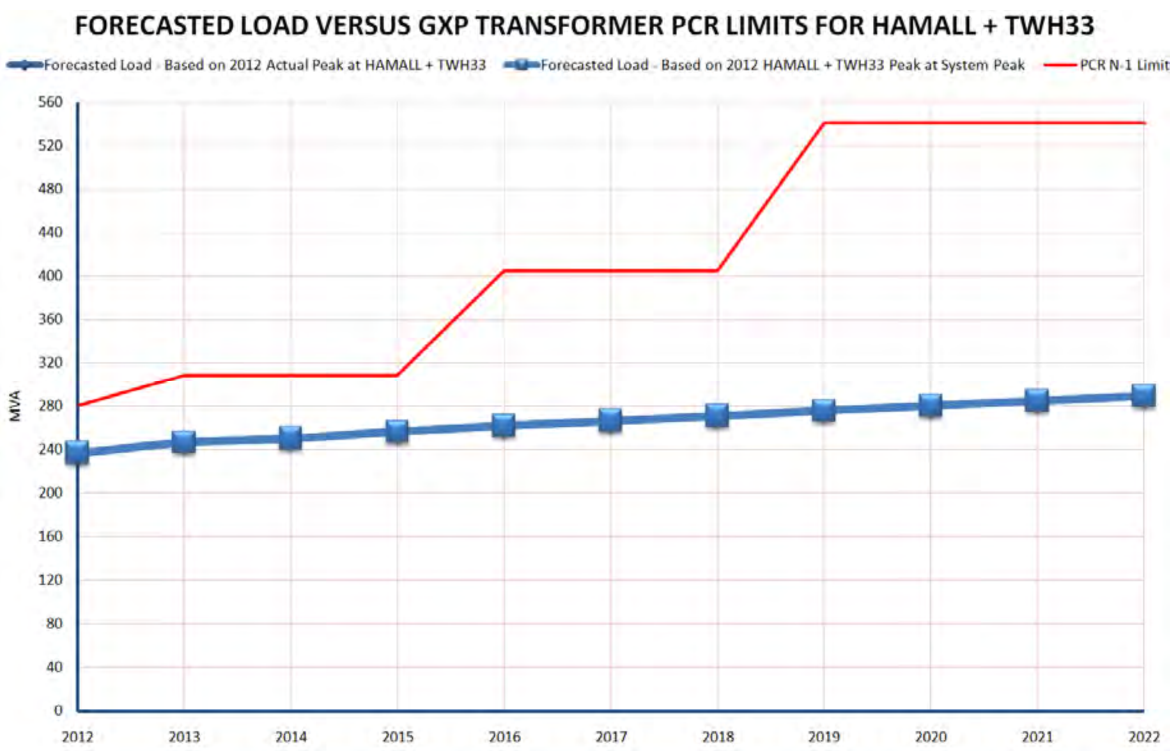
LAT, WAL and AVA will be transferred to TWH by 2018

Figure 88. Forecasted ADPCD for HAMALL



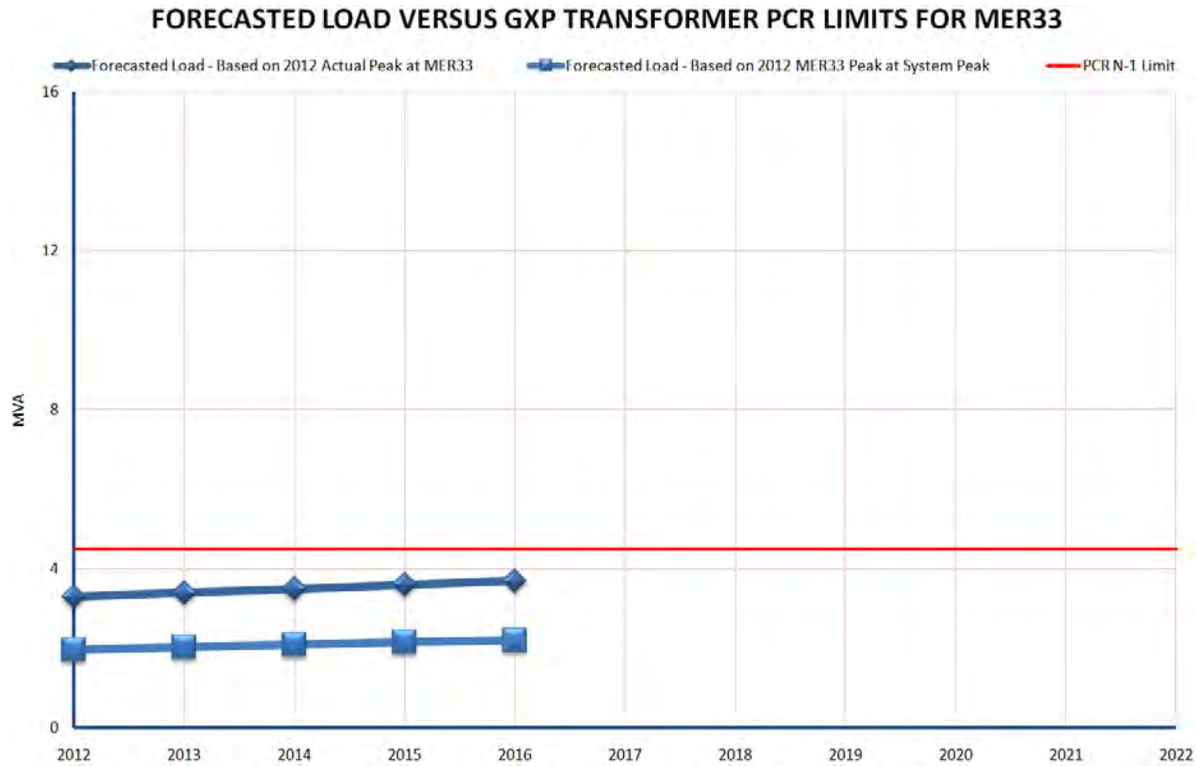
NOTE: LAT, WAL and AVA will be transferred to TWH from HAM33 by 2018

Figure 89. Forecasted ADPCD Loading for TWH33kV



Note: HAM ALL+TWH peaks at the same time as the System peaks

Figure 90. Forecasted ADPCD Loading for HAM ALL + TWH33kV



Note: Meremere load will be transferred to HLY by 2013

Figure 91. Forecasted ADPCD Loading for Meremere

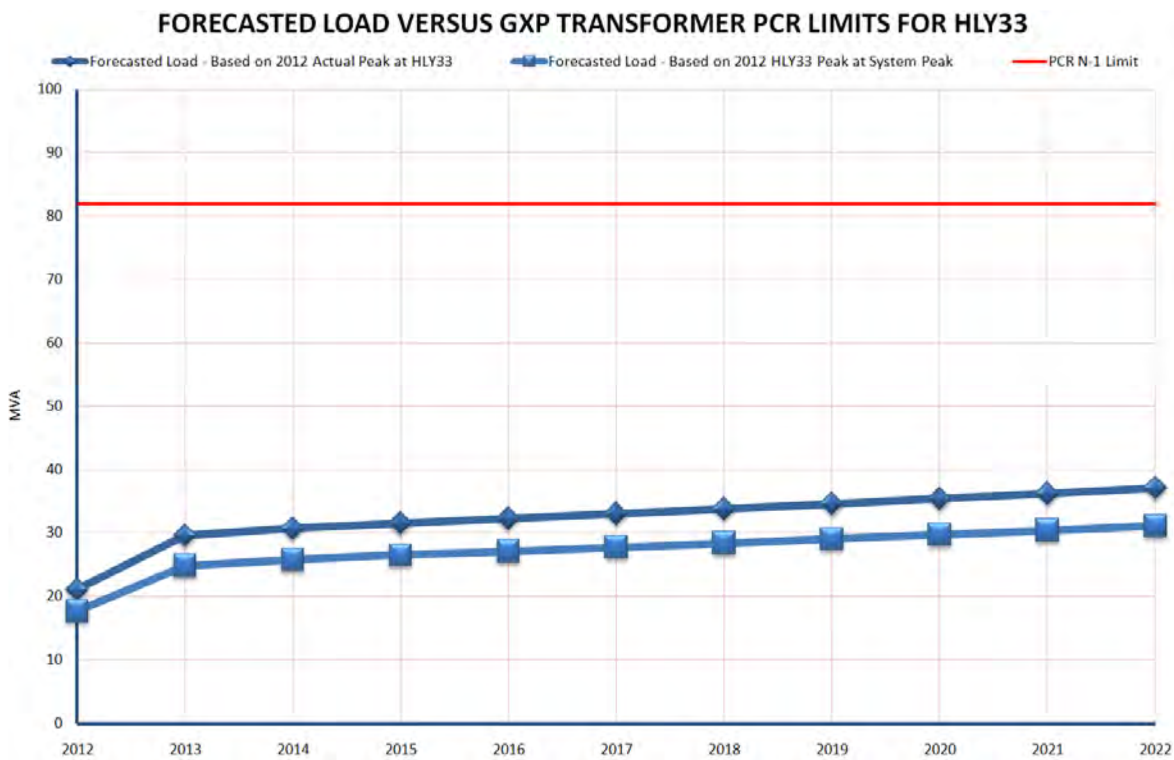
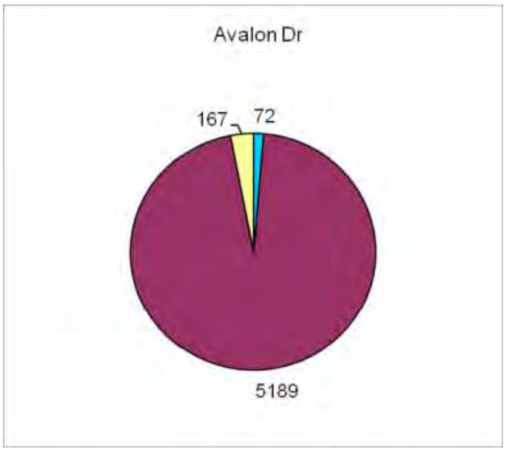


Figure 92. Forecasted ADPCD Loading for Huntly includes transfer of MER loads by 2013

Appendix 3 Customer Type Distribution by Zone Substation

Pie Chart Legend:

Customer Type	
Accommodation Cafes & Restaurants	
Agriculture-Forestry & Fishing	
Communication Services	
Cultural & Recreational Services	
Electricity - Gas & Water Supply	
Electricity - Gas & Water Supply	
Finance & Insurance	
Health & Community Services	
Manufacturing	
Other	
Property & Business Services	
Residential	
Retail Trade	
Transport & Storage	
Wholesale Trade	



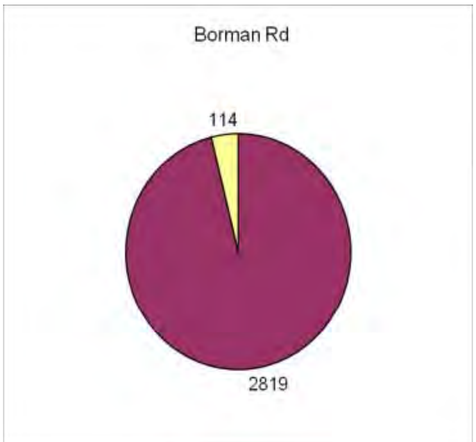
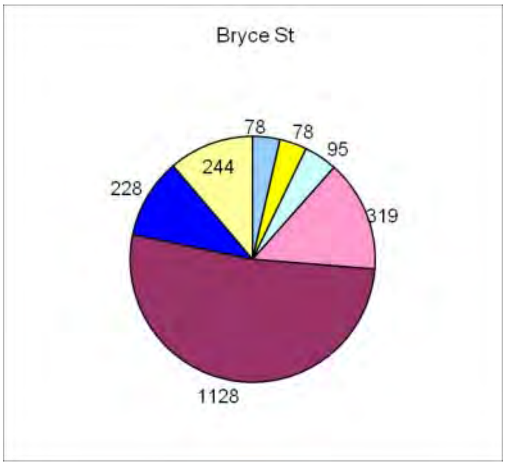


Figure 93. Chart 1 of 13 showing Zone substation customer makeup



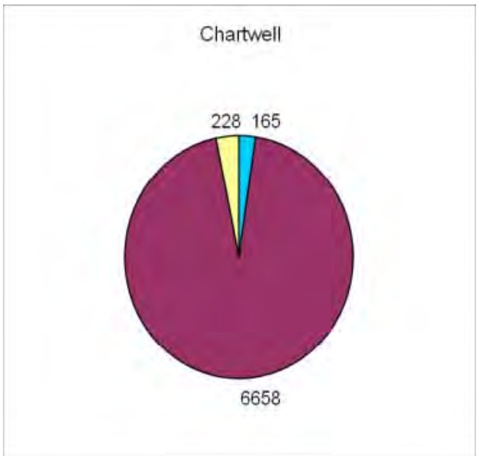
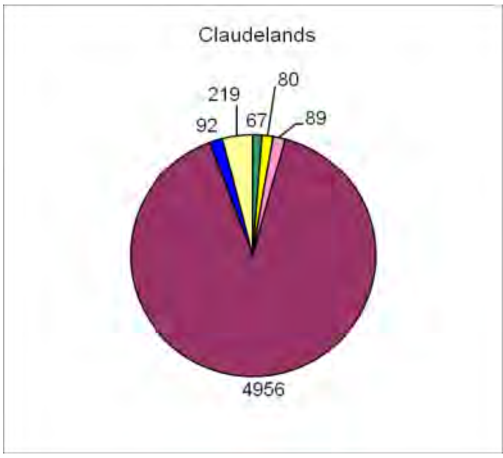


Figure 94. Chart 2 of 13 showing zone substation customer makeup



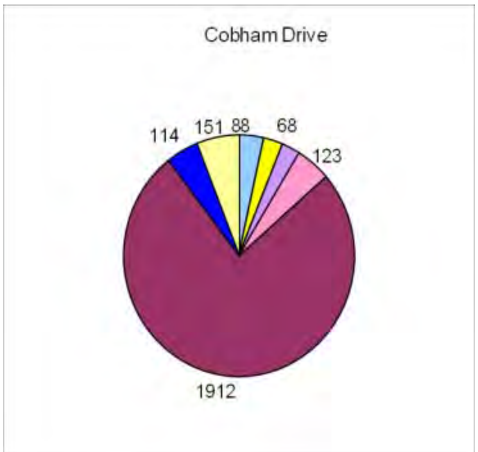


Figure 95. Chart 3 of 13 showing zone substation customer makeup

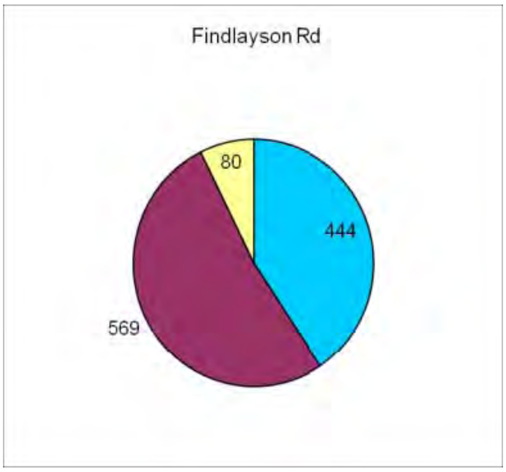


Figure 96. Chart 4 of 13 showing zone substation customer makeup

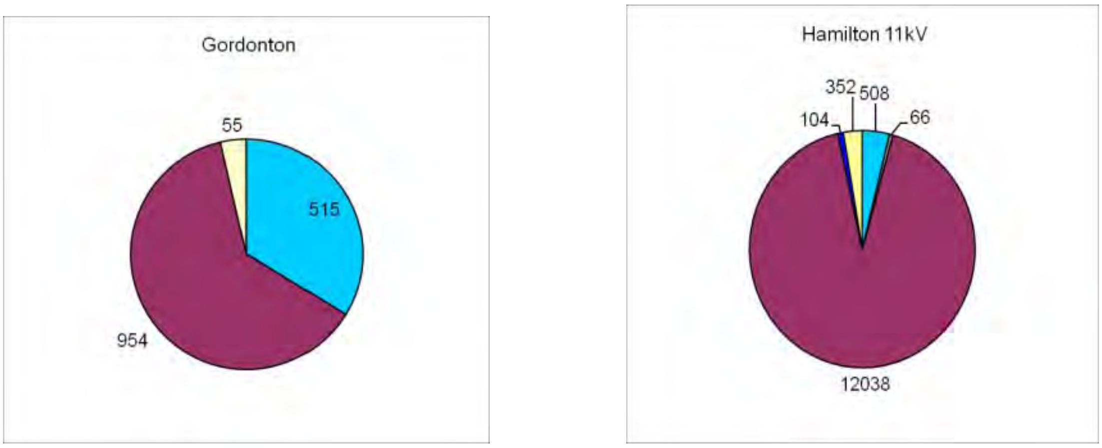


Figure 97. Chart 5 of 13 showing zone substation customer makeup

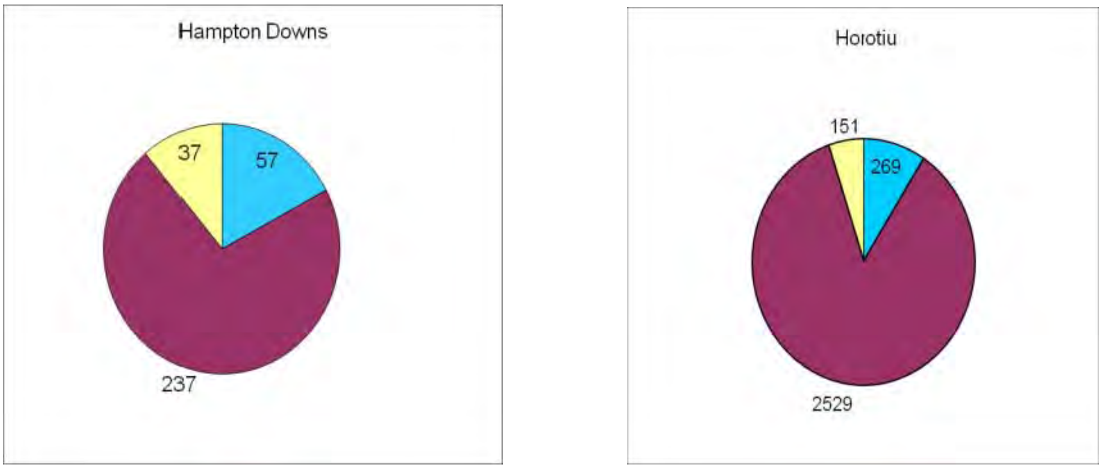


Figure 98. Chart 6 of 13 showing zone substation customer makeup

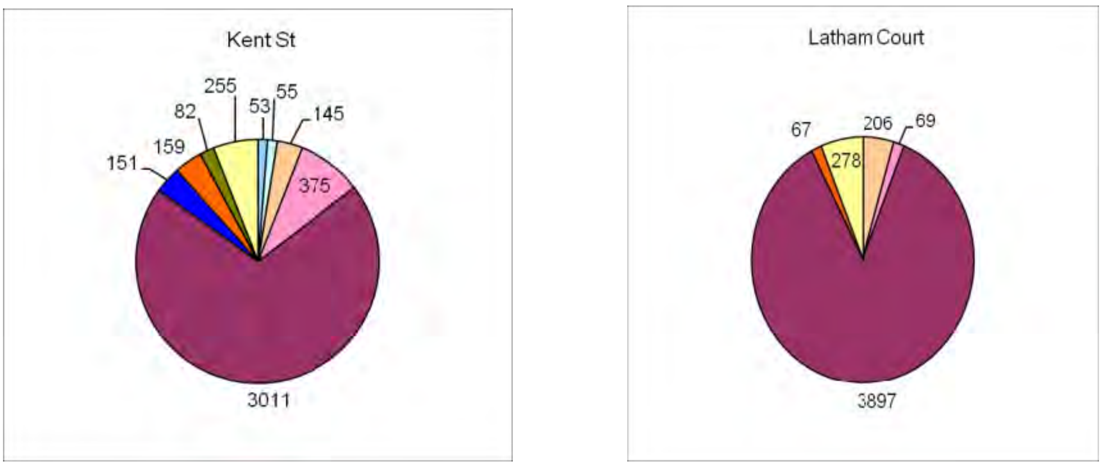


Figure 99. Chart 7 of 13 showing zone substation customer makeup

Figure 100. Chart 8 of 13 showing zone substation customer makeup

Figure 101. Chart 9 of 13 showing zone substation customer makeup

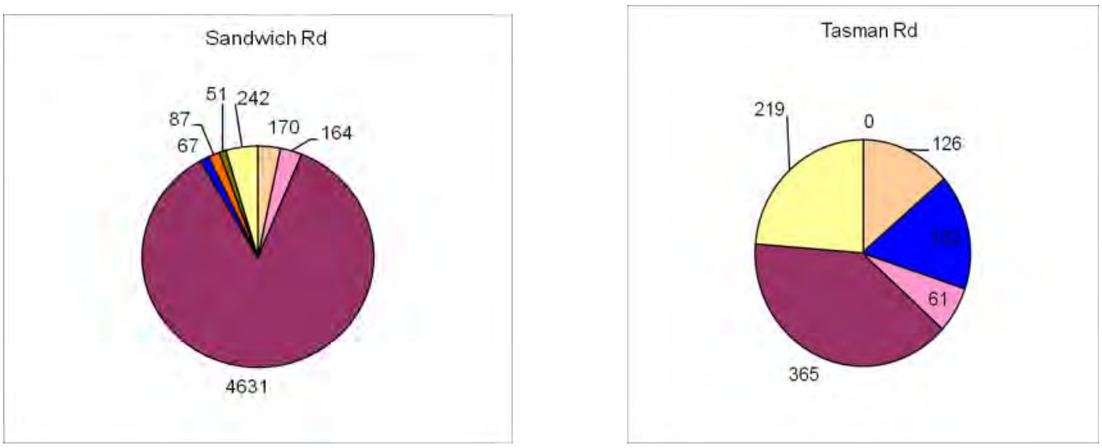
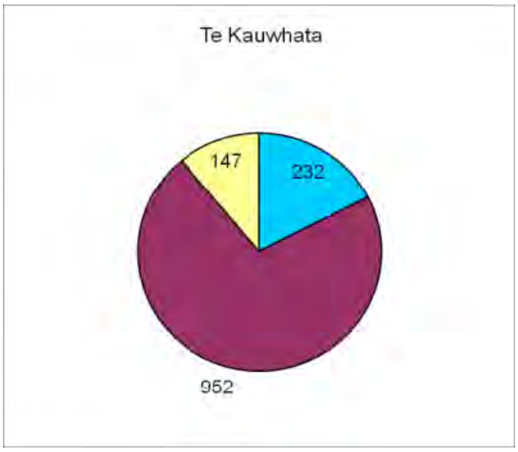


Figure 102. Chart 10 of 13 showing zone substation customer makeup



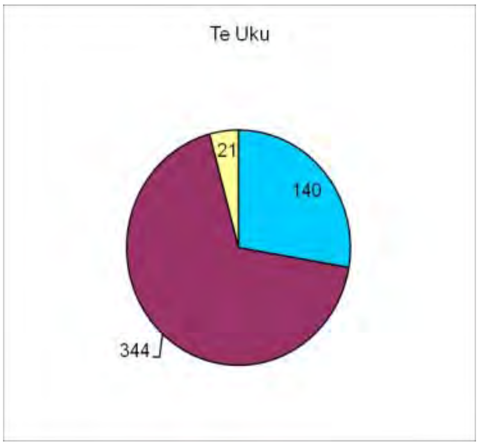
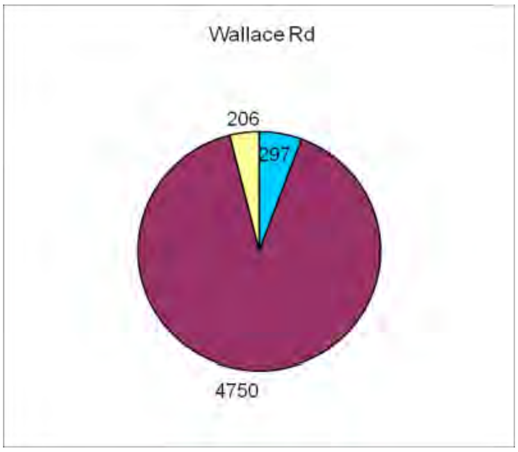


Figure 103. Chart 11 of 13 showing zone substation customer makeup



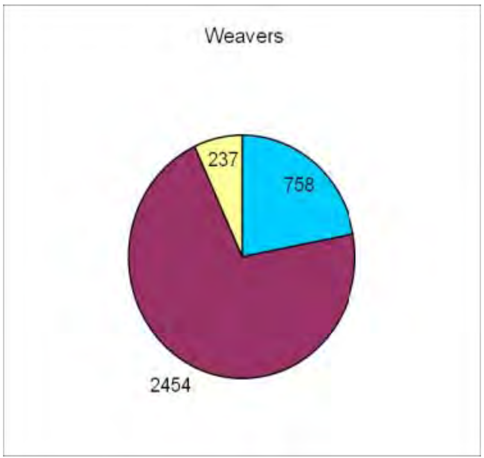


Figure 104. Chart 12 of 13 showing zone substation customer makeup

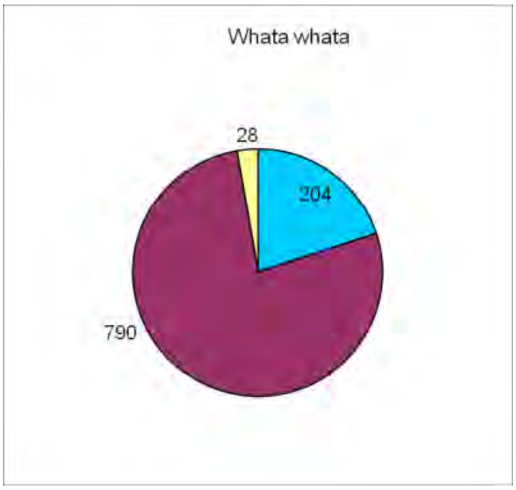


Figure 105. Chart 13 of 13 showing zone substation customer makeup

Appendix 4 Schematic Diagrams of 33kV Sub-transmission System

33kV Network Configuration - Hamilton Point of Supply

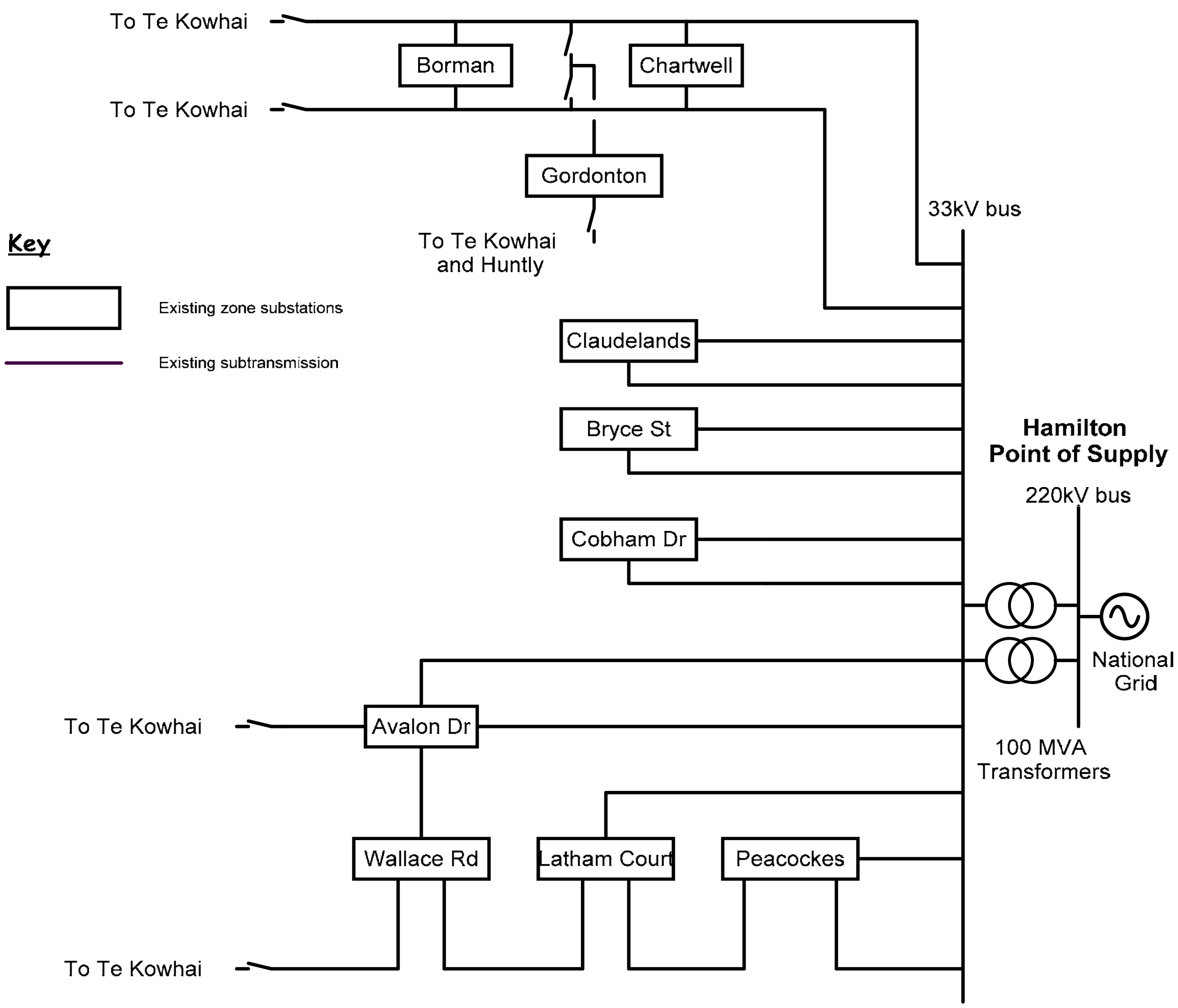


Figure 106. 33kV Network Configuration – Hamilton Point of Supply

33kV Network Configuration - Te Kowhai Point of Supply

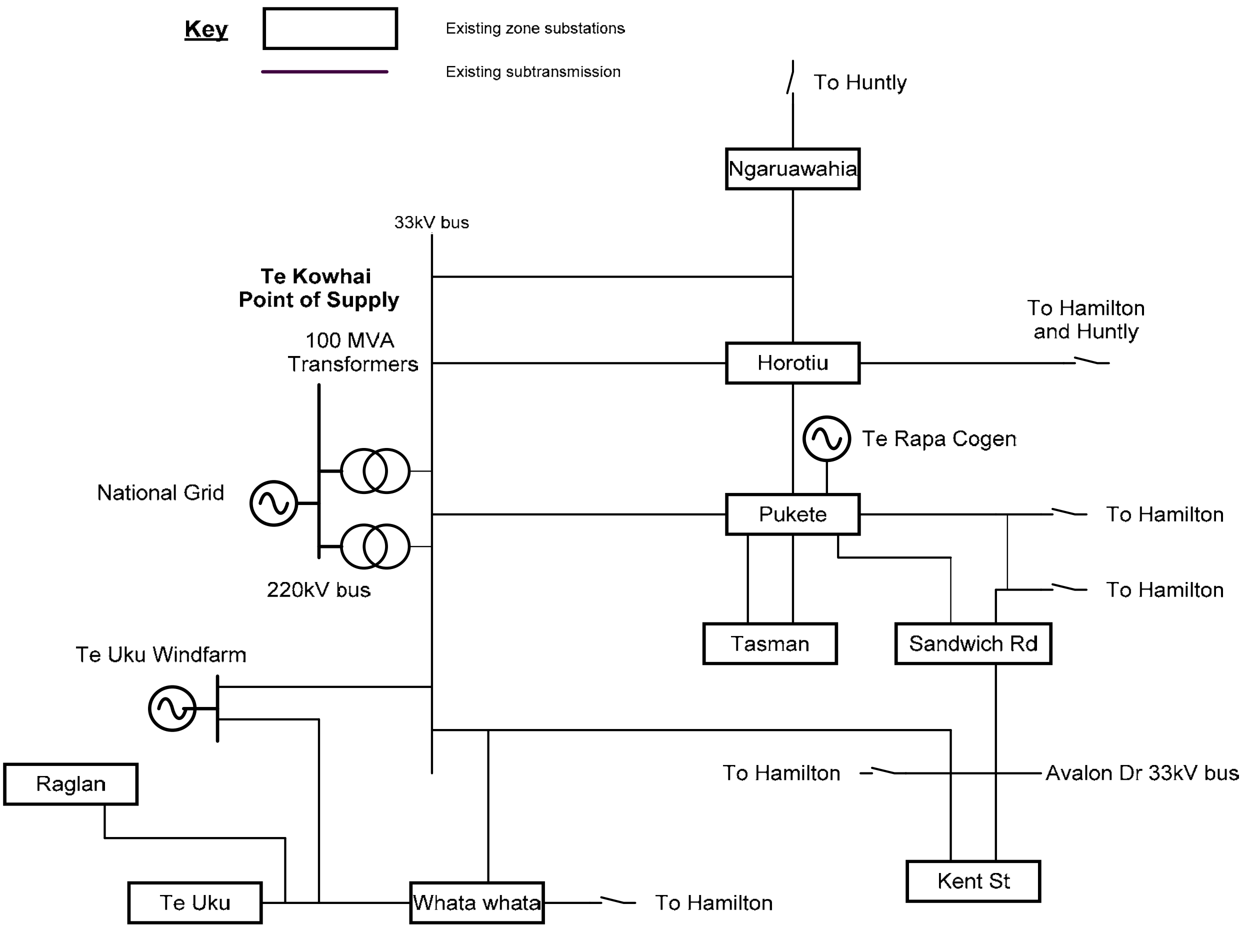


Figure 107. 33kV Network Configuration – Te Kowhai Point of Supply

33kV Network Configuration - Huntly Point of Supply

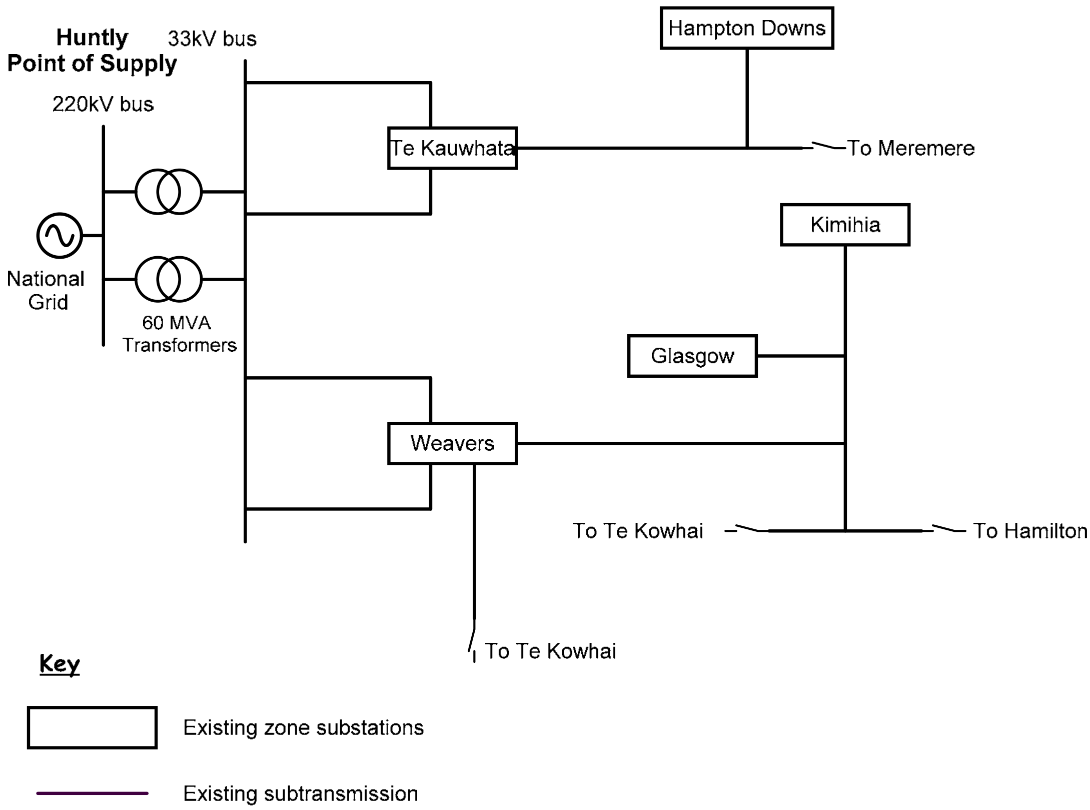


Figure 108. 33kV Network Configuration – Huntly Point of Supply

33kV Network Configuration - Meremere Point of Supply

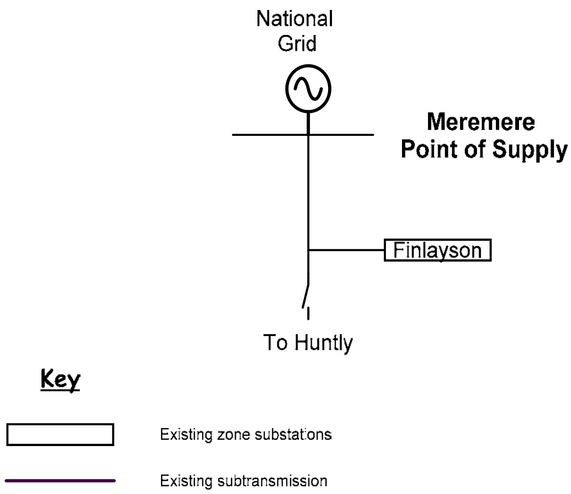


Figure 109. 33kV Network Configuration – Meremere Point of Supply

33kV Network Configuration – Future Hamilton POS

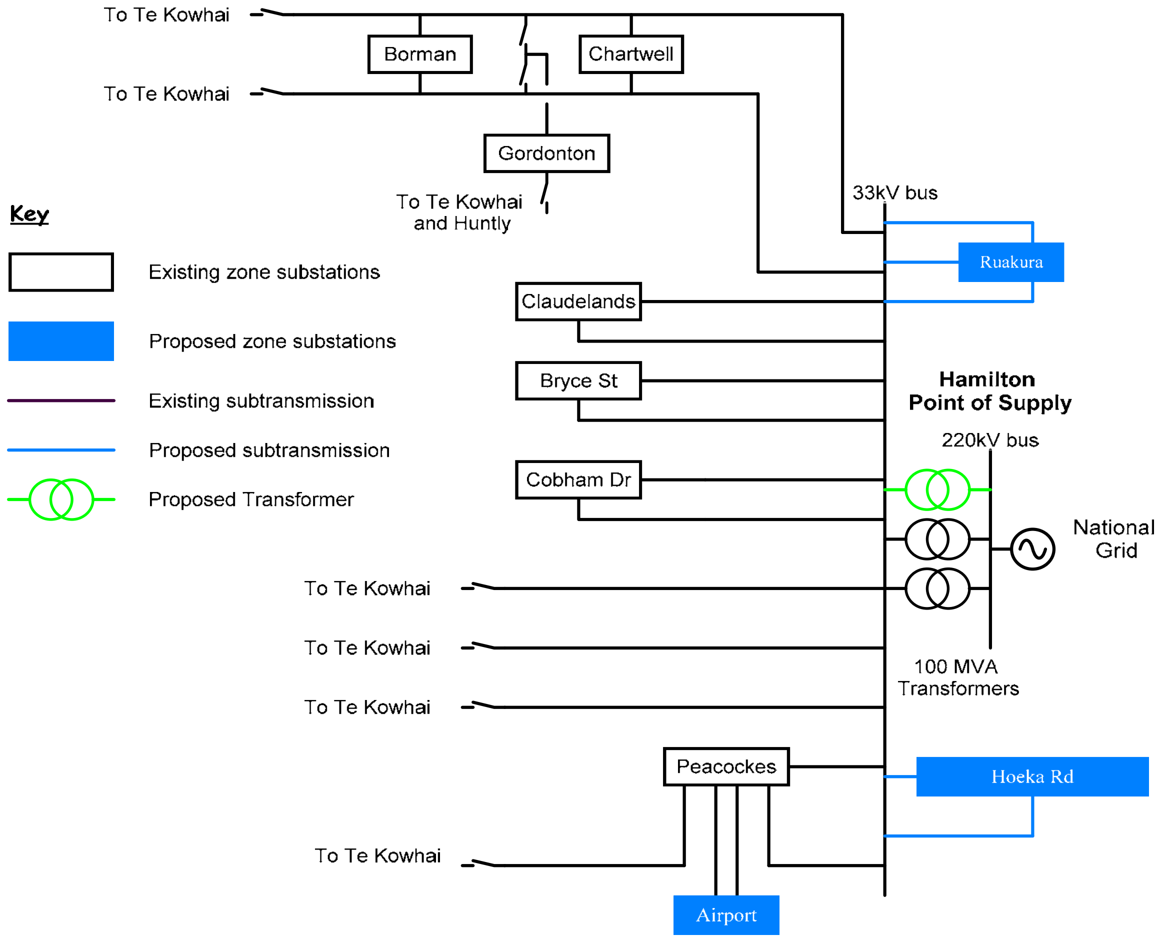


Figure 110. 33kV Network Configuration – Future Hamilton Point of Supply

33kV Network Configuration – Future Te Kowhai POS

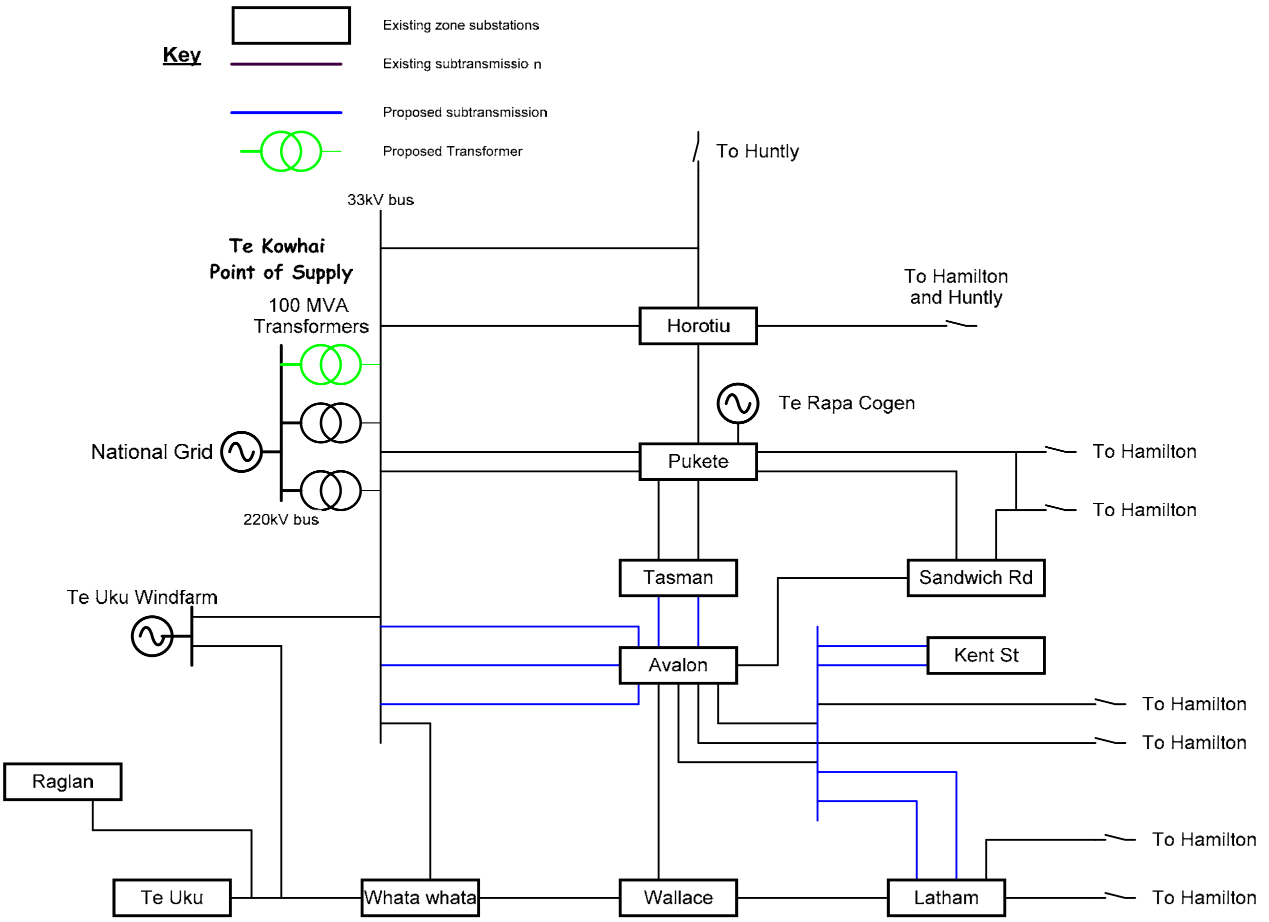


Figure 111. 33kV Network Configuration – Future Te Kowhai Point of Supply

33kV Network Configuration – Future Huntly POS

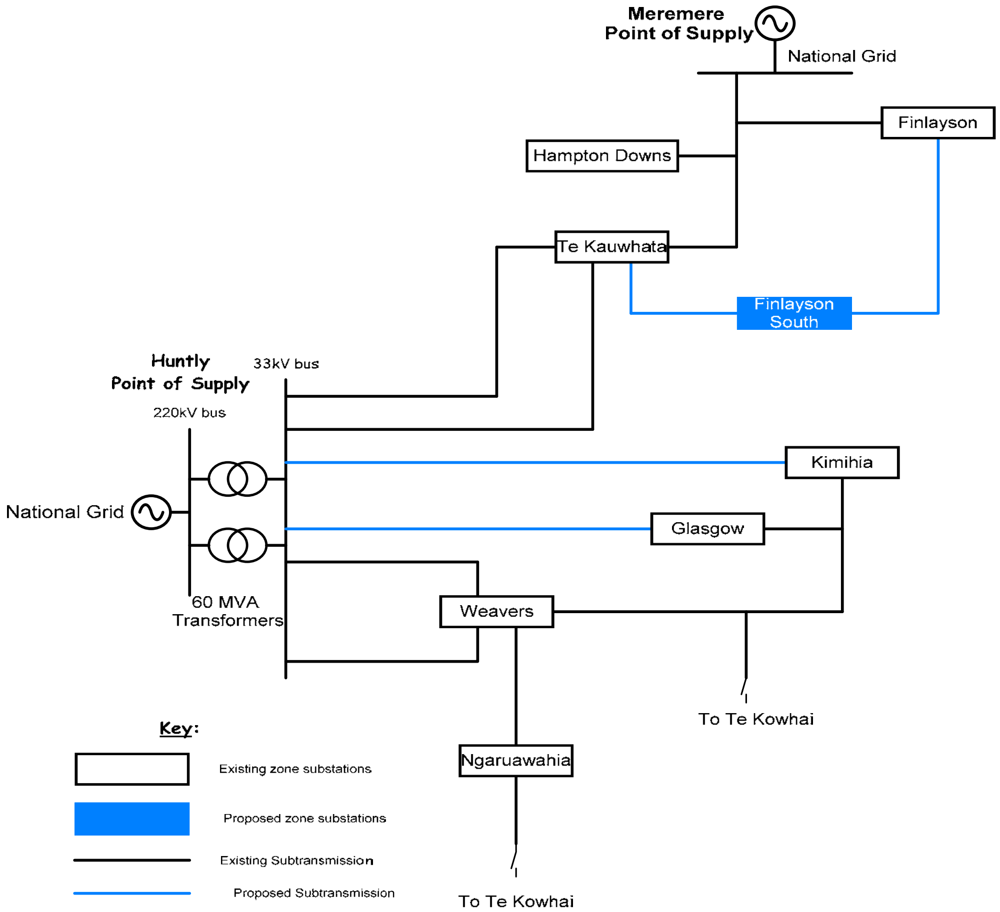


Figure 112. 33kV Network Configuration – Future Huntly POS

Appendix 5 Health and Safety Statistics Since April 2009

(**Notes: FAR –** Field Action Report, **LTI –** Lost Time Injury)

Table 36 Performance Statistics for Health and Safety

Month	Total No of FARs Received	Serious Harm	Lost Time Injury (LTI) / Medical Treatment Injury (MTI)	Minor Injuries	Near Misses
April 2009	18	0	0	2	0
May 2009	22	0	0	2	5
June 2009	30	0	0	6	1
July 2009	26	0	0	7	6
August 2009	43	1	2	9	6
September 2009	38	0	1	3	7
October 2009	24	0	0	0	4
November 2009	37	0	1	3	6
December 2009	23	0	3	4	7
January 2010	22	0	1	6	5
February 2010	31	1	0	4	4
March 2010	30	0	0	5	8
April 2010	24	0	1	4	4
May 2010	27	0	1	3	4
June 2010	22	0	0	7	1
July 2010	27	0	0	4	3
August 2010	27	0	2	3	7
September 2010	29	0	1	6	2
October 2010	19	0	3	2	4
November 2010	31	0	1	4	6
December 2010	33	0	2	2	4
January 2011	25	0	3	5	2
February 2011	43	0	2	8	6
March 2011	39	0	1	6	4
April 2011	22	0	1	1	5
May 2011	37	0	1	4	3

June 2011	38	0	1	4	5
July 2011	25	0	2	3	4
August 2011	39	0	1	11	1
September 2011	30	0	2	9	3
October 2011	40	0	2	4	6
November 2011	32	0	0	6	5
December 2011	21	0	1	5	5
January 2012	28	0	0	5	2
February 2012	27	0	5	5	2
March 2012	52	0	1	17	7
April 2012	40	0	0	12	4
May 2012	63	0	1	12	10
June 2012	40	0	1	6	3
July 2012	47	0	1	3	5
August 2012	48	0	0	7	13
September 2012	50	0	0	8	7
October 2012	48	0	0	8	6
November 2012	33	0	0	5	4
December 2012	21	0	0	3	4
January 2013	27	0	1	7	3
February 2013	31	1	1	4	5

(**Notes: FAR –** Field Action Report, **LTI –** Lost Time Injury)

Photo 23 Live Line Installation of Delta Support

Appendix 6 Project Definition Documents for Projects within next 12 months

Te Kauwhata Zone Substation Transformer Replacement

Background

The existing 33/11kV transformers at Te Kauwhata are 5MVA Brush units that are 1950s vintage that are nearing the end of their economic life. It is proposed to replace these transformers with units being made spare following an upgrade at the Horotiu substation. The 5MVA units will be scrapped.

The Horotiu transformers were replaced in 12/13 financial year, and the 2x10MVA Brush transformers that were removed from Horotiu will be installed in the Te Kauwhata zone substation. These transformers will have a half-life refurbishment prior to installation.

Scope of Works

- Decommission and remove the 5MVA units at Te Kauwhata in accordance with the decommissioning sequence.
- Install the two ex. Peacockes Road 10MVA units in accordance with the installation sequence. There are relatively new REG-D AVR relays at Te Kauwhata that will be retained as they are without the addition of remote I/O modules.
- Check the rating of the 33kV bus jumpers to the transformer bushings and replace if required.
- Modify / extend the 11kV cables at T6 and T7 as required to reach the cable support stands that are fixed to the transformer bunding wall.
- Commission the units as appropriate to match the installation sequence.

Timing of Works:

To be completed in the 2013/14 financial year.

Hoeka Rd Substation (HOE)

Background

This project provides a long term solution for the voltage and loading issues that currently exist in the Matangi lifestyle, Matangi Township, Tauwhare and Eureka areas and follows on from the interim line re-conductoring implemented in 2012/2013. The project will also allow reduction of the Silverdale switching station load to sustainable levels (around 6MVA) and de-loading of other highly loaded Hamilton 11kV feeders. The Initial load level for the new zone substation is expected to be around 9MVA.

To achieve the long term solution a new zone substation will be built in the vicinity of the corner of Morrinsville Rd (SH26) and Hoeka Rd (exact location subject to in-progress negotiation). The zone substation will consist of two 15/23 MVA zone transformers with a suite of nine 11kV CBs. The 33kV supply will be sourced from the existing Transpower Ruakura POS indoor 33kV circuit breakers.

Scope of Works

To design, construct and commission Hoeka Rd Zone Substation on the selected site with the following:

- Zone substation building to be built in accordance with the building design. The design must allow the required functionality to be achieved and also meet any requirements or conditions imposed by the consenting process.
- Two 33/11kV 15/23MVA transformers to be installed in a roofless enclosure on standard pad including oil containment facilities. The transformers are Dyn11 construction but to be connected as Dyn3.
- Indoor 10-unit 11kV switchboard, (6 x feeders, 2 x incomers, 1 x bus-section, 1 x bus-riser). Space to be provided for an additional future CB at each end of 11kV switchboard whilst maintaining minimum 1,000 mm horizontal clearance to all walls.
- Install SEL relays for protection, monitoring and control of the new switchgear and transformers. SEL 351-6 and SEL 387A for transformer protection and SEL 751A for 11kV feeder protection. A SEL 2032 will be installed on the 11kV switchgear to communicate with the on-board protection relays and marshal the signals to the existing communications panel.
- Install six 33kV – single core 630mm2 Aluminium, 3kA 1sec copper wire screen, XLPE cables (two x 3 phase circuits) from Transpower's Hamilton POS 33kV switchboard to the proposed substation site. Route length approximately 3,600m. Cable length approximately 21,600m.
- Perform required 33kV cable jointing and testing between sections.
- Install a ducted 96 core fibre optic cable along the entire 33kV circuit route from Ruakura to the new zone substation. 50mm duct to be used.
- Connect the 33kV circuits to two spare 33kV CBs at Ruakura. At the new HOE zone sub connect the 33kV cables directly to the 33kV transformer bushings.
- 11kV underground cable 1c 630mm2 AL XLPE (two per phase) connections from transformers T6 and T7 to 11kV incomer circuit breakers CB36 and CB37.
- Install a WEL standard 24V DC distribution system complete with battery and charger to supply the switchgear and protection.
- Install a Safe-link CFC RMU and a 200kVA 11/0.4kV, 3 phase local service transformer. Install a 230V single phase AC supply and distribution panel in the new 11kV switch room, the building should also be wired with door sensors, security lights and smoke detectors.
- Install a WEL standard communications panel complete with a SEL 3530 communications processor to connect the RegD AVR relays to.

- Install six 3c 300mm2 AL XLPE 11kV underground feeder cables to connect to nearby overhead lines to establish the following feeders:
  - CB1 - Matangi
  - CB2 - Eureka
  - CB3 – Ruakura
  - CB4 – Woodside Rd
  - CB5 – Tauwhare
  - CB6 – Morrinsville Rd

Timing of Works:

The 33kV cable circuits and fibre optic cable from HAM Ruakura to Hoeka are programmed for installation commencing in April 2013 with completion by early summer of 2013/14. This will coincide with the substation building construction work and full site establishment as soon as practicable in the 2014/15 financial year.

LAT-PEA 33kV Circuit Upgrade

Background

The 33kV mesh steady state load flow calculation identified sections of the Peacockes to Latham 33kV circuit nearly exceeding the conductor thermal limit. The load flow calculation is worse under contingency scenario (when one HAMCB is switched off) which results to thermal limits being exceeded by as much as 35%.

With this proposed upgrade the thermal limit on the particular 33kV mesh circuit will increase to acceptable limits and mitigate the risk of conductor thermal limit being exceeded under contingency by increasing the thermal limit to 550 Amps.

Scope of Works

Upgrade the weak section of PEA CB392 – LAT CB362 33kV Circuit as follows:

- Install a single circuit of 3x 1c 630 mm^2 Al XLPE cable from Latham Court substation to connect to the existing Peacockes cable circuit at the Mahoe St / Bader St intersection. Approximate cable route length is 2,500 meters.
- Install a 96c fibre from Latham Court substation to where the trench meets the existing Peacockes cable circuit at the Mahoe St / Bader St intersection. Approximate cable route length is 2,500 meters.
- Perform required 33kV cable jointing and testing between sections.
- Protection settings and alarms to be reviewed and amended as required.

Timing of Works:

To be performed in the 2013/14 financial year at a suitable time when outages on the 33kV sub-transmission circuits to liven the new cable are permissible.

Seismic Upgrade of Substations and Switching Stations

Background

In 2009/10 an assessment was made of several of the existing zone substation and switching station buildings. It has been identified that some only marginally meet seismic compliance requirements and recommendations have been made for remedial work to bring the buildings up to a better standard. Of the sites that needed attention, works have been completed at Claudelands and Bryce St and Peacockes and Glasgow are scheduled for completion in 2012/13.

There is budget available in several more financial years to complete the balance of the sites and it is prudent to use the budget for 2013/14 to carry out all the assessment work to ensure the correct timing and budgets are set in future AMP plans.

Scope of Works

Carry out the seismic assessments for the following sites and establish a programme and budget to upgrade the sites based on location and criticality:

- Te Kauwhata Zone Substation – assessment of the 11kV switchgear building only, 33kV building is compliant.
- Wallace Rd Zone Substation – assessment of the old portion of the 11kV switchgear building only, the extension of the 11kV building is compliant. Remedial work can be scheduled with the transformer upgrade and 33kV switchgear replacement projects.
- Barton St switching station.
- Civic switching station.
- Findlay Rd switching station.
- Killarney Rd switching station.
- MAF Ruakura switching station.
- Massey St switching station.
- Peachgrove Rd switching station
- Steele Park switching station
- Whitiora switching station

Timing of Works:

Site assessments for all sites to completed in the 2013/14 financial year and recommendations for future years' work to be added to future AMP plans.

Caro Street 11kV Switching Station

Background

The site currently has two 1MVA transformers, and the customer has requested an additional two 1MVA transformers for this year and another two 1MVA transformers in two to three years time, with total future load expected to be 6MVA.

A new switching station is proposed to increase the capacity to the customer and to improve the level of security.

Caro Street switching station will improve the load distribution in the CBD and is envisaged to offload Garden Place Switching Station which has inadequate access due to its underground location.

Scope of Works

To design and construct a new 11kV switching substation on the selected site to be provided by the customer in Caro St consisting of:

- Switching station building approximately 10 m long x 4 m wide. Proposed construction to be concrete block, with colour steel roof, similar to recently constructed Hospital switching station. Space to be provided minimum 1000mm horizontal clearance around switchboard to all walls. Structure to be seismically compliant for its intended use.
- Install new 11kV 11-unit switchboard, (2 x incomers, 8 x feeders, 1 x bus-section and 1 x bus-riser).
- Install SEL relays and meters for protection, monitoring and control of new switchgear and transformers. SEL 751A and SEL 311L for incomer protection, SEL 351-6 and SEL 734 for customer's feeder protection and metering, SEL 751A for 11kV bus-coupler and external feeder protection c/w arc flash protection. Siemens 7SD6101 for differential protection
- Install 24V DC distribution system complete with battery and charger. Emergency DC lighting required.
- Communications link via radio or fibre cable connection to WEL SYSCON. SCADA I/O as per WEL standards.
- Earth grid and earthing of equipment in accordance with WEL standards. An earth grid design will be prepared for the site and the equipment installed.
- Install two 11kV trunk feeder cables 3c 300mm^2 ALXLPE, one from TELCB3 and one from TELCB7 along Anglesea Street northwards along Anglesea Street across Caro Street. Cut and connect through joint to existing UG 11kV cable 3c 300mm^2 ALXLPE, trunk feeder BRYCB5

beside P621. Approximate cable route length is 90 meters. Note the new cables shall connect to existing cables and the two existing cable joints shall be abandoned.

- Install two 11kV feeder cables 3c 95mm^2 ALXLPE, one from TELCB2 and one from TELCB4 along Anglesea Street northwards then eastwards on Caro Street until it reaches the two existing 1 MVA transformers T3685 and T3686. Terminate TELCB1 – 3c 95mm^2 ALXLPE to T3685. Terminate TELCB2 – 3c 95mm^2 ALXLPE to T3686. Approximate cable route length is 105 meters.
- Install new 11kV feeder cables 3c 95mm^2 ALXLPE from TELCB6 along Anglesea Street northwards until it reaches the new 2 MVA transformer. Approximate cable route length is 20 meters. Terminate the new cable 3c 95mm^2 ALXLPE to the new 2 MVA transformer 11kV bushings.
- Carry out review and changes to protection settings at affected zone substations.

Timing of Works:

Presently programmed to be performed partly in the 2012/13 financial year and partly in the 2013/14 financial year. However this project is entirely dependent on the client committing to the upgrade work and may be performed later than the timeframes indicated.

Dannemora Subdivision – remedial work Stage 2

Background

During recent times, there have been several issues raised about the quality of work performed by a design / build contractor at WELs external 'Dannemora' subdivision in Auckland. These work quality issues have resulted in several outages where WEL has been exposed to numerous customer complaints and loss of reputation. A project has been scoped to provide several stages of improvements that will restore the subdivision to acceptable reliability levels.

Stage 1 is being completed in the 2012/13 financial year to provide immediate security benefits to the site. Subsequent stages are planned to improve the reliability of the site and accommodate future load growth.

Scope of Works

Stage 2 remedial works – 2013/14:

- Install a CFC-F RMU (A) in the vicinity of Jeffs Road/Jeffs Road intersection. This will need to be an extendable Schneider Ring Master to enable the option of fitting a Metering unit to provide a secondary 11kV supply from Vector.
- Install and terminate a 3c 300mm^2 AL XLPE cable between RM630U1 and RMU_AU1.
- Install and terminate a 3c 95mm^2 AL XLPE cable between RMU_A and the HV Bushings of T5245. A generator will be required to supply the customers from T5245.

- Install a 3c 95mm² AL XLPE cable between RMU_A and the vicinity of T5245. Locate the HV cable supplying T5246 and carry out a thru-joint to the existing 3c 35mm² AL XLPE Cable. Terminate and test the cable within RMU_A. A generator will be required to supply the customers from T5246.
- Cut, cap and abandon the HV cable located between T5244 and T5245.
- Upgrade T5244 to a 500kVA Mini Kiosk Transformer and upgrade the HV fuses within RM631U3 to be rated at 50A. Upgrade the LV Distribution Panel to a Hamer Safe Frame and refit the existing Sub Logger. During this upgrade the customers will experience an extended outage.
- Install a CFCF Safelink RMU in the vicinity of Jeffs Road/Chateau Rise within the Road Reserve – RMU_B. This installation will require a 70mm2 CU earthing arrangement.
- Install and terminate a 3c 300mm² AL XLPE cable between RMU_A and RMU_B.
- Install and terminate a 3c 95mm² AL XPLE cable between RMU_B and the HV bushings of T5243. A generator will be required to supply the customers from T5243.
- Install a 3c 95mm² AL XLPE cable between RMU_B and the vicinity of T5243. Locate the HV Cable connected to the HV bushings of T5242 and carry out a thru-joint to the existing 3c 35mm² AL XLPE Cable. A generator will be required to supply the customers from T5242.
- Cut, cap and abandon the HV cable between T5241 and T5242.
- Upgrade T5243 to a 500kVA Mini Kiosk Transformer and upgrade the HV fuses within RM631U2 to 80A. Upgrade the LV Distribution Panel to a Hamer Safe Frame and refit the existing Sub Logger. During this upgrade the customers will experience an extended outage.

Timing of Works:

The second stage of this work is to be performed in the 2013/14 financial year.

Whatawhata CB6 to Wallace Rd CB6 Feeder interconnection and reconfiguration

Background

WHACB6 comprises a total of 11km of overhead lines (including branch off) with 153 customers connected. This is a relatively short rural feeder and there is no back feeding ability apart from via an ABS to another WHA CB supply at WHA end. The peak loading of this feeder is 24A.

This project proposes to construct approximately 0.6km of overhead lines along Kakaramea Road between poles 527644 and pole 535283 to link WHACB6 to WALCBX104 branch of WAL CB6. Reconductoring to upgrade the section of 11kV lines from WHACB6 to pole 527644 (approximately 3Km of existing GOPHER) using KRYPTON is also required to allow sufficient load transfer and improve reliability.

Scope of Works

- Construct approx 0.6km of 11kV overhead lines from pole 527644 (end of WHACB6) to pole 535283 (end of WALCBX104 branch) using KRYPTON aerial conductors where at least 9 x 11.6m concrete poles shall be installed and fitted with the current DELTA STEEL cross arms.
- Replace existing GOPHER OH11kV conductors from pole 527517 to 527644 using KRYPTON aerial conductors using DELTA STEEL cross arm assemblies.
- Remove redundant X104 from pole 551204 and install 11kV jumpers to connect. Return this NULEC auto recloser to store for refurbishment and re-use for other project. Relocate X115 to pole 534802 to maximize protection coverage.
- Change setting of AB410 on pole 534228 to be normally open link switch.
- Construct approx. 0.5km of 11kV overhead lines from pole 535273 to pole 535371 using IODINE aerial conductors where at least 7 x 11.6m concrete poles shall be installed and fitted with the current DELTA STEEL cross arms.
- Install a SECTOS switch between the new section of OH11kV lines mentioned above. This 11kV switch shall be normally open.
- Update SCADA to reflect the new line section and the new 11kV configuration of WHACB6 and WALCB6.

Timing of Works:

To be completed in the 2013/14 financial year.

<u>Duke St 16mm² Cu Conductor replacement</u>

Background

During Network studies, it was discovered that there are nine distribution transformers with a total of 2,300kVA connected to 16 mm² Cu OH line along Duke Street on LATCB3. There is a plan to replace all the 16mm² copper conductors due to ageing and deterioration over a period of time. Also, the existing 11kV feeder LATCB8 has no interconnection or transfer ability with any other LAT feeders.

This project will upgrade the existing OH 16 mm² Cu OH line along Duke Street thereby mitigating the risk of conductor overloading and will interconnect LATCB3 and LATCB8 using 3c 300 mm² UG 11kV cables and an RMU along Duke Street thereby creating provision for supplying each feeder under contingency and importantly during any 11kV switchgear maintenance work requiring half bus shutdowns.

This project will also standardize the transformer protection by providing individual fuse switches to seven transformers. The opportunity will also be taken to upgrade T5644 to 200kVA to remove and disconnect T4687 in able to remove and disconnect the existing 16mm² Cu along Duke Street.

Scope of Works

Install 4 Ring Main Units as follows:

- One CFCF RMU (1) beside T5644.
- One CFCF RMU (2) in the vicinity of Duke and Ellis Street - location to be coordinated with HCC.
- One CFCF RMU (3) in the vicinity of Duke and Ellis Street - location to be coordinated with HCC.
- One CFCF RMU (4) in the vicinity of Duke and Ellis Street - location to be co-ordinated with HCC.

New CFCF RMU4 - Connect to LATCB8 RMU4 by cutting through existing 3c 300 mm² UG 11kV cable on corner of Duke and Ellis Street.

- Install new 3c 95mm² Al UG 11kV cable from RMU4 “F” switch across Ellis Street to P546304. Approximate cable route length 65m.
- Disconnect and remove existing 3c 35 mm² UG 11kV cable on P546304. Remove DDT1044.
- Terminate one end of new 3c 95 mm² UG 11kV cable to “F” switch to be fused at 25 Amps and joint the other end to 3c 35 mm² UG 11kV cable removed from P546304.
- Install a new 3c 300 mm² UG 11kV cable from RMU4 to RMU3. Approximate cable route length 10m.
- Terminate one end of the new 3c 300 mm² UG 11kV cable to RMU4 left “C” switch to RMU3 middle “C” switch.
- New CFCF RMU3.
- Install 2 sets of 3c 95mm² Al UG 11kV cable from RMU3 “F” switch across Ellis Street to P554109. Approximate cable route length 250m.
- Locate existing 3c 25mm² UG 11kV cable on P546304. Remove DD1590 on P554109 and replace with jumpers.
- Terminate one end of new 3c 95mm² UG 11kV cable to “F” switch of RMU3 to be fused at 80 Amps and joint the other end to the 25mm² Cu UG 11kV cable connecting to T5364.
- Terminate one end of new 3c 95mm² UG 11 V cable to “F” switch of RMU3 to be fused with 6 Amps and joint the other end to the existing 25 mm² Cu UG 11kV cable connected to P554109. This will supply T2149.
- Install a 3c 300mm² UG 11kV cable from RMU3 to RMU2. Approximate cable route length 10m.

- Terminate one end of new 3c 300 mm² UG 11kV cable of RMU3 left “C” switch to RMU2 middle “C” switch.

New CFCF RMU2

- Install new 3c 95mm² Al UG 11kV cable from RMU2 right end “F” switch across Ellis Street to P539216. Approximate cable route length 180m.
- Disconnect and remove existing 3c 35mm² UG 11kV cable on P539216. Remove DD783.
- Terminate one end of new 3c 95mm² UG 11kV cable to “F” switch to be fused at 25 Amps and joint the other end to the 35 mm² Al UG 11kV cable removed from P539216.
- Install new 3c 95mm² Al UG 11kV cable from RMU2 right end “F” switch to P539214. Approximate cable route length 25m.
- Disconnect and remove existing 3c 35mm² UG 11kV cable on P539214. Remove AB1229.
- Terminate one end of new 3c 95mm² UG 11kV cable to “F” switch to be fused at 25 Amps and joint the other end to the 3c 35mm² Al UG 11kV cable removed from P539214.
- Install new 3c 300mm² UG 11kV cable from RMU2 to RM918. Approximate cable route length 300m.
- Terminate one end of new 3c 300mm² UG 11kV cable to RMU2 left “C” switch and the other end to RM918U3.

Existing RM918

- Disconnect, remove and abandon the existing 35 mm² UG 11kV cable between P539210 and RM918U1. Remove H50.
- Install new 3c 300mm² UG 11kV cable from RM918 to RMU1. Approximate cable route length is 180m.
- Terminate one end of new 3c 300mm² UG 11kV cable to RM918U1 left “C” switch and the other end to RMU1.

New CFCF RMU1

- Replace T5644 with a 200kVA transformer. Install a new LV panel with 2 LV fuses for the existing LV circuits and 1 additional fuse unit to supply existing OH LV on P551616.
- Disconnect and remove T4687 LV tails. Disconnect DDT4687 and T4687.
- Install new 4c 185mm² Al UG LV cable from new LV panel (to be fuse at 200 Amps) to P551616. Run the LV cable and connect hard on to existing OH line Beetle. Approximate cable route length 15 meters.
- Install new 3c 95mm² Al UG 11kV cable from RMU1 right end “F” switch to supply the new 200kVA transformer. Approximate cable route length 10m.
- Disconnect and remove existing 3c 35mm² Cu UG 11kV cable on P551616. Remove DD1359.
- Terminate one end of new 3c 95mm² UG 11kV cable to “F” switch to be fused with 25 Amps and terminate the other end to the new 200kVA transformer.
- Install a 3c 95mm² Al UG 11kV cable from RMU1 middle “F” switch to P539201. Approximate cable route length 125m.
- Disconnect and remove existing 3c 35mm² UG 11kV cable on P539201. Remove DD1126.
- Terminate one end of new 3c 95mm² UG 11kV cable to “F” switch to be fused at 50 Amps and joint the other end to the 3c 35mm² Al UG 11kV cable removed from P539201.
- Install new 3c 300mm² UG 11kV cable from RMU1 to P539201. Approximate cable route length 125m. Run the 3c 300mm² UG 11kV cable on P539201 and connect hard onto the existing 11kV OH line Stoat via isolating links.

Timing of Works

To be performed in the 2013/14 financial year.

Avalon Drive CB1 11kV Feeder Upgrade

Background

AVA CB1 was identified to be one of the highest loaded 11kV feeders in the Network Load Forecasting 2012 study. The limitation on this feeder is due to thermal limit of 270 Amps due to a section of 70 mm² Cu OH conductors.

The load analysis study shows that AVACB1 will not be able to supply AVACB4, AVACB8, X92 and X91 under contingency.

This project will increase the capacity of AVACB1 to be able to supply AVACB4, AVACB8, X92 and X91 under contingency. This project will also improve reliability by replacing RM599 with an automated RMU.

Scope of Works

- Install a CCCC RMU in the vicinity of Avalon Drive and the corner of Rotokauri Road - temporarily designated as RM1.
- Install a CFCC RMU in the vicinity of Avalon Drive and the corner of Grandview Road - temporarily designated as RM2.
- Install a CCCC RMU in the vicinity of Avalon Drive and the corner of Ellicott Road - temporarily designated as RM3.
- Connect the new RM1 by cutting and through-jointing the existing 3c 300mm² Al UG 11kV cable AVACB1. Connect the extended ends to the right end and middle left "C" switches.
- Install new 3c 300mm² AL UG 11kV cable from new RM1 to P553382. Approximate cable route length is 60m. Terminate one end of this cable to the middle right "C" switch.
- Disconnect and remove the existing 3c 300mm² AL UG 11kV cable from P553382. Connect this cable to the other end of the new 3c 300mm² cable mentioned above.
- Install new 3c 300mm² AL UG 11kV cable from RM1 to new RM2. Terminate one end of this cable to the left "C" switch. Terminate the other end of this cable to the right "C" switch of RM2. Approximate cable route length is 1,000m.
- Install new 3c 300mm² AL UG 11kV cable from RM2 to new RM3. Terminate one end of this cable to the left "C" switch. Terminate the other end of this cable to left "C" switch of RM3. Approximate cable route length is 700m.
- Install new 3c 300mm² AL UG 11kV cable from RM2 to RM599. Approximate cable route length is 30m. Terminate one end of this cable to the middle left "C" switch.
- Disconnect and remove the existing 3c 300mm² AL UG 11kV cable from RM599U1. Connect this cable to the new cable from RM2 mentioned above.
- Open AB437 and close AB96.
- Distribution Technology Specialist to supply the amendment of the AVACB1 protection settings before commissioning to the new 11kV configuration.

Timing of Works:

To be performed in the 2013/14 financial year.

<u>Utilize a redundant 33kV OH line to off-load Wallace Rd CB2 and Horotiu CB5</u>

Background

WAL CB2 and HOR CB5 were identified as two of the highest loaded 11kV feeders in Network Load Forecasting 2012 study. There is an existing 33kV OH line running along Horotiu Rd from RMZ869 to Whatawhata substation that was made redundant by the new Wind Farm connections but was left in place. Because the redundant 33kV is installed on the same poles as the 11kV feeders, the 33kV can be easily converted to 11kV to eliminate some undersized sections of 11kV line.

A number of gains can be made by initiating this project as follows:

- 82 customers can be transferred from HOR CB5 to WHA CB3 with the increase in conductor size and a further 43 customers can be transferred by relocating AB362A.
- Load from WAL CB2 can be transferred to WHA by changing devices and open points around WAL CBX82 and AB448A.
- Around 0.8 MVA can be offloaded from HOR CB5 to WHA CB3 and 0.7 MVA offloaded from WAL CB2 to WHA CB5.
- WHA CB3 capacity to support HOR CB5 under contingency will increase.
- WHA CB3 line clashing risk is eliminated by using the 33kV construction with greater clearance distances.
- WHA Zone transformer utilization will increase from 13% to 19%.
- Overall reliability increase around the affected Wallace and Horotiu feeders.

Scope of Works

Convert the redundant 33kV OH line to 11kV as follows:

- At P527722, remove the existing WHA CB3 3c 300mm^2 cables from the 11kV level and connect to the redundant 33kV L1 arrangement to create the new WHA CB3 circuit.
- Transfer transformers T84, T2783, T3704 and T5904 from the L2 11kV connections to the new L1 11kV by installing new jumpers.
- Interchange WAL CBX82 and AB448A to transfer load from WAL CB2 to WHA CB5.
- Transfer transformer T4487 and the lateral connections to Cemetery Rd and Laxon Rd from the L2 11kV connections to the new L1 11kV by installing new jumpers.
- Remove the 11kV OH 25mm^2 Cu conductor and L2 cross arms between P510989 and P510975.
- Install a new Sectos switch on P510960 and connect to the new L1 11kV circuit.
- Transfer transformer T1295 and the lateral connection to Blackett Rd from the L2 11kV connections to the new L1 11kV by installing new jumpers.
- Remove the 11kV OH 25mm^2 Cu conductor and L2 cross arms between P510975 and P510960.
- Transfer transformers T4429, T82 and T923 from the L2 11kV connections to the new L1 11kV by installing new jumpers.
- Remove the 11kV OH 25mm^2 Cu conductor and L2 cross arms between P510960 and P510939.

- Transfer transformer T5181 from the L2 11kV connections to the new L1 11kV by installing new jumpers.
- Disconnect and remove AB362A from P510936.
- Transfer the lateral connection to Woolrich Rd from the L2 11kV connections to the new L1 11kV by installing new jumpers.
- Remove remaining redundant 11kV equipment and conductor.
- Distribution Technology Specialist to supply the amendment of the WHA CB3 and WAL CBX82 protection settings before commissioning to the new 11kV configuration.

Timing of Works:

To be performed in the 2013/14 financial year.

Weavers Zone Substation Resonant Earthing System Installation

Background

Weavers Substation has some of the worst performing rural 11kV feeders on the Network. Because of the length and remoteness of these feeders, the attempts to increase the reliability have reached a point where the cost to gain benefits far outweigh the benefits achieved due to the low customer numbers on those feeders.

WEL are to install a Resonant Earthing System (RES) at Weavers that basically compensates for any ground faulted feeder to reduce any earth fault to a very low level to enable the 11kV feeder to stay in service whilst fault finding and repair is carried out. Although commonly used in Europe, this system will be a first for WEL.

Scope of Works

- Design, install and commission a RES system at Weavers substation in conjunction with the agents for Swedish Neutral and HV Power.
- Upgrade any WEA 11kV surge arrestors not rated to 11kV.
- Replace any 11kV insulators that may fail under full 11kV application.

Timing of Works:

To commence in the 2013/14 financial year and to be carried out over three years.

Wallace Rd Zone Substation Transformer Replacement

Background

The existing 33/11kV transformers at Wallace Rd are 10MVA units that are reaching their N-1 capacity and are also not meeting the noise requirement levels for the site.

It is proposed to replace the Wallace Rd transformers with new 15/23 MVA units that will cater for the increasing lifestyle load in the area and reduce the site noise emissions. Wallace Rd is a compact site with outdoor 33kV equipment that will present some constructability challenges. To overcome these challenges, it is also proposed to schedule this project with the 33kV outdoor to indoor conversion project. The projects should be timed to allow safe access and constructability for both projects as well as continuity of the required Network security levels for the site.

Scope of Works

- Decommission and remove the 10MVA units at Wallace Rd in accordance with the decommissioning and construction sequence.
- Construct new civil pads for the transformer complete with bunding and oil interceptor valve facilities.
- Install the 15/23 MVA units in accordance with the installation sequence. The new units will be complete with I/O modules and new RegD AVR relays installed on the 11kV incomer panels.
- Install new 33kV and 11kV cables to the transformers as required.
- Commission the units as appropriate to match the installation sequence.

Timing of Works:

To be completed in the 2013/14 financial year.

Arc Flash Protection Installation – Stage 2

Background

An Arc flash study has provided the Incident Energy at a fixed working distance from the arc source and thus determines the hazard level for that particular equipment. The assessment was carried out in accordance with IEEE STD 1584-2002.

This project focuses on the 11kV metal-clad switchgear in zone substations and switching stations over a 2 stage, 2 year project. Of the 44 11kV sites, at 21 of them the faults at the switchgear equipment can result in arc flash hazard levels that exceed WEL's standard Category 2 PPE rating. Under Stage 1, the design has been completed for Pukete, Wallace and Latham with the Pukete installation to be deferred to 2013/14 to occur with the next Anchor generation outage.

This PDD looks at designing three more substations and fitting those three substations plus Pukete at high with arc flash protection under stage 2. With the installation of arc flash relays, the incident energy will be reduced to levels that are deemed acceptable.

Scope of Works

- Complete the detailed design for Chartwell, Ngaruawahia and Sandwich Rd substations.
- Complete the installation at Chartwell, Ngaruawahia, Sandwich Rd and Pukete substations.
- Commission all sites and provide test reports and as-built drawings.

Timing of Works

To be performed in the 2013/14 financial year.

33kV Protection upgrade from Distance to Differential

Background

The objective of the project is to reduce the risk of 33kV network failure from protection inadequacies to the existing 33kV circuits by:

- Retrofitting Line Differential Protection scheme on all 33kV circuits and ensuring duplicate communication links are available.
- Installing Busbar Protection on those 33kV switchboards that are presently not fitted with this.
- Installing Breaker Failure Protection schemes on all switchboards that have Busbar protection fitted.
- Installing Trip Circuit Supervision to all relevant circuit breaker control circuits where this is not already fitted.

The above work has been re-scheduled to be completed in the next 2 to 3 financial years.

The precise order of circuits to be retrofitted has not yet been finalised and will coincide with other scheduled project works at the affected sites

Scope of Works

Upgrade the 33kV protection relays at the following sites:

- PEA CB872 to complete the differential circuit – HAM CB1152 end complete.
- PEA CB882 to complete the differential circuit – HAM CB1202 end complete.
- Install differential on both ends of the PUK CB732 to HOR CB572 circuit.
- Install differential on both ends of the AVA CB272 to WAL CB172 circuit.
- Install differential on both ends of the WAL CB252 to LAT CB482 circuit.
- Install differential on both ends of the SAN CB772 to AVA CB492 circuit.
- Install Bus Zone and CB Fail protection at Pukete substation.

- Install Bus Zone and CB Fail protection at Horotiu substation.
- Install Trip Circuit Supervision monitoring at Pukete and Horotiu substations.
- Supply as left protection settings and as-built drawings for works completed at all sites.

Timing of Works:

The work at these sites is to be performed in the 2013/14 financial year.

Peacockes 33kV GIS Installation

Background

The 33kV outdoor lattice steel structure, oil-filled circuit breakers, and air-break switches at Peacockes substation, are nearing the end of their economic life. The existing 33kV outdoor switchgear will be replaced with new indoor GIS switchgear complete with new protection relays.

A new 33kV switchroom has already been completed in the 12/13 financial year as part of the building seismic strengthening project. The new 33kV GIS switchgear will enable the 33kV differential protection upgrade programme to maintain and improved the security of the subtransmission network. New transformer protection scheme will also be implemented to replace the current outdated scheme. Also the removal of the existing outdoor structure will make space available for the construction of a new 11kV switchroom and zone transformer replacement in the 14/15 year.

In addition some landscaping is to be provided to improve the overall appearance and security of Peacockes Substation.

Scope of Works

- Replace the existing 33kV outdoor oil circuit breakers and all other outdoor structures with a suite of 8 indoor gas insulated units come with new SEL protection relays.
- Upgrade the zone transformer protection schemes using new protection relays come with the switchgear.
- Establish control and protection communication to the relevant sites.
- Install 33kV 1c/630mm2 AL XLPE cables per phase from the bushings of transformers T6 and T7 to the indoor transformer feeder circuit breakers CB4932 and CB4952. Install cable termination stands adjacent to each transformer to enable connection to transformer bushings via jumpers.
- Install 33kV 3x1c/630mm2 AL XLPE cables from CB4912 to pole 543090 Weston Lea Drive and connect to overhead HAMCB2172 line. Overhead conductor to connect to is Butterfly 320mm2 AAC. Install surge arrestors. These cables will replace the existing 33kV 3 x 1c/300mm2 AL XLPE cables which are under-rated. Cable route length approx 670m.

- Cap, seal and bury ends of redundant 33kV cables. These may be used in the future for new 11kV feeders or to replace existing overhead sections of PEACB1 or PEACB2 from the substation. (If this is done the opportunity should be taken to OHUG the LV along here also).
- Install 33kV 3x1c/630mm2 AL XLPE cables to connect the remaining two incoming 33kV circuits to the new switchgear. Cable route length approx 100m each.
- Provide perimeter landscaping to improve the appearance and screen the substation providing additional security. Details to be provided by Network Design after consultation with HCC.
- Earth grid and earthing of equipment in accordance with WEL standards. The existing substation earth grid design will be checked to ensure adequacy.
- Following commissioning, the 33kV outdoor structure is to be dismantled and removed. This will include removal of redundant assets including oil circuit breakers CB362, CB372, CB392, CB872, CB882, air break switches Z60, Z61, Z62, Z63A, Z64A, voltage transformer VT1, associated steel structure and bus bars, all redundant concrete pads. Grassed areas are to be reinstated.

Timing of Works

To be completed in the 2013/14 financial year.

Photo 24 WEL Depot, Maui St

Photo 25 WEL Depot, Maui St

Appendix 7 Key Amendments to the AMP dated March 2013

Clause Amended	Amendment	Amendment Date
General	Plan reviewed and updated for the new 10 year period	27 March 2013

Appendix 8 Project Maps

The following maps give an overview of the major projects WEL plans to undertake within five years from 1 April 2013. There is no guarantee all of these projects will go ahead and timing may vary, due to external factors and WEL's project prioritisation process. The maps show only the major projects (over $500k) and exclude the numerous smaller projects WEL plans to undertake. More detailed lists of proposed projects are described in section 5.10 of the Asset Management Plan, including smaller capital projects, customer driven projects and asset replacements projects. The northern network region fed from Meremere and Huntly GXPs; has been grouped within the Huntly GXP region in the following maps.

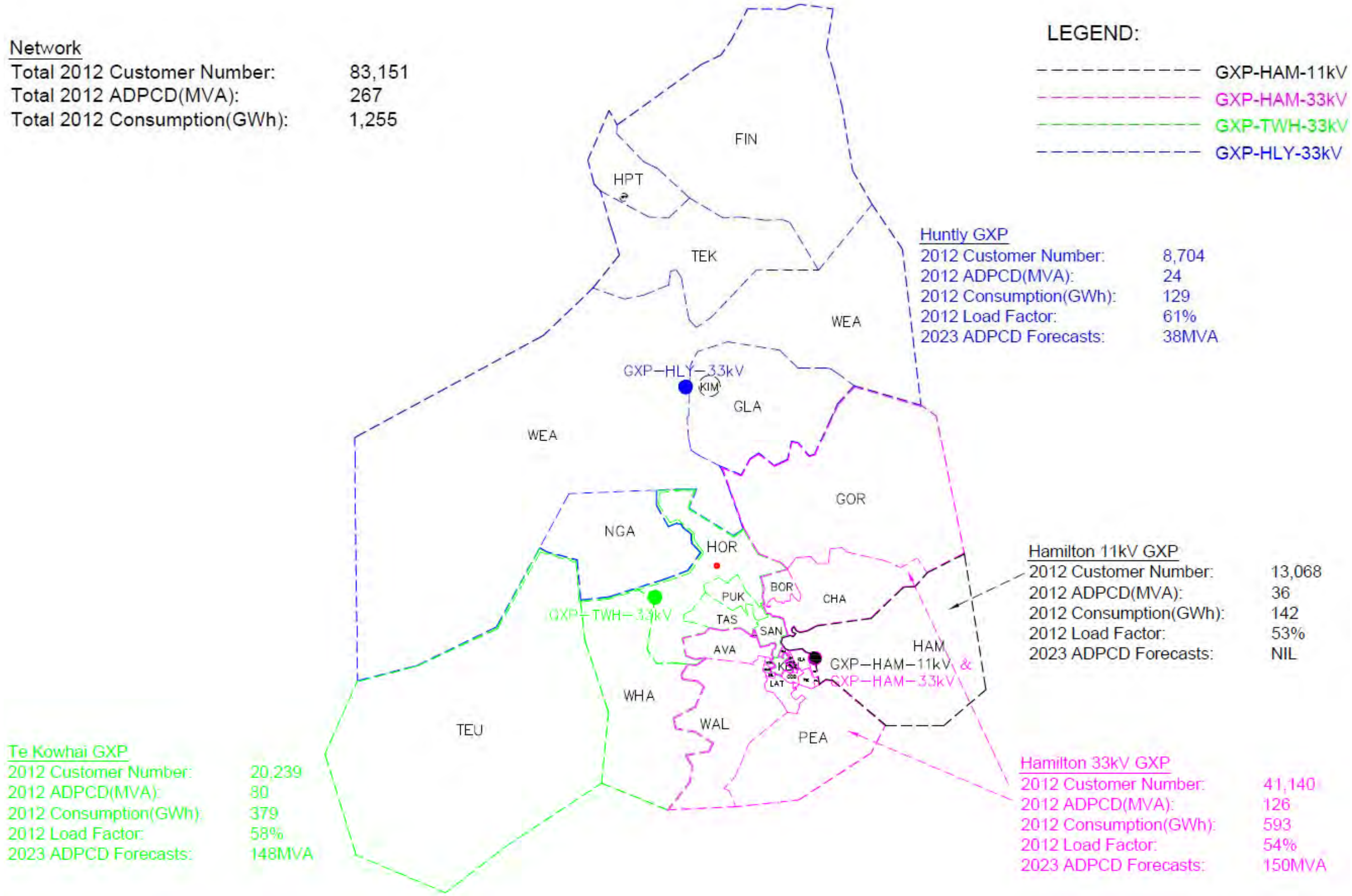


Figure 113. Key Statistics By Each GXP

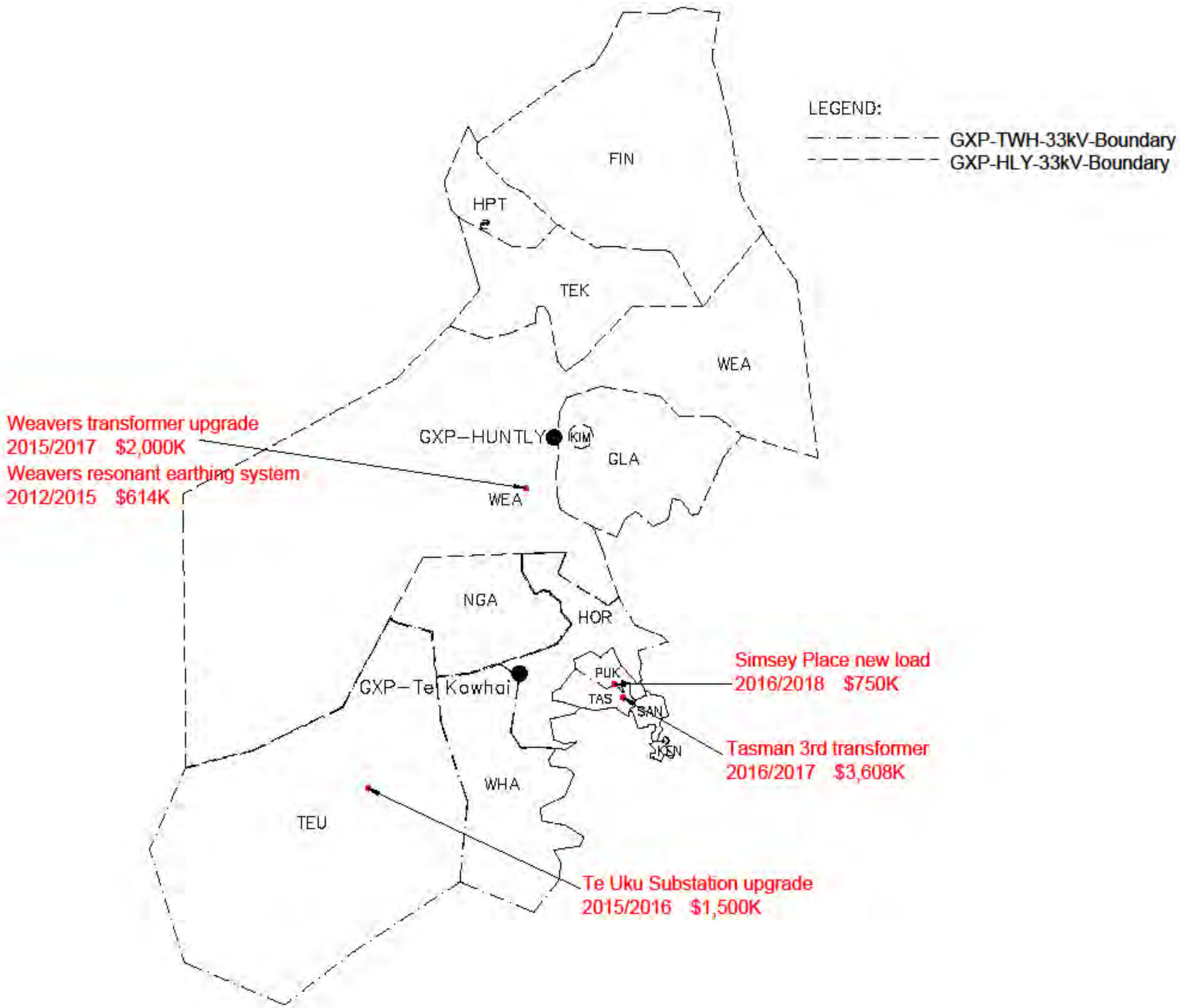


Figure 114. Major projects WEL plans to undertake within five years from 1 April 2013 for Huntly and Te Kowhai GXP areas

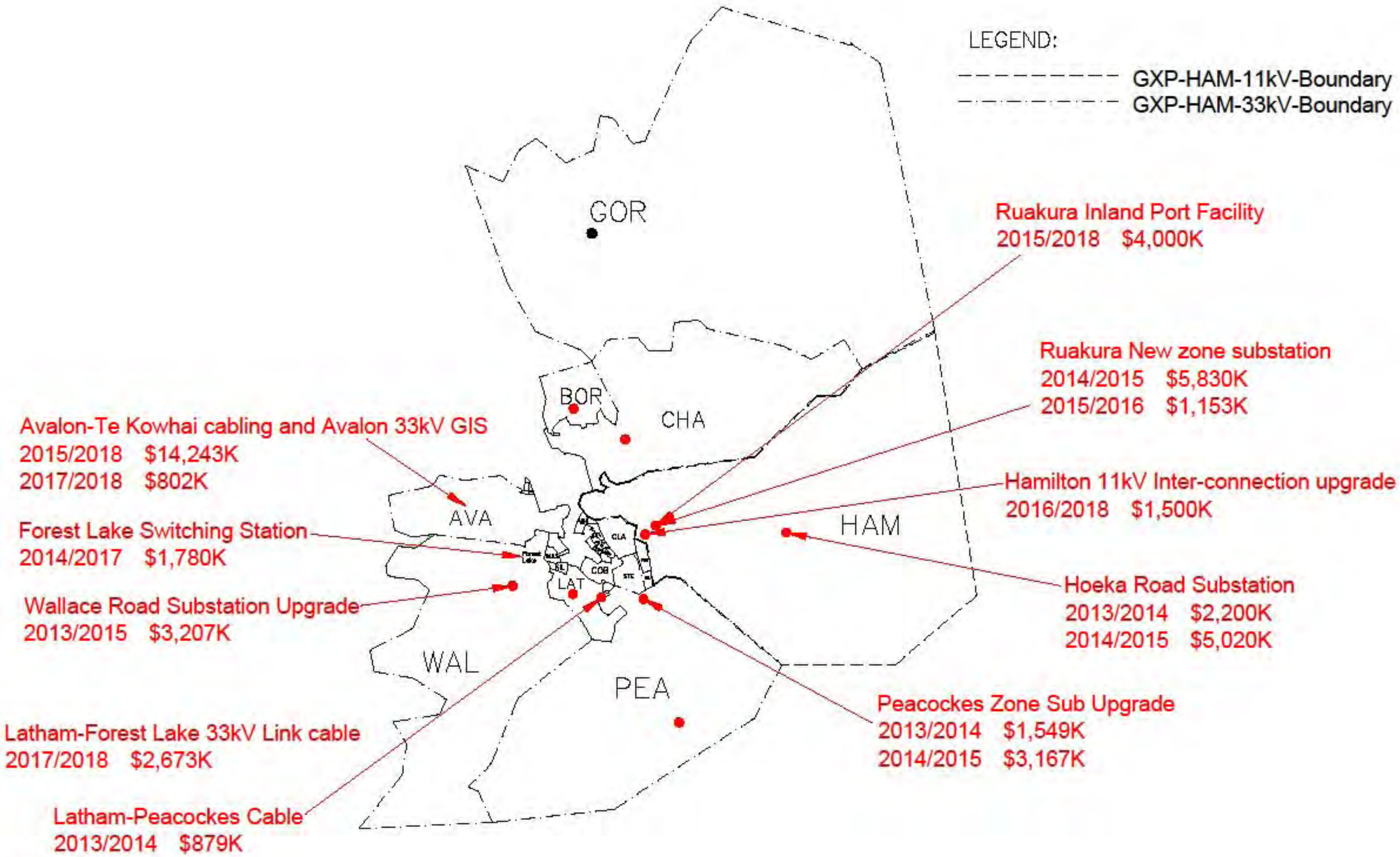


Figure 115. Major projects WEL plans to undertake within five years from 1 April 2013 for the HAM area excluding the CBD

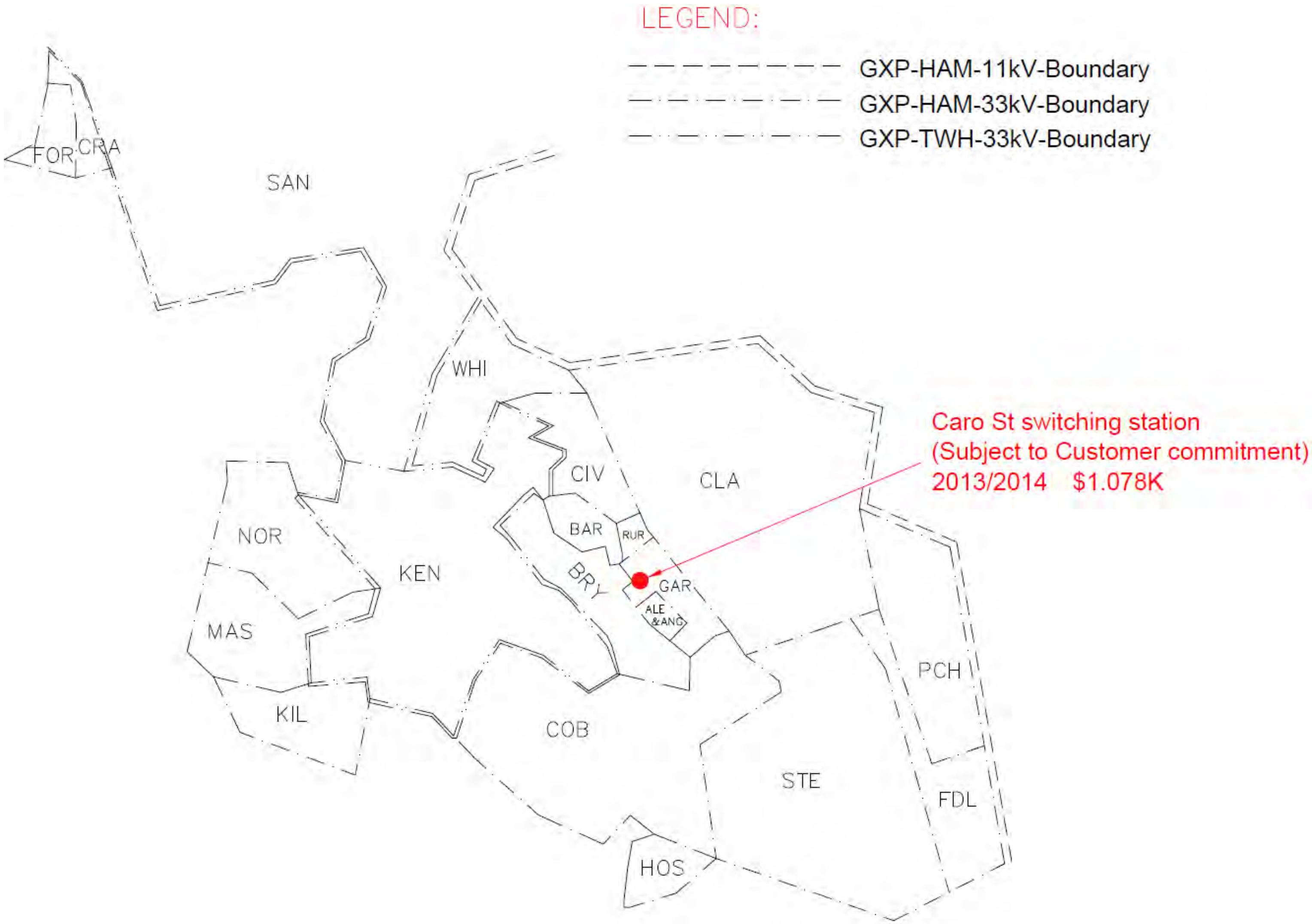


Figure 116. Major projects WEL plans to undertake within five years from 1 April 2013 for the CBD in the HAM area

Appendix 9 Required Reports in 2.6.5 of Electricity Distribution Information Disclosure Determination 2012

- The Report on Forecast Capital Expenditure in Schedule 11a
- The Report on Forecast Operational Expenditure in Schedule 11b
- The Report on Asset Condition in Schedule 12a
- The Report on Forecast Capacity in Schedule 12b
- The Report on Forecast Network Demand in Schedule 12c
- The Report on Forecast Interruptions and Duration in Schedule 12d
- The Report on Asset Management Maturity in Schedule 13

Company Name **WEL Networks Ltd**
AMP Planning Period **1 April 2013 – 31 March 2023**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)
EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
8	for year ended	31 Mar 13	31 Mar 14	31 Mar 15	31 Mar 16	31 Mar 17	31 Mar 18	31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23
9	**11a(i): Expenditure on Assets Forecast**	**$000 (in nominal dollars)**										
10	Consumer connection	8,197	8,338	7,270	7,426	7,855	7,962	7,555	7,408	7,552	7,696	7,840
11	System growth	10,957	25,487	26,832	12,820	23,347	19,569	13,991	11,329	12,112	5,201	4,873
12	Asset replacement and renewal	8,465	12,683	11,945	12,207	12,590	12,054	14,460	11,945	12,862	11,776	10,572
13	Asset relocations	3,685	2,659	2,717	2,776	2,834	2,893	2,951	3,010	3,068	3,127	3,185
14	Reliability, safety and environment:											
15	Quality of supply	443	614	627	641	654	668	681	695	708	722	718
16	Legislative and regulatory	660	675	105	107	109	111	114	-	-	-	-
17	Other reliability, safety and environment	2,531	3,536	822	853	1,192	706	888	801	778	541	499
18	**Total reliability, safety and environment**	3,634	4,825	1,554	1,601	1,955	1,485	1,683	1,495	1,486	1,263	1,216
19	**Expenditure on network assets**	34,939	53,992	50,318	36,829	48,581	43,962	40,640	35,187	37,080	29,063	27,686
20	Non-network assets	14,447	7,601	3,619	4,734	4,522	4,990	2,484	3,105	2,908	3,946	3,791
21	**Expenditure on assets**	49,386	61,594	53,937	41,563	53,103	48,952	43,124	38,292	39,987	33,008	31,477
22												
23	*plus* Cost of financing	574	349	1,022	1,068	1,332	1,287	1,267	118	-	-	-
24	*less* Value of capital contributions	4,723	3,383	4,317	4,317	4,317	4,317	4,317	4,317	4,317	4,317	4,317
25	*plus* Value of vested assets	-	-	-	-	-	-	-	-	-	-	-
26												
27	**Capital expenditure forecast**	45,238	58,559	50,642	38,314	50,117	45,922	40,074	34,093	35,670	28,691	27,159
28												
29	Value of commissioned assets	32,491	34,946	29,800	24,217	30,144	28,258	24,071	20,816	21,448	18,477	17,634

30		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
	for year ended	31 Mar 13	31 Mar 14	31 Mar 15	31 Mar 16	31 Mar 17	31 Mar 18	31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23
32		**$000 (in constant prices)**										
33	Consumer connection	8,197	8,155	6,957	6,957	7,207	7,157	6,657	6,400	6,400	6,400	6,400
34	System growth	10,957	24,926	25,676	12,009	21,420	17,590	12,327	9,787	10,264	4,325	3,978
35	Asset replacement and renewal	8,465	12,404	11,431	11,435	11,550	10,835	12,740	10,320	10,900	9,793	8,630
36	Asset relocations	3,685	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600
37	Reliability, safety and environment:											
38	Quality of supply	443	600	600	600	600	600	600	600	600	600	586
39	Legislative and regulatory	660	660	100	100	100	100	100	-	-	-	-
40	Other reliability, safety and environment	2,531	3,459	787	800	1,094	635	783	692	659	450	407
41	**Total reliability, safety and environment**	3,634	4,719	1,487	1,500	1,794	1,335	1,483	1,292	1,259	1,050	993
42	**Expenditure on network assets**	34,939	52,804	48,151	34,500	44,570	39,517	35,806	30,399	31,423	24,168	22,601
43	Non-network assets	14,447	7,377	3,496	4,483	4,198	4,542	2,217	2,716	2,494	3,318	3,125
44	**Expenditure on assets**	49,386	60,181	51,647	38,983	48,768	44,059	38,023	33,115	33,917	27,486	25,726
45												
46	**Subcomponents of expenditure on assets (where known)**											
47	Energy efficiency and demand side management, reduction of energy losses	7,081	14,556	5,840	451	451	451	451	451	451	451	451
48	Overhead to underground conversion	1,534	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
49	Research and development	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
for year ended	31 Mar 13	31 Mar 14	31 Mar 15	31 Mar 16	31 Mar 17	31 Mar 18	31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23
Difference between nominal and constant price forecasts	**$000**										
Consumer connection	-	183	313	470	649	805	899	1,008	1,152	1,296	1,440
System growth	-	561	1,155	811	1,928	1,979	1,664	1,541	1,848	876	895
Asset replacement and renewal	-	279	514	772	1,040	1,219	1,720	1,625	1,962	1,983	1,942
Asset relocations	-	59	117	176	234	293	351	410	468	527	585
Reliability, safety and environment:											
Quality of supply	-	14	27	40	54	68	81	95	108	122	132
Legislative and regulatory	-	15	5	7	9	11	14	-	-	-	-
Other reliability, safety and environment	-	78	35	54	98	71	106	109	119	91	92
Total reliability, safety and environment	-	106	67	101	161	150	200	203	227	213	223
Expenditure on network assets	-	1,188	2,167	2,329	4,011	4,446	4,834	4,788	5,656	4,894	5,085
Non-network assets	-	225	123	251	324	448	267	389	414	628	666
Expenditure on assets	-	1,413	2,290	2,580	4,335	4,894	5,101	5,176	6,070	5,522	5,751

11a(ii): Consumer Connection

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 13	31 Mar 14	31 Mar 15	31 Mar 16	31 Mar 17	31 Mar 18
*Consumer types defined by EDB**	**$000 (in constant prices)**					
Residential and Business Customers (non TOU)*	4,668	4,900	4,900	4,900	4,900	4,600
External Networks	784	357	257	257	257	257
Low voltage, low energy (400V)	628	639	639	639	639	639
Low voltage, high energy (400V)	642	652	652	652	652	652
Medium voltage (11kV)	501	1,588	509	509	509	509
High voltage (33kV)	-	-	-	-	-	-
Asset Specific Customer	974	20	-	-	250	500
	-	-	-	-	-	-
**include additional rows if needed*						
Consumer connection expenditure	8,197	8,155	6,957	6,957	7,207	7,157
less Capital contributions funding consumer connection	2,582	2,285	2,617	2,617	2,617	2,617
Consumer connection less capital contributions	5,616	5,870	4,340	4,340	4,590	4,540

11a(iii): System Growth

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
Subtransmission	706	2,276	2,881	3,630	9,401	8,396
Zone substations	1,321	4,394	13,100	4,494	8,228	5,451
Distribution and LV lines	755	2,424	1,775	2,596	2,425	2,425
Distribution and LV cables	243	241	1,188	589	721	668
Distribution substations and transformers	727	502	201	91	91	91
Distribution switchgear	124	532	437	95	85	84
Other network assets	7,081	14,556	6,095	514	468	475
System growth expenditure	10,957	24,926	25,676	12,009	21,420	17,590
less Capital contributions funding system growth	-	-	-	-	-	-
System growth less capital contributions	10,957	24,926	25,676	12,009	21,420	17,590

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
	for year ended	**31 Mar 13**	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**

11a(iv): Asset Replacement and Renewal

		$000 (in constant prices)					
	Subtransmission	-	32	-	-	-	-
	Zone substations	231	2,640	831	805	930	325
	Distribution and LV lines	5,881	6,676	6,968	6,918	6,818	6,818
	Distribution and LV cables	173	110	109	109	109	109
	Distribution substations and transformers	605	836	1,137	1,537	1,637	1,637
	Distribution switchgear	952	1,125	1,425	1,325	1,340	1,340
	Other network assets	622	985	961	741	716	606
	Asset replacement and renewal expenditure	8,465	12,404	11,431	11,435	11,550	10,835
less	Capital contributions funding asset replacement and renewal	308	281	401	401	401	401
	Asset replacement and renewal less capital contributions	8,157	12,124	11,030	11,035	11,150	10,435

11a(v):Asset Relocations

	*Project or programme**						
	Relocations	1,546	1,600	1,600	1,600	1,600	1,600
	HCC Ring Road Ruakura to Peachgrove	1,139	-	-	-	-	-
	Undergrounding	1,000	1,000	1,000	1,000	1,000	1,000
	[Description of material project or programme]	-	-	-	-	-	-
	[Description of material project or programme]	-	-	-	-	-	-
	**include additional rows if needed*						
	All other asset relocations projects or programmes						
	Asset relocations expenditure	3,685	2,600	2,600	2,600	2,600	2,600
less	Capital contributions funding asset relocations	1,832	818	1,300	1,300	1,300	1,300
	Asset relocations less capital contributions	1,852	1,782	1,300	1,300	1,300	1,300

11a(vi):Quality of Supply

	*Project or programme**						
	Voltage upgrade projects due to monitoring	55	100	100	100	100	100
	Power Quality - Works required to correct customer complaints	388	500	500	500	500	500
	[Description of material project or programme]	-	-	-	-	-	-
	[Description of material project or programme]	-	-	-	-	-	-
	[Description of material project or programme]	-	-	-	-	-	-
	**include additional rows if needed*						
	All other quality of supply projects or programmes	-	-	-	-	-	-
	Quality of supply expenditure	443	600	600	600	600	600
less	Capital contributions funding quality of supply	-	-	-	-	-	-
	Quality of supply less capital contributions	443	600	600	600	600	600

11a(vii): Legislative and Regulatory

Project or programme*						
Seismic upgrades of substations	-	100	100	100	100	100
Seismic strengthening of Glasgow and Avalon (old) buildings	120	560	-	-	-	-
Seismic strengthening of Peacokes Substation	540	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
*include additional rows if needed						
All other legislative and regulatory projects or programmes	-	-	-	-	-	-
Legislative and regulatory expenditure	660	660	100	100	100	100
less Capital contributions funding legislative and regulatory	-	-	-	-	-	-
Legislative and regulatory less capital contributions	660	660	100	100	100	100

11a(viii): Other Reliability, Safety and Environmer

for year ended	*Current Year CY* 31 Mar 13	*CY+1* 31 Mar 14	*CY+2* 31 Mar 15	*CY+3* 31 Mar 16	*CY+4* 31 Mar 17	*CY+5* 31 Mar 18
*Project or programme**	**$000 (in constant prices)**					
Dannemora subdivision remedial works	359	773	-	-	-	-
Weavers Sub via resonant earthing (Ground fault neutralizer).	31	473	107	-	-	-
Network Communication upgrades	554	584	216	352	623	163
DR Site relocation	106	459	-	-	-	-
	-	-	-	-	-	-
*include additional rows if needed						
All other reliability, safety and environment projects or programmes	1,481	1,170	465	448	471	472
Other reliability, safety and environment expenditure	2,531	3,459	787	800	1,094	635
less Capital contributions funding other reliability, safety and environment	-	-	-	-	-	-
Other reliability, safety and environment less capital contributions	2,531	3,459	787	800	1,094	635

11a(ix): Non-Network Assets

Routine expenditure						
*Project or programme**						
Computer equipment	153	520	250	140	390	250
Comp software	1,138	3,194	2,272	2,053	2,025	3,528
Plant and equipment	430	215	252	252	262	292
Motor vehicles	1,411	1,872	722	2,038	1,521	472
	-	-	-	-	-	-
*include additional rows if needed						
All other routine expenditure projects or programmes	-	-	-	-	-	-
Routine expenditure	3,132	5,801	3,496	4,483	4,198	4,542
Atypical expenditure						
*Project or programme**						
Office and depot purchase and renovations	11,316	1,576	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
*include additional rows if needed						
All other atypical projects or programmes	-	-	-	-	-	-
Atypical expenditure	11,316	1,576	-	-	-	-
Non-network assets expenditure	14,447	7,377	3,496	4,483	4,198	4,542

Report on Forecast Operational Expenditure, Schedule 11b

Company Name	**WEL Networks Ltd**
AMP Planning Period	**1 April 2013 – 31 March 2023**

SCHEDULE 11b: REPORT ON FORECAST OPERATIONAL EXPENDITURE

This schedule requires a breakdown of forecast operational expenditure for the disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms.
EDBs must provide explanatory comment on the difference between constant price and nominal dollar operational expenditure forecasts in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref												
7		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
8	for year ended	**31 Mar 13**	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**
9	**Operational Expenditure Forecast**	**$000 (in nominal dollars)**										
10	Service interruptions and emergencies	2,699	2,495	2,550	2,605	2,660	2,715	2,769	2,824	2,879	2,934	2,989
11	Vegetation management	1,150	1,464	1,327	1,356	1,384	1,413	1,305	1,331	1,357	1,383	1,409
12	Routine and corrective maintenance and inspection	3,117	3,876	3,989	4,085	4,215	4,302	4,481	4,570	4,659	4,844	4,934
13	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
14	**Network Opex**	6,965	7,834	7,866	8,046	8,259	8,429	8,556	8,725	8,895	9,161	9,332
15	System operations and network support	5,329	6,014	7,078	7,288	7,426	7,576	7,714	7,853	7,992	8,131	8,271
16	Business support	6,803	7,447	7,390	7,578	7,798	7,955	8,248	8,479	8,703	8,953	9,196
17	**Non-network opex**	12,132	13,460	14,468	14,866	15,224	15,531	15,963	16,332	16,695	17,085	17,467
18	**Operational expenditure**	19,097	21,294	22,334	22,912	23,483	23,961	24,518	25,058	25,590	26,245	26,799

19		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
20	for year ended	**31 Mar 13**	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**
21		**$000 (in constant prices)**										
22	Service interruptions and emergencies	2,699	2,440	2,440	2,440	2,440	2,440	2,440	2,440	2,440	2,440	2,440
23	Vegetation management	1,150	1,431	1,270	1,270	1,270	1,270	1,150	1,150	1,150	1,150	1,150
24	Routine and corrective maintenance and inspection	3,117	3,790	3,817	3,827	3,867	3,867	3,948	3,948	3,948	4,028	4,028
25	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
26	**Network Opex**	6,965	7,662	7,527	7,537	7,577	7,577	7,538	7,538	7,538	7,618	7,618
27	System operations and network support	5,329	5,923	6,807	6,878	6,878	6,888	6,888	6,888	6,888	6,888	6,888
28	Business support	6,803	7,335	7,113	7,154	7,224	7,234	7,364	7,433	7,493	7,573	7,642
29	**Non-network opex**	12,132	13,258	13,920	14,032	14,102	14,122	14,251	14,321	14,381	14,460	14,530
30	**Operational expenditure**	19,097	20,920	21,447	21,569	21,679	21,699	21,789	21,859	21,919	22,078	22,148
31	**Subcomponents of operational expenditure (where known)**											
32	Energy efficiency and demand side management, reduction of											
33	energy losses	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	Direct billing*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	Research and Development	116	130	125	125	125	125	125	125	125	125	125
	Insurance	444	485	518	538	558	578	598	618	637	657	677
37	** Direct billing expenditure by suppliers that direct bill the majority of their consumers*											
38												

39		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
40	for year ended	**31 Mar 13**	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**
41	**Difference between nominal and real forecasts**	**$000**										
42	Service interruptions and emergencies	-	55	110	165	220	275	329	384	439	494	549
43	Vegetation management	-	32	57	86	114	143	155	181	207	233	259
44	Routine and corrective maintenance and inspection	-	85	172	258	348	435	533	622	711	816	906
45	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
46	**Network Opex**	-	172	339	509	682	852	1,018	1,187	1,357	1,543	1,714
47	System operations and network support	-	90	271	411	549	688	827	966	1,105	1,244	1,383
48	Business support	-	112	278	423	574	721	885	1,046	1,210	1,380	1,554
49	**Non-network opex**	-	202	548	834	1,122	1,410	1,711	2,012	2,314	2,624	2,937
50	**Operational expenditure**	-	374	887	1,343	1,804	2,262	2,729	3,199	3,671	4,167	4,651

The Report on Asset Condition, Schedule 12a

Company Name	**WEL Networks Ltd**
AMP Planning Period	**1 April 2013 – 31 March 2023**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref											
7					**Asset condition at start of planning period (percentage of units by grade)**						
8	**Voltage**	**Asset category**	**Asset class**	**Units**	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
9											
10	All	Overhead Line	Concrete poles / steel structure	No.	-	1.72%	-	88.28%	10.00%	2	2.40%
11	All	Overhead Line	Wood poles	No.	34.62%	-	41.76%	13.62%	10.00%	2	35.00%
12	All	Overhead Line	Other pole types	No.	-	-	-	-	-	N/A	-
13	HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km						N/A	-
14	HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km	-	-	-	-	-	N/A	-
15	HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km						N/A	-
16	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km	-	-	-	-	-	N/A	-
17	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km	-	-	-	-	-	N/A	-
18	HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km						N/A	-
19	HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km	-	-	-	-	-	N/A	-
20	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km	-	-	-	-	-	N/A	-
21	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km	-	-	-	-	-	N/A	-
22	HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km	-	-	-	-	-	N/A	-
23	HV	Subtransmission Cable	Subtransmission submarine cable	km	-	-	-	-	-	N/A	-
24	HV	Zone substation Buildings	Zone substations up to 66kV	No.	-	2.11%	58.73%	34.16%	5.00%	3	-
25	HV	Zone substation Buildings	Zone substations 110kV+	No.	-	-	-	-	-	N/A	-
26	HV	Zone substation switchgear	22/33kV CB (Indoor)	No.	-	25.71%	41.50%	27.79%	5.00%	2	20.37%
27	HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.	-	25.71%	41.50%	27.79%	5.00%	2	20.37%
28	HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.						N/A	-
29	HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.	-	-	100.00%	-	-	3	-
30	HV	Zone substation switchgear	33kV RMU	No.	-	-	-	100.00%	-	3	-
31	HV	Zone substation switchgear	50/66/110kV CB (Indoor)	No.	-	-	-	-	-	N/A	-
32	HV	Zone substation switchgear	50/66/110kV CB (Outdoor)	No.	-	-	-	-	-	N/A	-
33	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.	-	-	-	-	-	N/A	-
34	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.	-	-	-	-	-	N/A	-

Row	Voltage	Asset category	Asset class	Units	Grade 1	Grade 2	Grade 3	Grade 4	Grade unknown	Data accuracy (1–4)	% of asset forecast to be replaced in next 5 years
42					Asset condition at start of planning period (percentage of units by grade)						
43											
44											
45	HV	Zone Substation Transformer	Zone Substation Transformers	No.	4.91%	0.89%	49.15%	40.05%	5.00%	4	4.35%
46	HV	Distribution Line	Distribution OH Open Wire Conductor	km						2	2.88%
47	HV	Distribution Line	Distribution OH Aerial Cable Conductor	km						N/A	-
48	HV	Distribution Line	SWER conductor	km	-	-	-	-	-	N/A	-
49	HV	Distribution Cable	Distribution UG XLPE or PVC	km						N/A	-
50	HV	Distribution Cable	Distribution UG PILC	km						N/A	-
51	HV	Distribution Cable	Distribution Submarine Cable	km	-	-	-	-	-	N/A	-
52	HV	Distribution switchgear	3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers	No.	-	-	100.00%	-	-	2	14.66%
53	HV	Distribution switchgear	3.3/6.6/11/22kV CB (Indoor)	No.	0.34%	21.31%	38.31%	35.03%	5.00%	3	4.40%
54	HV	Distribution switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.	6.23%	1.11%	15.65%	62.01%	15.00%	4	6.34%
55	HV	Distribution switchgear	3.3/6.6/11/22kV Switch (ground mounted) - except RMU	No.	-	-	-	-	-	N/A	-
56	HV	Distribution switchgear	3.3/6.6/11/22kV RMU	No.	3.21%	-	53.01%	23.78%	20.00%	4	4.43%
57	HV	Distribution Transformer	Pole Mounted Transformer	No.	8.03%	-	7.80%	59.16%	25.00%	3	13.18%
58	HV	Distribution Transformer	Ground Mounted Transformer	No.	11.43%	1.03%	31.48%	36.06%	20.00%	3	13.45%
59	HV	Distribution Transformer	Voltage regulators	No.	3.06%	-	34.05%	57.89%	5.00%	3	4.00%
60	HV	Distribution Substations	Ground Mounted Substation Housing	No.	-	-	-	-	-	N/A	-
61	LV	LV Line	LV OH Conductor	km						N/A	-
62	LV	LV Cable	LV UG Cable	km						N/A	-
63	LV	LV Streetlighting	LV OH/UG Streetlight circuit	km						N/A	-
64	LV	Connections	OH/UG consumer service connections	No.						N/A	-
65	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.	20.39%	38.64%	16.27%	14.70%	10.00%	3	37.80%
66	All	SCADA and communications	SCADA and communications equipment operating as a single system	Lot	20.27%	-	4.54%	65.19%	10.00%	3	16.41%
67	All	Capacitor Banks	Capacitors including controls	No.	-	-	-	100.00%	-	3	-
68	All	Load Control	Centralised plant	Lot	0.23%	3.24%	62.93%	23.60%	10.00%	3	-
69	All	Load Control	Relays	No.						N/A	
70	All	Civils	Cable Tunnels	km	-	-	-	-	-	N/A	-

Report on Forecast Capacity, Schedule 12b

Company Name **WEL Networks Ltd**
AMP Planning Period **1 April 2013 – 31 March 2023**

SCHEDULE 12b: REPORT ON FORECAST CAPACITY

This schedule requires a breakdown of current and forecast capacity and utilisation for each zone substation and current distribution transformer capacity. The data provided should be consistent with the information provided in the AMP. Information provided in this table should relate to the operation of the network in its normal steady state configuration.

sch ref

7 **12b(i): System Growth - Zone Substations**

sch ref	*Existing Zone Substations*	Current Peak Load (MVA)	Installed Firm Capacity (MVA)	Security of Supply Classification (type)	Transfer Capacity (MVA)	Utilisation of Installed Firm Capacity %	Installed Firm Capacity +5 years (MVA)	Utilisation of Installed Firm Capacity + 5yrs %	Installed Firm Capacity Constraint +5 years (cause)	Explanation
9	Avalon Dr	18.1	23	N-1	10.4	79%	23	88%	No constraint within +5 years	
10	Borman	9.1	23	N-1	7.7	40%	23	76%	No constraint within +5 years	
11	Bryce St	15.4	23	N-1	15.4	67%	23	76%	No constraint within +5 years	
12	Chartwell	19.9	23	N-1	15.7	86%	23	73%	No constraint within +5 years	
13	Claudelands	17.4	23	N-1	17.4	76%	23	79%	No constraint within +5 years	
14	Cobham	15.2	23	N-1	15.2	66%	23	78%	No constraint within +5 years	
15	Finlayson Rd	3.3	8	N	3.3	44%	8	49%	No constraint within +5 years	
16	Glasgow St	8.1	10	N	6.8	81%	10	91%	No constraint within +5 years	
17	Gordonton	6.7	10	N	4.8	67%	10	76%	No constraint within +5 years	2x5MVA transformer. Due to bus arrangement, practically an N-security site.
18	Hampton Downs	1.7	10	N	1.7	17%	10	25%	No constraint within +5 years	
10	Horotiu	11.6	18	N-1	11.6	64%	18	73%	No constraint within +5 years	
11	Kent St	17.1	23	N-1	17.1	74%	23	78%	No constraint within +5 years	
12	Kimihia	3.7	10	N	1.5	37%	10	37%	No constraint within +5 years	
13	Latham Court	17.8	23	N-1	13.5	77%	23	86%	No constraint within +5 years	
14	Hoeka Rd (planned)	-	-	N-1	-	-	23	43%	No constraint within +5 years	Subject to review given the Ruakura development
15	Ngaruawahia	5.5	8	N-1	5.5	73%	8	83%	No constraint within +5 years	
16	Peacockes Rd	15.0	10	N-1	10.7	150%	23	81%	No constraint within +5 years	Emergency rating 15MVA.
17	Pukete - Anchor (major customer)	18.3	30	N-1	-	61%	30	61%	No constraint within +5 years	3-winding tx - share with Contact Energy. With embeded generation.
18	Pukete - WEL's 11kV	7.8	15	N-1	7.8	52%	15	55%	No constraint within +5 years	3-winding tx - share with Contact Energy
19	Raglan	5.4	23	N	5.1	24%	23	27%	Subtransmission circuit	limited by the incoming 33kV OH conductor - suggested by Sriram
20	Ruakura (Replacing TP HAM 11 kV GXP.)	36.5	40	N-1	13.6	91%	46	65%	No constraint within +5 years	Phase shift issue at 11kV.
21	Sandwich Rd	21.5	23	N-1	14.7	93%	23	97%	No constraint within +5 years	
22	Tasman	18.4	23	N-1	17.7	80%	46	66%	No constraint within +5 years	
23	Te Kauwhata	4.4	5	N-1	4.4	88%	10	50%	No constraint within +5 years	
24	Te Uku	1.7	10	N	1.7	17%	10	19%	No constraint within +5 years	
25	Wallace Rd	15.4	10	N-1	15.4	154%	23	68%	No constraint within +5 years	Emergency rating 15MVA.
26	Weavers	9.3	8	N-1	9.3	125%	23	46%	No constraint within +5 years	Emergency rating 11.25MVA.
27	Whatawhata	2.9	23	N	2.9	12%	23	18%	No constraint within +5 years	
28										

29 [1] *Extend forecast capacity table as necessary to disclose all capacity by each zone substation* N

30 **12b(ii): Transformer Capacity**

sch ref		(MVA)
32	Distribution transformer capacity (EDB owned)	771
33	Distribution transformer capacity (Non-EDB owned)	26
34	**Total distribution transformer capacity**	797
35		
36	**Zone substation transformer capacity**	740.0

Company Name	**WEL Networks Ltd**
AMP Planning Period	**1 April 2013 – 31 March 2023**

SCHEDULE 12C: REPORT ON FORECAST NETWORK DEMAND

This schedule requires a forecast of new connections (by consumer type), peak demand and energy volumes for the disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumptions used in developing the expenditure forecasts in Schedule 11a and Schedule 11b and the capacity and utilisation forecasts in Schedule 12b.

sch ref							
7	**12c(i): Consumer Connections**						
8	*Number of ICPs connected in year by consumer type*			**Number of connections**			
9		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
10	for year ended	**31 Mar 13**	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**
11	*Consumer types defined by EDB**						
12	Residential and Business Customers (non TOU)*	82,190	82,606	83,928	84,952	85,989	87,038
13	Low voltage, low energy (400V)	231	237	208	209	210	211
14	Low voltage, high energy (400V)	238	248	243	244	245	246
15	Medium voltage (11kV)	189	189	192	192	192	192
16	High voltage (33kV)	5	5	6	6	6	6
	Street lighting	31	31	31	31	31	31
	Other unmetered	245	245	245	245	245	245
	External networks	2,117	2,162	1,972	1,972	1,972	1,972
	Asset specific customers	5	7	7	7	7	7
	one tariff group.						
17	**Connections total**	82,853	83,285	84,577	85,603	86,642	87,693
18	**include additional rows if needed*						
19	**Distributed generation**						
20	Number of connections	4	4	4	4	4	4
21	Installed connection capacity of distributed generation (MVA)	109	109	109	109	109	109
22	**12c(ii) System Demand**						
23		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
24	**Maximum coincident system demand (MW)** — for year ended	**31 Mar 13**	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**
25	GXP demand	240	252	255	262	270	275
26	*plus* Distributed generation output at HV and above	0	0	0	0	0	0
27	**Maximum coincident system demand**	240	252	256	262	271	275
28	*less* Net transfers to (from) other EDBs at HV and above	-	-	-	-	-	-
29	**Demand on system for supply to consumers' connection points**	240	252	256	262	271	275
30	**Electricity volumes carried (GWh)**						
31	Electricity supplied from GXPs	960	971	978	1,002	1,027	1,052
32	*less* Electricity exports to GXPs	133	135	136	139	143	146
33	*plus* Electricity supplied from distributed generation	480	485	488	500	513	526
34	*less* Net electricity supplied to (from) other EDBs	(14)	(14)	(16)	(16)	(17)	(17)
35	**Electricity entering system for supply to ICPs**	1,320	1,336	1,347	1,380	1,414	1,449
36	*less* Total energy delivered to ICPs	1,256	1,270	1,281	1,312	1,344	1,378
37	**Losses**	65	65	66	68	69	71
38							
39	**Load factor**	63%	60%	60%	60%	60%	60%
40	**Loss ratio**	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%

Report on Forecast Interruptions and Duration, Schedule 12d

Company Name	**WEL Networks Ltd**
AMP Planning Period	**1 April 2013 – 31 March 2023**
Network / Sub-network Name	

SCHEDULE 12d: REPORT FORECAST INTERRUPTIONS AND DURATION

This schedule requires a forecast of SAIFI and SAIDI for disclosure and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumed impact of planned and unplanned SAIFI and SAIDI on the expenditures forecast provided in Schedule 11a and Schedule 11b.

sch ref		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
9	for year ended	**31 Mar 13**	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**
10	**SAIDI**						
11	Class B (planned interruptions on the network)	13.7	15.3	15.0	15.0	15.0	15.0
12	Class C (unplanned interruptions on the network)	56.3	54.7	55.0	55.0	55.0	55.0
13	**SAIFI**						
14	Class B (planned interruptions on the network)	0.13	0.15	0.15	0.15	0.15	0.15
15	Class C (unplanned interruptions on the network)	1.16	1.15	1.15	1.15	1.15	1.15

Report on Asset Management Maturity, Schedule 13

Company Name	**WEL Networks Ltd**
AMP Planning Period	**1 April 2013 – 31 March 2023**
Asset Management Standard Applied	

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	3	There are 12 relevant policies signed and published in WEL's internal intranet-Ingrid. A signed and authorised Asset Management policy covers components of safety, reliability, quality, security, efficiency, environment, risk management, legislation and appropriate financial return. It is aligned with other policies. WEL has separate polices: Health and Safety, risk management, environmental and sustainability, data and information integrity and delegated authority policy. Communicated through presentations to the the various teams. Stored in WEL's Content Manager system.	1. Do we have an Asset Management policies to cover: Safety, reliability, quality, security, effeciency, enrionment, risk management, legislation and align with other policies? 2. Have the AM policies documented and authorised and reviewed regularly? 3. How well the AM polices been communicated? 4. Where I can find it?	Widely used AM practice standards require an organisation to document, authorise and communicate its asset management policy (eg, as required in PAS 55 para 4.2 i). A key pre-requisite of any robust policy is that the organisation's top management must be seen to endorse and fully support it. Also vital to the effective implementation of the policy, is to tell the appropriate people of its content and their obligations under it. Where an organisation outsources some of its asset-related activities, then these people and their organisations must equally be made aware of the policy's content. Also, there may be other stakeholders, such as regulatory authorities and shareholders who should be made aware of it.	Top management. The management team that has overall responsibility for asset management.	The organisation's asset management policy, its organisational strategic plan, documents indicating how the asset management policy was based upon the needs of the organisation and evidence of communication.
10	Asset management strategy	What has the organisation done to ensure that its asset management strategy is consistent with other appropriate organisational policies and strategies, and the needs of stakeholders?	3	The AIS 01, Asset Strategy planning process, is in place and has been applied. It states that asset strategy planning is a core business activity within WEL, in conjunction with strategic business planning. This process guide provides the general instructions for each process step, what to do, why it's done and who is responsible for the outcome. This process will guide relevant staff to generate and evaluate high-level investment and maintenance strategies to achieve the strategic performance requirements. It also provides a review of the optimal decisions to balance performance, cost and risk.	Do we have a process for asset management strategy development to ensure that its asset management stratgey is consistent with asset management policy and other appropriate organizational policies and strategies, and the needs for stakeholders?	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?	2.7	The asset management strategy takes into account the lifecycle of most of it's assets, asset types and asset systems and all of their phases. WEL is in the process of developing an Asset Condition Base Risk Management Model (CBRM). It still needs to be implemented.	This relates to the life cycle of the asset from Planning, Design, Construction, Operation, Maintenance, Disposal and Renewal. Each of these phases should incorporate Asset Management and other relevant policies and its strategies. In most cases these are spelt out within the AMP but it needs to be clear. In	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	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. However, as mentioned above, the asset strategy will further be enhanced as a result of the CBRM work.	Lifecycles are generally well covered in AMP but checks should be made by senior managers to satisfy themselves this is the case.	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	**WEL Networks Ltd**
AMP Planning Period	**1 April 2013 – 31 March 2023**
Asset Management Standard Applied	

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	WEL Networks Ltd
		AMP Planning Period	1 April 2013 – 31 March 2023
		Asset Management Standard Applied	

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
27	Asset management plan(s)	How has the organisation communicated its plan(s) to all relevant parties to a level of detail appropriate to the receiver's role in their delivery?	3	The communication occurs in two stages: the first during the development stage, the other during the implementation stage, after approval. Planners, Designers, Project Mangers, Field Service Managers, Schedulers, Supervisors and other relevant stakeholders are involved in both stages. The 10 year spend profile on asset renewal has been modified to reflect the internal resource capability level.	The AMP should be communicated to relevant stakeholders. As the AMP contains details of work, both long term and short term (with higher level of detail for nearer work), end users are the relevant stakeholders and should be consulted as to effects the work plans may have on their activities. This usually involves major users who may have their own plans to change their operations in the future. The consultation must be recorded and evidence provided the outcomes have been considered in 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	This is clearly documented in section 2.5 of 2012 AMP.	The asset management team structure should clearly designate responsibilities and authorities for the delivery of the AMP actions.	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)	2.5	Our inhouse work force has been developed to undertake faults, routine maintenance, asset replacement works and some capital project works. The inhouse workforce is relatively effective and efficient while there is still room for improvement. A number of projects are outsourcing using our tendering process. A high level overall resource plan is developed after approval but has not been monitored and updated	Financial estimates are provided in AMPs for the expected work to be completed. Once established, detailed discussion should be included as to the forward planning developed to ensure areas of risk are identified to achieve the asset management strategies and objectives.	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?	3.1	Well defined and applied systems for faults, emergencies and planning for disasters is in place. Refer to section 7.4 of 2012 AMP	The AMMAT requirement is for a Plan to get Critical Assets back on line after a disaster. To provide evidence this will be achieved, regular written reviews of the Plan are required along with evidence of simulated events, training, communication and consultation.	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.

Company Name	**WEL Networks Ltd**
AMP Planning Period	**1 April 2013 – 31 March 2023**
Asset Management Standard Applied	

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	User Guidance	Why	Who	Record/documented Information
37	Structure, authority and responsibilities	What has the organisation done to appoint member(s) of its management team to be responsible for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s)?	3	This has been clearly documented in section 2.5 of 2012 AMP. The relevant appointment for such positions and the next level are documented and stored in WEL's Content Manager system.	This function has a specific requirement to appoint a manager within the organisation to have the authority to ensure the company delivers on its asset management policies, strategies and plans. This question is intended to apply to the delegation of responsibilities to a senior level manager.	In order to ensure that the organisation's assets and asset systems deliver the requirements of the asset management policy, strategy and objectives responsibilities need to be allocated to appropriate people who have the necessary authority to fulfil their responsibilities. (This question, relates to the organisation's assets eg, para b), s 4.4.1 of PAS 55, making it therefore distinct from the requirement contained in para a), s 4.4.1 of PAS 55).	Top management. People with management responsibility for the delivery of asset management policy, strategy, objectives and plan(s). People working on asset-related activities.	Evidence that managers with responsibility for the delivery of asset management policy, strategy, objectives and plan(s) have been appointed and have assumed their responsibilities. Evidence may include the organisation's documents relating to its asset management system, organisational charts, job descriptions of post-holders, annual targets/objectives and personal development plan(s) of post-holders as appropriate.
40	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	2.5	Executive review and approval of the AMP before the Board presentation and final approval of AMP. The AMP forms the basis of the key Opex and Capex Budgets. The funding requirements in the AMP is factored into our Pricing and Funding calculations and used in the decision making process for both short and long term planning. The company's capex and opex budgets include funding for materials, equipment, services provided by third parties and personnel (internal and service providers) with appropriate skills, competencies and knowledge.	If resources are identified in the AMP, top managers demonstrate sufficient resources are available when approving the AMP. Functional responsibilities for critical duties should be described and need to be tied back to training and competency and defined in the individual position descriptions.	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	The budgets and individual projects are approved by the board, executive and senior managers with appropriate financial authority. Performance reports (safety, quality of delivery, timeframes, cost against budgets and collecting data timely and accurately) are required on a monthly basis. Any differences, and hence perceived risks, to future asset management strategies and objectives are identified and action plans implemented. Typical actions are summarised below: incidence investigation and actions, rework completion, budget variation approval or decline, re-prioritisation on resources for critical project timeline, as built process management review and implementation including training, and continuous improvements processes.	Operating budgets for EDBs are based on the requirements of their AMP. The budgets are approved by top management and senior managers provide performance reports against budget on a monthly basis. Any differences and hence perceived risks to future asset management strategies and objectives need to be identified and action plans put in place.	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	There is a contract strategy management process in place to manage different types of contracts such as preferred contractors, tendering process, alliance contractors etc. however, the balance between inhouse workforces and external contractors and its contract strategy is under review to enable short and long term efficiency and effectiveness of AMP delivery.	In most cases of outsourcing, contracts are in place setting out requirements and performance expectations. The contracts need reference the asset management policies and strategies outlines above. EDBs need to record evidence of regular reviews of the contract performance, operation progress, equipment calibration and other relevant issues.	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	User Guidance	Why	Who	Record/documented Information
48	Training, awareness and competence	How does the organisation develop plan(s) for the human resources required to undertake asset management activities - including the development and delivery of asset management strategy, process(es), objectives and plan(s)?	2.5	Position descriptions detail outputs, standards and qualification, experience and role specific competencies required. This is used as the basis for the recruitment of suitable staff and subsequent training and development. In terms of resource levels, a shortfall has been identified through an assessment done and will be addressed in the 2013/14 financial year.	Asset management activities should be broken down to the extent a defined amount of human resources can be allocated for each activity, including the competence levels required. This analysis should be included in the AMP. This appears to be an area of concern for the Commerce Commission with a national shortage of resources looming so it would be worthwhile ensuring conformance in some detail.	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?	3	Individual competence are compared to those specified in the JD. Individual development plans are drawn up by the incumbent and their manager, in consultation with HR, if required. Graduate Engineers have a competence workbook, aligned with the competence framework set by IPENZ, to track progress. Individual training records are filed electronically in personal files	Most EDBs rely on competency for asset management through experience and qualifications and provide regular training to remain competent. In a lot of cases, the records for this level of staff are not complete and staff are not formally authorised as competent by the company.	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	See 48 and 49 above.	Staff competency should be reviewed regularly to ensure up to date asset management techniques are employed by staff who are fully trained in the new technologies. Records of this progression should be maintained and regular reviews undertaken and development plans put in place	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	User Guidance	Why	Who	Record/documented Information
53	Communication, participation and consultation	How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers?	3	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. Internal, various forums: Exec Meetings, Team Meetings, Team Leader Forum, Staff Forum, InfoShare. External: Project Meetings. A simplier version of the AMP is prepared and distributed to external key stakeholders.	Pertinent information in the AMP must be communicated to employees and contractors. In smaller EDBs the employees usually develop certain sections of the AMP but may not be aware of other pertinent information. Contractors may not be aware of the AMP and act solely on their contractual obligations. EDBs must make a conscience effort to ensure consultation and engagement is developed with all relevant stakeholders.	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?	3	WEL has established a comprehensive business management system including policies, strategic business plans, master processes, sub-processes, procedures, standard operating procedures, WEL standards, manuals, and records. WEL has implemented a document management system for record management (content manager) and a process mapping tool (XSOL).	This function requires documentation (in one form or another) for all the functions above and evidence the documentation is reviewed and up-to-date. EDBs now have document control systems thanks to the new safety management system requirements and asset management documentation should use these facilities to conform to AMMAT.	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?	3	WEL has determined what its asset information system should contain in order to support its asset management system. GIS including Fibre, SAP ERP System, Network Management System, PSS SINCAL Power Analysis Tool, Drawing Management System, Protection Database, Vegetation Management Database (VMD), ICP, Silver Spring Smart Box Head End and Asset Information System for asset valuations are in place. SAP Business Intelligence Reporting and Geomedia Geographic Reporting have been established. Data and information integrity policy and its associated data and information collection and validation processes are in place. refer to section 2.6 of 2012 AMP.	asset information includes asset registers, drawings, contracts, licences, legal, regulatory and statutory documents, policies standards notes and instructions, procedures, operating criteria, performance and condition data and asset records. Most EDBs cover the bulk of This requirement in their GIS. standards, standard drawings and procedures are common. the management of This information is critical and This includes availability of the information to those parties requiring it. Good backup systems are required for computer stored data. the information system to be	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	WEL has a general data and information collection and validation process as well as specific data collection and validation processes and guidelines for the asset management systems. Competent staff are employed to undertake data management roles. Data profiler and integrator are in place to ensure data and information consistency is maintained across different systems.	What controls are in place to insure the information is up-to-date? The AMP is up-to-date but what about the GIS, standards and drawings etc. This function is difficult to control in small EDBs with limited resources and reliance is placed on an experienced and stable work force. However, the comments in Q62 above still apply.	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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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
64	Information management	How has the organisation's ensured its asset management information system is relevant to its needs?	3	WEL addresses this are in two parts. Firstly the system selected is managed by the IS Team using two processes, BSIT 04 Business Requirements Projects Process and BSIT01, Application and Systems Development. The second part is the information requirements. The Asset Information Manager is responsible for collecting information and data, analyzing the benefits, considering cost and risk over the whole life cycle, prioritising needs and obtaining approval for the required information and data capture. Then ensures the data collection and validation process is working effectively and efficiently.	There is no predetermined level of information management. Each EDB must settle on what is appropriate for the size of the organisation and describe what that level and associated process might be. It does, however, need to be demonstrated appropriate processes are systematically managed.	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?	2	We have some good age profile information, some asset condition assessments, and have undertaken the PSMS risk analysis. We also have a good overall process of company risk assessment and all of these are considered during the preparation of the AMP, but we do not have a good solid understanding of all asset class risks over the full life cycle and integration of information.	Most EDBs have addressed the issues of risk management in their AMP. This function requires EDBs to demonstrate appropriate documentation exists across the life cycle of the asset.	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	WEL has a clearly defined a Risk Management Policy, which is published on the company intranet. This Policy and supporting procedure identifies risk management as a core management responsibility and outlines in broad terms the emphasis given to this in both the day-to-day and longer-term facets of managing the assets and overall business. A detailed description of how WEL manages risk is provided in Section 7 of 2012 AMP.	To manage risk effectively, consideration of risk should be embedded into all activities of asset management. EDBs should keep the results of risk identification, assessments and controls up-to date and document where lack of risk control could affect the delivery of asset management objectives and strategies.	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	Evidence exists to demonstrate that the organization's legal, regulatory, statutory and other asset management requirements are identified and kept up to date. Ron Jackson's (Asset Acceptance Assessor) audit checking list is aligned with updated WEL adopted standards, laws and good industry practices. Quarterly Compliance certification is provided to the board. We have also significant external processes (e.g. external audits and reviews) to ensure this occurs.	EDBs a subject to high levels of regulation so, in general, should have This function under control. Executives generally report regularly to the board on compliance issues so have controls in place to ensure direct accountability, competencies, reporting and review cycles.	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	User Guidance	Why	Who	Record/documented Information
88	Life Cycle Activities	How does the organisation establish implement and maintain process(es) for the implementation of its asset management plan(s) and control of activities across the creation, acquisition or enhancement of assets. This includes design, modification, procurement, construction and commissioning activities?	3	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. Details are provided in section 2.6 of 2012 AMP	This function requires a documented process to ensure the life cycle activities in the AMP are carried out under specified conditions that are consistent with the asset management policies and strategies. It includes controls in place for cost and risk minimisation.	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?	3	WEL has two audit positions to carry out internal audit process. One is Asset Acceptance Assessor who is mainly responsible for 1. Review, update and implement worksite inspections to ensure alignment between all relevant Health and Safety, Quality standards, regulations and work practise. 2. Carry out internal audits to further improve existing work methods, 3. Review, update and implement the worksite assessment process 4. Daily job assessments Secondly the Risk and Quality Auditor who is responsible for:- 1. Undertaking regular internal audits to ensure compliance with WEL's BMS and provide recommendations for continuing improvement 2. Undertaking regular internal audits to ensure that the risk	This function requires a process to ensure the documented process above is implemented. This can be achieved with a formal review process of the effectiveness and putting KPI in place to measure performance.	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	Consistent asset performance monitoring linked to the asset management objectives is in place and universally used including reactive and proactive measures. Data quality management and review process are also carried out. Evidence of leading indicators and analysis detail is provided in section 3.3 and 6 of the 2012 AMP. We still have gaps, mainly in the interpretation of "asset condition". Condition Based Risk Management (CBRM) models are being developed with a review of the condition grading system.	A new asset can perform as well as a 50 year old asset but the performance of the 50 year old asset will require closer monitoring due to its age. Asset condition therefore relates closely to performance. Performance indicators such as SAIDI and SAIFI are reactive measures whereas condition monitoring is proactive. The EDBs asset monitoring program should be well defined.	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?	3	WEL have defined the appropriate responsibilities and authorities for the Root Cause Analysis (RCA) process. Agreed actions are put into Action Request (AR) system for implementation and monitoring.	This requires a documented process for investigation of asset failures, incidents and nonconformities and, in particular, requires clearly defined responsibilities and authorities for these activities. A process for feedback of non-conformance is required	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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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	3	WEL have a good range of internal and external audits in place. See comments on question 91.	A documented audit process of the asset management system (not just the AMP) should be planned, established, implemented and maintained. The audit should be conducted by personnel competent in the audit process and ideally be independent of those having direct responsibility for the asset management activities.	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?	3	WEL has defined the appropriate responsibilities and authorities for the Root Cause Analysis (RCA) process. Agreed actions are put into the Action Request (AR) system for implementation and monitoring. Agreed actions include preventative and corrective actions.	Investigation of asset failures, incidents and nonconformities should establish root causes. Preventative action is required to ensure similar failures do not occur in the future. A documented process is required, including responsibilities, competencies and authorities, to ensure processes and systems include feed-back loops to prevent future similar failings.	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	The primary focus of WEL's Business Management System is to improve continually. In addition to audits and its associated process review for continual improvement, an Organisation Development Advisor position has been established to identify company wide improvement projects to be analysed, prioritised, approved, communicated and implementation. There is also a new technology committee who are responsible for identification of new technology, analysis of the potential impact and usefulness, considering life cycle costs. They have to prepare business cases for approval and implement adopted new technology and incorporated into WEL's standard for design and construction.	This function looks beyond audit and review processes for continual improvement. A review process may say things are being done according to plan and an audit may confirm this but continual improvement requires definite actions to look for improving processes and systems. The introduction of new technologies, updating systems and monitoring of international advancements all support continual improvement.	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	WEL encourages staff, and provides financial support, to attend appropriate conferences, workshops, site visits or specific study and training programmes for acquiring knowledge about new systems, processes, new technologies.	How does the organisation go about acquiring knowledge about new systems, processes, new technologies, opportunities, staff skills and environments?	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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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.