Eastland Network

# Asset Management Plan 2019 – 2029

1 April 2019

# Summary of Eastland Network Limited's AMP

## Purpose of the AMP

This Asset Management Plan ("AMP") has been prepared to meet regulatory compliance requirements, demonstrate responsible asset stewardship, integrate stakeholder views, and communicate and justify network management practice and expenditure to Eastland Network Limited ("Eastland Network Limited") stakeholders. Presentation of the AMP in this format also meets the requirements of the Electricity Distribution Information Disclosure Determination 2012.

Primary stakeholders include Eastland Network Limited's shareholder and customers, including retailers, generators and end-use electricity consumers. Other parties with an interest in Eastland Network Limited's asset management include contractors who physically work on the system and regulatory agencies.

Many factors impact on the effective long term management of a complex network of electricity assets, the life of which exceeds the tenure of the Managers responsible for them and whose operating environment introduces significant investment risks. For this reason, the overall scope of the AMP is wide, covering the regulatory environment, future service demands and technology development.

While making long term forecasts to provide sustainability and establish the framework for Eastland Network Limited's future, the AMP primarily drives work programs in the short to medium term. It is in all respects a living document. The practices and processes described are subject to continuous improvement, and detailed work programs are progressively refined throughout the year. The Eastland Group asset management team is the "owner" of this AMP.

## Completion date and planning period

Preparation of the AMP was undertaken between August 2018 and March 2019.

The ten year planning period considered is from 01 April 2019 to 31 March 2029.

The plan documents how Eastland Network Limited ensures long lived network assets are being managed in a sustainable way over their lifecycle within defined boundaries of Shareholder returns, Regulatory requirements for performance and revenues, Customer expectations and Regulatory requirements for Safety and Quality.

The Eastland Network Limited Board of Directors approved the AMP for disclosure on 31 March 2019.

The next revision of the AMP, (covering the period 2020 to 2030) will be prepared for disclosure on 1 April 2020.

## AM systems and information

A quality management system is used to provide policy and procedures covering, Health and Safety, Public Health and Safety, Risk Management, Design Standards, Project Management and Emergency Management.

Asset information covering physical attributes, condition and performance is stored in Databases associated with the GIS system. Standalone systems provide Work management and financial management capabilities.

This plan includes some minimal expenditure associated with reviewing the currency of Eastland Network Limited's GIS and work management system, and upgrading Eastland Network Limited's drawing management system and a number of other ancillary systems. If required the replacement and upgrading of these systems will necessitate additional non-network capex during the planning period. This expenditure will almost be solely renewal/replacement related hence efficiency improvements will be relatively small. With that said, as and when the project business cases are developed it is expected that some efficiency benefits will be recognised and incorporated into future reviews of this plan.

A SCADA system (Supervisory Control and Data Acquisition) provides real time data, trending information and enables remote control of key components of the network. This data and network modelling software are used to analyse the network and assess the impact of changes in utilisation and operation.

Strategic Plans, Business Plans, Budget Processes and the asset management process set the programs for maintenance and asset development to ensure optimum customer service and operational efficiency within financial boundaries. This includes the recognition of the needs of customers that are willing to pay to have additional security and/or reliability of supply. Implicit in the asset planning process is an understanding and evaluation of the risks to operation and the consequences of failure.

The processes activities that form the core of asset management practice and decision making at Eastland Network Limited are regulatory requirement evaluation, condition assessment, reliability performance analysis, asset utilisation/capacity evaluation, risk management, economic optimisation, stakeholder feedback and benchmarking.

Management services are provided by the Eastland Group to Eastland Network Limited. The management services include executive support, financial management, general IT services, planning, design and network operating activities. Since all physical work on the network is contracted out, the network operating function includes significant responsibility for contractor management. In addition to applying commercial disciplines to project identification and justification, Eastland Network Limited negotiates competitive contracts for maintenance and capital projects. The need to train and continuously upgrade the skills of internal staff is recognised through improvement programs and specific training. In the case of contractors and suppliers, forward-looking commercial agreements encourage a partnering approach to skills development and productivity improvement.

Eastland Network Limited is continually striving to find more efficient ways to carry out its activities, reducing costs and improving productivity, and maintaining safety levels. The replacement of a number of Eastland Network Limited's core systems will provide a platform to initiate further developments with the specific purpose of improving efficiency.

# Asset description

The distribution network assets included within the scope of the AMP are indicated below together with quantities and the depreciated replacement cost.

| Asset description | Approx Qty | Unit | Avg Age | Condition Summary | RAB 2018 ($000) | Book Value 2018 |
|---|---|---|---|---|---|---|
| 01. Sub Transmission Line | 641 | km | 48 | Ageing | $2,607 | $6,115 |
| 02. Sub Transmission Poles | 2,666 | each | 35 | Average | $11,377 | $10,737 |
| 03. Sub Transmission Cable | 1 | km | 12 | Good | $9,769 | $359 |
| 04. Other Sub Transmission Assets | | | | Good | $1,464 | $1,413 |
| 05. Zone substation assets | | | | New/Good Condition | $8,978 | $9,842 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 06. Major Transformers | 52 | each | 43 | Average | $6,152 | $8,360 |
| 07. Distribution Line | 2,298 | Km | 49 | Ageing | $9,499 | $8,109 |
| 08. Distribution Poles | 24,745 | each | 30 | Average | $36,771 | $34,509 |
| 09. Distribution Cable | 134 | km | 26 | Above Average | $13,838 | $11,945 |
| 10. Distribution Substations | 3,589 | each | 25 | Average | $5,209 | $6,165 |
| 11. Distribution transformers | 3,589 | each | 25 | Average | $10,968 | $12,006 |
| 12. Switchgear | 7,231 | each | 33 | Average | $12,727 | $12,181 |
| 13. Load Control Equipment | | | | Average | $2,090 | $1,915 |
| 14. Other Distribution Assets | | | | Average | $617 | $332 |
| 15. LV Lines incl Street Lighting | 496 | km | 50 | Ageing | $2,073 | $3,588 |
| 16. LV Poles | 6,150 | each | 39 | Average | $6,642 | $5,413 |
| 17. LV Cable incl Street Lighting | 268 | km | 28 | Average | $8,535 | $9,379 |
| 18. Connection Assets | | lot | 11 | Customer Drives Upgrades | $3,172 | $3,942 |
| 19. Communications | | lot | 10 | Technology Determines Condition | $1,421 | $1,410 |
| 20. SCADA & System Control | | lot | 12 | Technology Determines Condition | $185 | $381 |
| 21. Non System | | | **12** | | $9,540 | $10,654 |
| **Totals** | | | **28** | | **$163,000** | **$159,000** |

The Report on Value of the Regulated Assets Base (Rolled Forward) completed as part of Information Disclosure, which is based on asset additions and removals since the ODV valuation in 2004 of $86m, determined the disclosed 2018 valuation as $163 million. This is an overall average increase from 2004 of 5% p.a.

Like most electricity network infrastructure, Eastland Network Limiteds distribution assets are dispersed over a large area and are highly interdependent. Although the service area includes Gisborne City and Wairoa Township, the existing network is predominantly rural. It is also the cumulative result of around 80 years of investment and development.

## Service levels

The overall objective of asset management is to ensure the most efficient and optimum investment in assets to provide desired service delivery. Performance targets are established by considering a wide range of business and asset management drivers, some directly influenced by stakeholders, others a result of the historical pattern of development of Eastland Network Limited's network. Eastland Network Limited has surveyed customers and their representative groups in various market segments and considers their views and willingness to pay when making base investment decisions.

Eastland Network Limited's customers have clearly signaled through customer surveys that continuity and restoration are the two operational performance attributes that they value the most and at a minimum

Eastland Network Limited needs to maintain current levels of performance without increasing its line charges. These service level targets have also been identified by the Regulator as key.

The AMP forecasts steady state service levels for the planning period as investment to improve service beyond regulated levels is seen as over investment and as such cannot be justified.

Issues regarding levels of achievable network investment and the effect on operational performance are being continually reviewed, as the data trends increase in accuracy, and will be updated as appropriate in future versions of the AMP.

Eastland Network Limited describes levels of service delivery and efficiency using well recognisedand disclosed industry performance measures. The method for calculation of the measures is in accordance with prescribed rules.

### Quality of Supply

To measure operational performance with respect to continuity and restoration, Eastland Network Limited in accordance with industry standard practice and the Information Disclosure and Electricity Distribution Threshold regimes, sets targets for the next five years against the following key indices;

- SAIDI – system average interruption duration index. The measure of how many system minutes of supply are interrupted per year.
- SAIFI – system average interruption frequency index. The measure of how many system interruptions occur per year.

In 2014 the Regulator determined new targets for the regulatory period 2015-2020. The new targets have financial incentives for non-exempt distribution lines businesses. Accordingly Eastland Network Limited has set network performance targets/forecasts in consideration of the regulated requirement. It should be noted that external influences such as severe weather events and foreign interference, (i.e. trees) dramatically impact upon reliability statistics and year-to-year variances can be large.

The performance targets for the next 10 years are:

| Performance Measure | Actual 2017-18 | Target 2018-19 | Target 2019-20 | Target 2020-21 | Target 2021-22 | Target 2022-23 | Target 2023-24 | Target 2024-25 | Target 2025-26 | Target 2026-27 | Target 2027-28 | Target 2028-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAIDI: B ENL Planned | 41.8 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 |
| SAIDI: C ENL Unplanned | 370.1 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 |
| SAIDI: Total (B + C) | 411.9 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 |
| SAIDI: ½B + C (ComCom Target) | 391.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 |
| SAIFI: B ENL Planned | 0.31 | 0.540 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 |
| SAIFI: C ENL Unplanned | 3.18 | 3.000 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| SAIFI: (B + C) | 3.49 | 3.540 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 |
| SAIFI: ½B + C (ComCom Target) | 3.34 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 |

A potential conflict between the stakeholders linked to the primary service levels has emerged. On one side of the conflict, regulated service level targets have been set to reward improvement of security standards for network designs, maintenance, response and restoration of supply. On the other hand regulated revenue restrictions are in place that limit the rate at which improvement can be made to the current security standards. In addition, the results of surveys from consumers strongly indicate a preference to maintain current security levels rather than increase costs to achieve improved security levels.

### Financial Efficiency

| Financial Efficiency Measure | Actual 2017-18 | Target 2018-19 | Target 2019-20 | Target 2020-21 | Target 2021-22 | Target 2022-23 | Target 2023-24 | Target 2024-25 | Target 2025-26 | Target 2026-27 | Target 2027-28 | Target 2028-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Operational Expense ($/km) | $2,511 | $2,816 | $2,962 | $2,805 | $3,013 | $2,974 | $3,007 | $2,993 | $3,004 | $3,032 | $2,991 | $2,994 |
| Operational Expense ($/ICP) | $389 | $437 | $455 | $427 | $454 | $444 | $445 | $439 | $437 | $437 | $428 | $424 |

Maintenance expenditure is the dominant component of operational expenses. Eastland Network Limited has previously achieved a lower than average industry level of expenditure however the forecast shows an increase reflecting the increase in maintenance following the acquisition of the Eastland transmission spur assets, and regulatory compliance costs as capital development stabilises.

The indirect cost expenditure forecast has increased to reflect changes to the management structure of Eastland Group.

### Energy Delivery Efficiency

| Energy Delivery Efficiency Measure | Actual 2017-18 | Target 2018-19 | Target 2019-20 | Target 2020-21 | Target 2021-22 | Target 2022-23 | Target 2023-24 | Target 2024-25 | Target 2025-26 | Target 2026-27 | Target 2027-28 | Target 2028-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Load Factor ENL | 60% | 58% | 55% | 54% | 54% | 54% | 54% | 54% | 54% | 54% | 54% | 54% |
| Loss Ratio ENL | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 109.5% |
| Capacity Utilisation ENL | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% |

When compared with averages for NZ companies the average load factor indicates that the load characteristic of the region is consistent with other areas. The above average loss ratio reflects the low density long line length characteristic of the region. The loss ratio increased to 9.5% from 2015 due to inclusion of 110kV transmission losses following relocation of the Metering to Tuai GXP. For companies with no Transmission and Subtransmission assets the loss ratio is expected to be lower. The below average capacity utilisation reflects the low density connections using minimum size transformers that are larger than necessary. In general the results are in line with expected levels.

## Lifecycle and development plans

Growth trends indicate a reasonably low average peak demand increase over time with significant variation. Growth is uncertain and is driven by the region's economic outlook, and in the longer term, by changes in technology and other factors. New technology and the use of distributed generation represent opportunities for Eastland Network Limited to reduce the need for future transmission and sub-transmission network upgrades. Also the acquisition/transfer of the Eastland transmission spur assets has enabled the effective coordination of distribution, sub-transmission and distributed generation investments.

Eastland Network Limited's current after diversity maximum demand (ADMD) for the 2017/2018 financial year was 58.65MW.

Facing the challenges associated with serving a consumer base that is very different to what was historically planned for Eastland Network Limited has meant the use of a variety of load forecasting techniques to help predict the impact of accumulated load growth on capacity requirements and security standards.

Battery, solar and transport technology rollout is happening faster than initially expected. An accelerated shift to electricity for transport requires Eastland Network to increase its understanding and involvement with the end users. Inorder to gain a real understanding Eastland Network has implemented a distributed solar trial which will follow a number of typical installations and capture data in real time that can be extrapolated to determine future impact on the electricity assets. Eastland Network is participating in a regional energy centre to promote interactive communication with end users to ensure future development and needs are understood prior to investment.

By projecting growth trends forward, coincident system peak demand has been forecast to grow from 60 MW in 2017/18 to a worst case of 80 MW in 2028. This gives an overall growth rate of approximately 1.5% p.a.

Alternatively the conservative scenario indicates minimal if any growth to 60 MW in 2028 which equates to a rate of 0% p.a.

When making development decisions related to capacity requirements for long life assets, Eastland Network Limited considers the high load forecast and a prudent planning margin, to ensure investment covers the worst case scenario. To avoid over investment, the investment in capacity is deferred as long as possible. For other decisions the low or medium forecasts are used as appropriate.

Specific triggers have been identified for major upgrades to ensure efficient investment to meet security standards and avoid capacity constraints.

Life cycle management plans outline exactly what is planned to manage and operate the assets at the target levels of service while optimising lifecycle costs. An assets life cycle starts with planning its necessity, continuing through design, investment, operation and maintenance, and concludes with replacement and/or disposal. Life cycle asset management encompasses the policies and practices applied during all phases of an assets life to ensure the sustainable delivery of a power supply in the most efficient manner.

Load flow analysis is used to assist in identifying solutions to network issues such as capacity constraints, security, power quality and uneconomic supplies. Alternative scenarios and options are modelled to optimise development plans, while the timing of work is largely determined as secure load limits are exceeded or requests for additional load are received.

Life cycle management plans are prepared by asset and expenditure category. Capital plans present background data and plans for renewal, replacement, augmentation and non-asset solutions in response to asset aging, growth, reliability, performance, compliance and quality. Maintenance plans detail the regular on-going work that is necessary to keep assets operating, including the basis for condition monitoring, equipment standards, planned maintenance and provisions for unplanned actions in response to faults or incidents. Eastland Network Limited drives maintenance work based on condition and reliability assessments, as opposed to planned maintenance based on time usage of an asset.

Since many assets are in the age replacement phase of their life cycle, the management tactic focuses on replacement over heavy maintenance. The average age is forecast to increase as existing population profiles for conductor and poles in particular show the predominant installation period is nearing end of expected life while renewal rates have been minimized to balance renewal costs with allowable regulated revenues and return on asset value requirements.

# Risk assessment

Effective risk management is required to protect the long-term viability of Eastland Network Limited and to protect its stakeholders. Eastland Network Limited uses a systematic outcome-based method for assessing asset related risks. This focuses on identifying and prioritising mitigating actions, which are subsequently captured in work programs and network development plans. The acquisition of the Eastland transmission spur assets has impacted on the risk profile of the Eastland Network Limited's network in respect of low probability, high consequence events. That is, the assets to be acquired have very high reliability, and given the nature of the assets, failures are rare but expensive to repair or replace (and can take significantly more time to repair). The impacts of risks associated with ex-transmission assets, (and the appropriate treatment of those risks), continue to be analysed, assessed and updated, (in successive AMPs), as Eastland gains more operational experience of these assets.

# Financial summary

### 7.3.1 Capital Expenditure

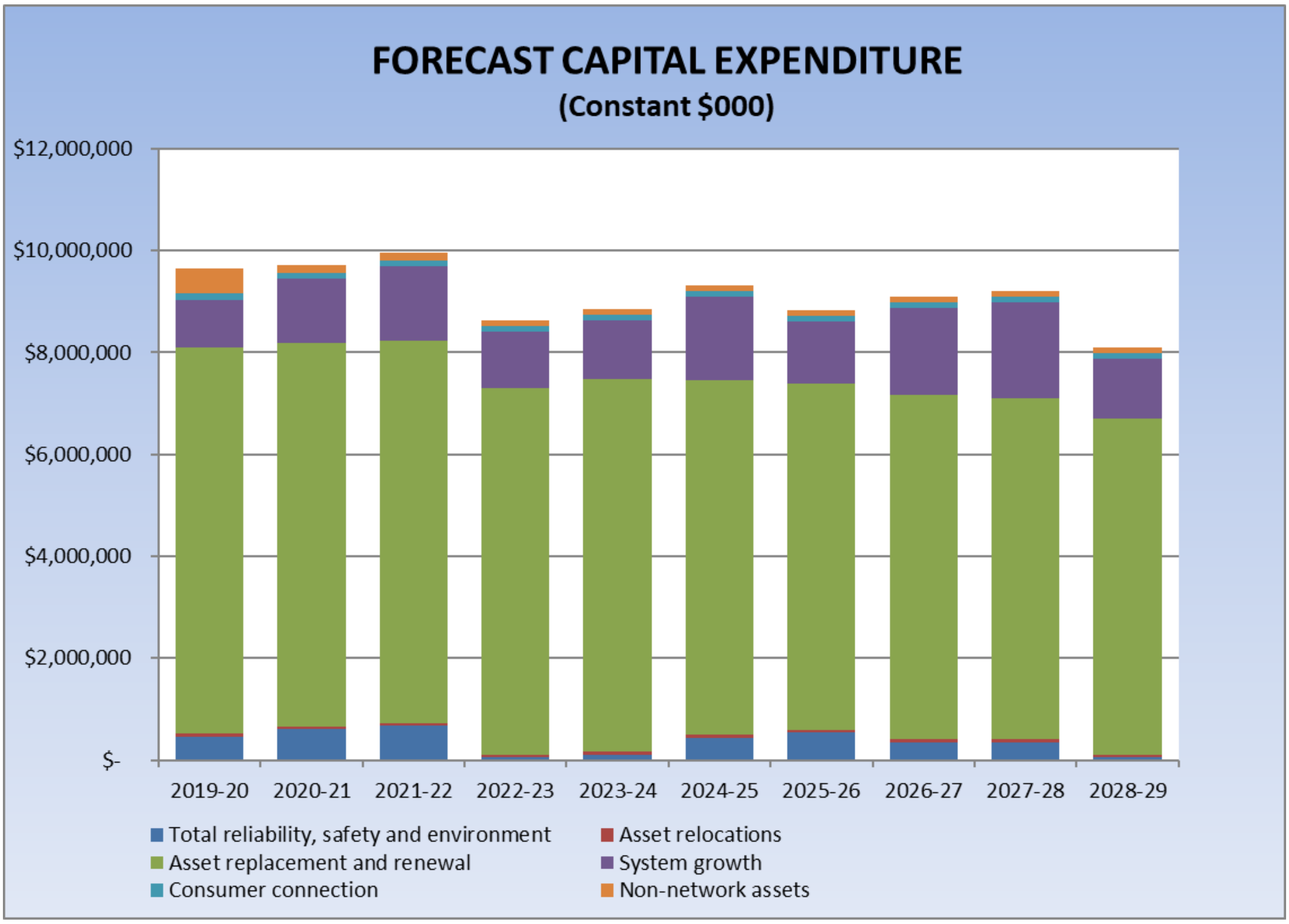
Total network + non-network asset capital expenditure over the planning period, as described in Sections 4.0 and 5.0, is $91.403m. The profile includes a significant 'step up' in expenditure from previous years due to the acquisition of the Eastland transmission spur assets; $10.822m of transmission asset renewal expenditure.

However the underlying distribution asset expenditure profile, (i.e. excluding the Eastland transmission spur assets) is relatively flat with an average expenditure of approximately $7.899m p.a., indicating that steady state assumptions apply. This level of capital expenditure equates to approximately 5.0% of the asset replacement cost.

Capital expenditure forecasts for the planning period are provided by asset type and expenditure category in accordance with the Electricity Distribution Information Disclosure Determination 2012. These forecasts include capitalisation of design and planning costs averaging 8.93% per expenditure category, ($8.165m in total for the period).

The 8.93% capitalisation allowance is an increase on the average 4.7% allowance previously applied. This increase recovers additional costs associated with an increase in the volume of capital work related design and planning being undertaken by “in-house “resources and increased complexity associated with design, planning and project management associated with 110kV transmission assets.

In accordance with Electricity Distribution Information Disclosure Determination 2012 requirements the design, planning and project management allowance is netted off System Operations and Network Support operating costs.




Comments on the categories of capital expenditure are made below.

### Customer Connection

*Capital expenditure primarily associated with the connection of new consumers to the network or alterations to the connections of existing consumers, where the expenditure relates to connection* *assets and/or parts of the network for which expenditure is recoverable in total, or in part, by a contribution from those new consumer(s).*

Where assets are required to be installed to facilitate a new, upgraded or altered customer connection it is Eastland Network Limited policy that cost responsibility resides with the customer. Accordingly the majority of Customer Connection expenditure is funded by customers who engage directly with Eastland Network Limited authorised contractors to carry out the required work with the ownership of network type assets being vested to Eastland Network Limited upon completion.

For the planning period the total $1.117m Customer Connection expenditure is 1.2% of the total capital expenditure forecast for the period. None of this unplanned expenditure allowance is related to Eastland transmission spur assets. The allowance is based on historical actual spend associated with the provision of new or upgraded assets which with the exception of $11k p.a. customer contributions to the provision of Load Control Receivers, cannot be reasonably expected to be met by the customer. Customer connection expenditure directly with contractors is not included in the forecast amounts.

### System Growth

*Capital expenditure primarily associated with a change in demand on the network assets, where the expenditure is not recoverable in total, or in part, through a contribution from the consumer(s) that is (are) responsible for the change in demand.*

For the planning period the total $13.599m System Growth expenditure is 14.88% of the total capital expenditure forecast for the period. System Growth expenditure over the period is dominated by expenditure associated with capacity upgrades forecast to be required within the Gisborne CBD.

This category of expenditure includes provision for the steady state customer driven network extension and capacity upgrades that cannot be avoided. The only major projects included are those where the upgrade triggers are currently exceeded. Trigger levels for growth upgrades predicted are described in Section 5.5.

A key feature of these projections is that while the AMP attempts to predict the impact of growth on network development, probable timings, etc. these issues are excluded from financial planning until more certainty on size and location and optimum response is evident.

### Asset Replacement and Renewal

*Capital expenditure primarily associated with the progressive physical deterioration of the condition of network assets or their immediate surrounds or expenditure arising as result of the obsolescence of network assets.*

This category of expenditure per asset type is described in Section 5.4.

For the planning period the total Asset Replacement and Renewal expenditure is $70.938m, (distribution assets $60.117m and ex transmission assets $10.821m).

The basis of transmission asset renewal budgeting is provisional forecasting information provided by Transpower. Having gained full operational control of the ex-transmission assets in March 2015 Eastland Network Limited has acquired improved asset performance and condition information that have allowed the reduction/deferral and/or smoothing of the “lumpy” asset renewal expenditure forecast for the transmission assets.

Asset Replacement driven capital expenditure for the planning period related to Eastland Network Limited distribution assets averages $7.094m p.a.

The predominance of this category of capital expenditure in the total expenditure for the period reflects the increasing average age of network assets, (especially poles and conductor) and that many assets are in the age replacement phase of their life cycle. Asset Replacement expenditure is predominantly funded by depreciation.

A previous issue regarding a "gap" between the failure and renewal rate of 11kV poles has been addressed by increasing the pole renewal budget to match the 10 year replacement rate.

A previously identified 8km pa "gap" between the 10 year renewal rate and targeted renewal rate for 11kV conductor has been addressed by increasing the annual renewal rate from 9km to 18km in 2019. Also performance to date indicates that the actual life of conductor is much greater than that forecast. It is not expected that any conductor renewal "gap" will unduly affect the achievement of levels of operational performance required by regulation or expected by customers.

### Asset Relocation.

*Capital expenditure primarily associated with the need to move assets. This normally results from local authority or Transit road widening projects. Accordingly this category of expenditure is to be used where the cost of moving assets is other than for reasons of routine maintenance, refurbishment and renewal maintenance or fault emergency maintenance.*

Asset Relocation driven capital expenditure for the planning period is an annual unplanned allowance of $50k p.a. based on historical actual spend. Territorial authorities operating in Eastland Network Limited's network coverage area are canvassed annually for information on immediate future and longer term requirements they might have regarding the relocation of Eastland Network Limited assets. Responses received have not identified any specific requirements to relocate Eastland Network Limited assets.

Asset Relocation capital expenditure equates to 0.55% of the total capital expenditure forecast for the period. No allowance has been made over the period for expenditure related to the relocation of transmission assets.

### Reliability, Safety and Environment

*Capital expenditure primarily associated with maintaining or improving the safety of the network for customers, employees and the public; expenditure primarily associated with the improvement of reliability or service standards; and expenditure primarily associated with meeting new or enhanced environmental requirements.*

Reliability, Safety and Environment driven capital expenditure for the planning period is $3.657m and equates to 4.0% of the total capital expenditure forecast for the period. None of this expenditure forecast relates to Eastland transmission spur assets.

This relatively low level of expenditure in this category is a result of large levels of expenditure that was undertaken between 2000 and 2004 for the purposes of addressing a backlog of safety and environmental issues and improvement of security of supply standards through the development of the sub-transmission network.

It should also be noted that a consequence of Eastland Network Limited's significant asset renewal program is an improvement in reliability, safety and environmental performance hence dedicated expenditure in these areas is not generally required.

### Non-network Assets

*Assets related to the provision of electricity lines services but are not a network asset.*

Capital expenditure on non-network assets is forecast at $1.591m over the planning period. The expenditure on non-network assets has increased significantly over previous plans with the replacement of the GIS and works management systems being included. These systems are approaching the end of their useful lives with the GIS no longer being supported, and the works management system being a bespoke development, with limited external support available. A new drawing management system is also included in the forecast, along with new software required to support the Eastland transmission spur assets.

### Overhead to Underground Conversions

For the planning period total of $2.005m is forecast for overhead to underground conversions. This expenditure is included under Asset Replacement and Renewal or Reliability, Safety and Environment-Other.

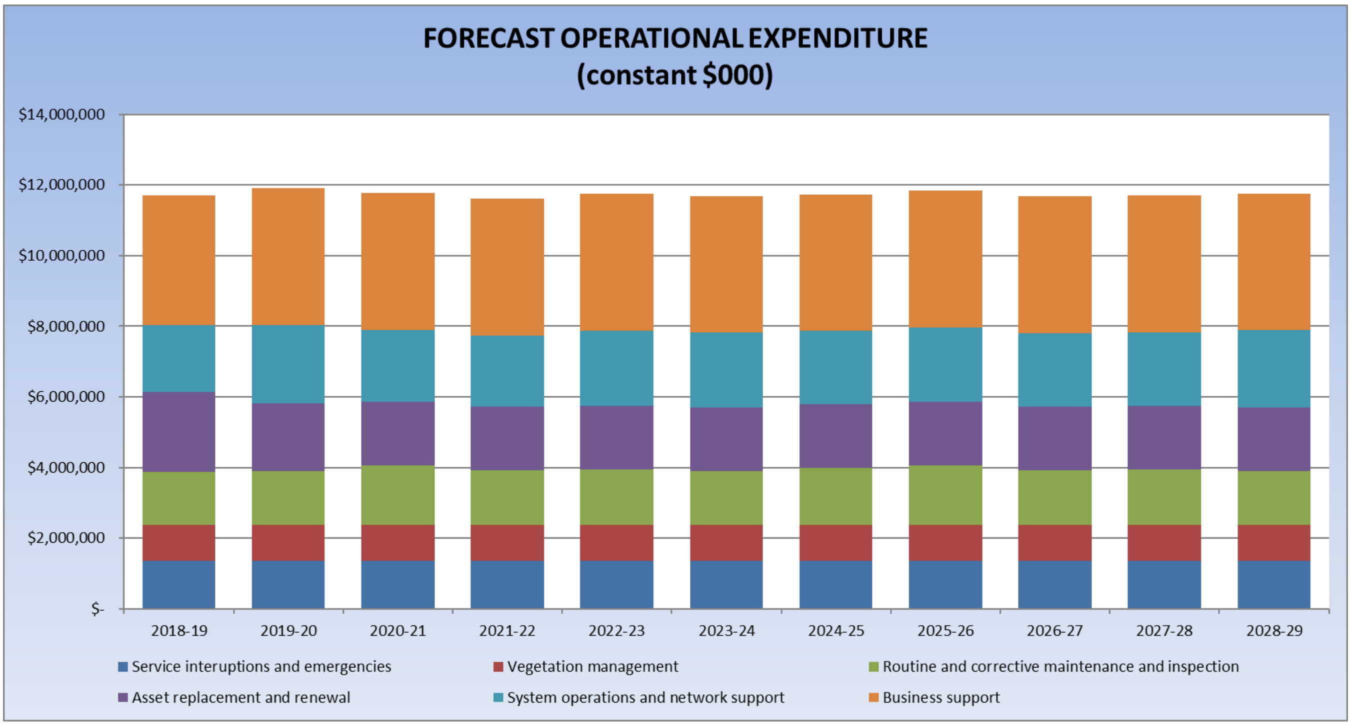
The following tables and graphs present the forecast expenditure as per the categorisation above, in summary by asset type and in full.

# Total operational expenditure forecast

## 7.3.2 Operational Expenditure

Total operational expenditure over the planning period, as described in Section 5.3, is $57.650m. This level of expenditure has increased over the previous plan as a result of the maintenance requirements associated with the Eastland transmission spur assets, and an increase in System Operations and Network Support.

Operational expenditure forecasts for the planning period are provided by asset type and expenditure category in accordance with the Electricity Distribution Information Disclosure Determination 2012.




General comments on the categories of expenditure are made below.

### Maintenance Expenditure

The total maintenance for the 10 year AMP period is forecast at $57.650m, ($48.876m distribution assets and $8.774m ex-transmission assets).

For current distribution assets maintenance plans have been prepared by asset type and expenditure category. These plans detail the regular on-going work that is necessary to keep assets operating, including the basis for condition monitoring, equipment standards, planned maintenance and provisions for unplanned actions in response to faults or incidents. It has been identified that Eastland Network Limited's current distribution assets are in the age replacement phase of their life cycle. The management tactic is to therefore replace rather than to continue with a heavy maintenance strategy. The expected improvement in average asset condition will lift performance and allows low maintenance expenditure to be sustained.

### Service Interruptions and Emergencies

For the planning period the total $13.644m, ($13.292m distribution assets and $352k ex-transmission assets), Fault and Emergency expenditure is 11.58% of the total maintenance expenditure forecast for the period. As described in section 5.3.1 included in this expenditure category is a standing allowance of $600k p.a. relating to a fault management/response service. This expenditure category has not been materially impacted by the acquisition of the Eastland transmission spur assets due to the very high reliability of those assets.

### Vegetation management

For the planning period the total $10.150m, ($9.000m distribution assets and $1.150m ex-transmission assets), Vegetation Management expenditure is 8.61% of the total maintenance expenditure forecast for the period. The 110kV lines routes have generally been well maintained by Transpower, and vegetation management spend represents an ongoing 'maintenance' programme to address network performance issues.

### Routine and Corrective Maintenance and Inspection

This expenditure that is driven by pre-planned and programmed work schedules and includes routine inspection and testing activities.

For the planning period the total $15.690m, ($9.068m distribution assets and $6.622m ex-transmission assets), Routine and corrective expenditure is 13.31% of the total operational expenditure forecast for the period. The increase in expenditure from 2016 reflects the comprehensive inspection and maintenance regime applied to the Eastland transmission spur assets. A comprehensive inspection and maintenance approach is warranted for these assets given the potential high consequence of the failure. The forecasts reflect the level of expenditure forecast by Transpower, and the programmes and costs will be reviewed as Eastland Network Limited gains operational experience of these assets.

### Asset Replacement and Renewal (expensed)

For the planning period the total $18.166m, ($17.516m distribution assets and $650k ex-transmission assets), Refurbishment and Renewal expenditure is 15.41% of the total maintenance expenditure forecast for the period.

As explained above, incorporated in Asset Replacement and Renewal maintenance expenditure associated with distribution assets, is $1.421m of annual ACOD expenditure, ($14.210m total for the period). The forecast ACOD payment is made to network connected distributed generation in recognition of avoiding investment, (in additional distribution assets and the upgrading of transmission assets), so as to meet required network service and performance standards.

This level of actual maintenance expenditure on the renewal of assets over the period is relatively low for both distribution and ex-transmission assets, and is the result of the large capital asset replacement and renewal program.

## Non network operational expenditure

An Electricity Distribution Information Disclosure Determination 2012 requirement for AMPs is to provide information and forecasts on non-network operational expenditure.

The two classifications of non-network operational are as follows;

### Business support

This includes the usual "corporate" support costs associated with HR, IT, finance, legal, property services, Director costs, marketing, consultants (other than engineering) and corporate communications - most of which are included in the current Shared Services/Management Fee structure.

Additional items of expenditure included in this costs associated with category are Regulation, Pricing, Billing, Customer liaison (including Transpower) and revenue collection.

For the planning period total Business Support is forecast at $36.718m.

### System operations and network support

This includes the usual "direct" support costs such as asset management and planning, network engineering and design costs, network policies and standards, network record keeping and associated systems, engineering and technical consultants, IT and comms for network management and customer management.

For the planning period total System Operations and Network Support is forecast at $20.927m. This total is reduced by capitalised design/project management costs totaling $8.148m.

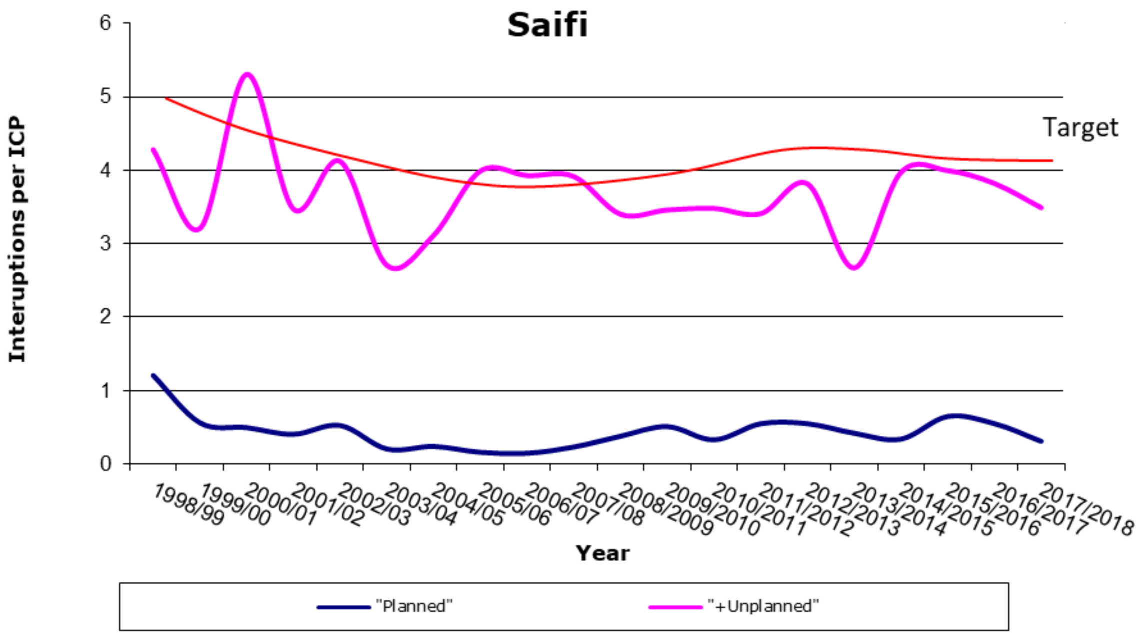
## Performance and improvement plans

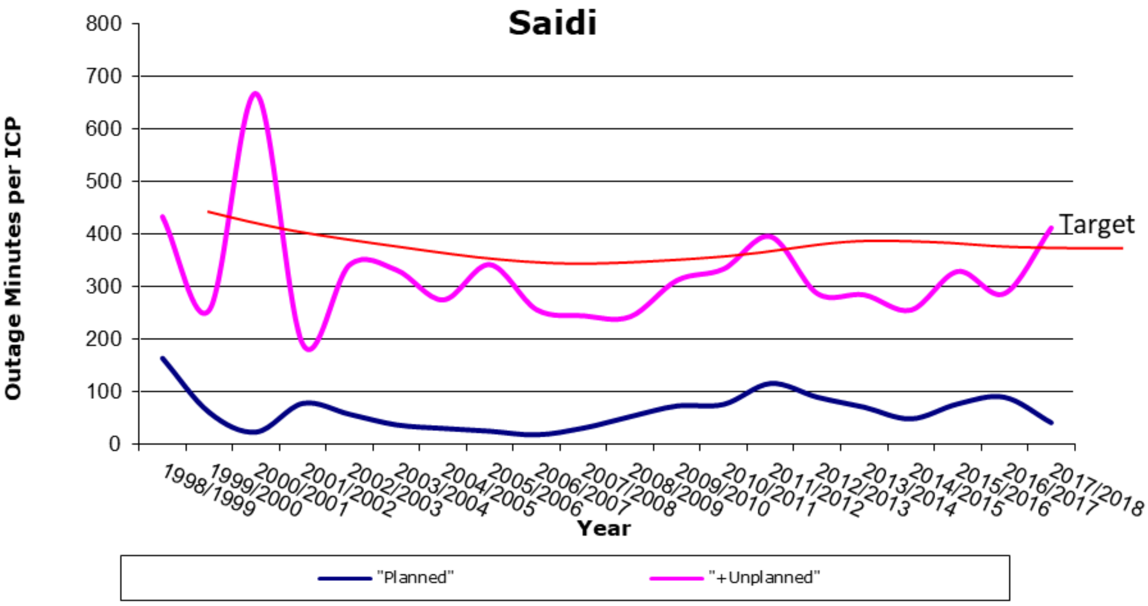
Improvement of the assets is achieved by strategic and business plans which contain agreed guidance and criteria. The primary responsibility of the asset management team is to identify options for improvement and asset management plans for input into the strategy and business planning process. The resulting improvement is continuous as the AMP is updated during the normal business planning cycle. Internal and external audits/reviews are undertaken at regular intervals to confirm the validity of technical content, assess asset management performance against best practice, and identify areas where implementation of asset management practice can be improved.

Eastland Network Limited reviews benchmarking results for similar companies in order to more effectively target improvements in line with national trends. Performance measures have been developed to ensure that meaningful comparisons with comparable lines companies can be undertaken and compliance with regulatory targets is maintained.

On-going asset management improvement initiatives target increased capture of detailed asset attributes and performance information, to aid predictions, which facilitates the development of improved capital and maintenance strategies to correct condition and asset deficiencies and meet growth requirements.

The primary indicators for reliability and performance are the SAIDI index and SAIFI index




Installation of remote diesel generators between 2002 and 2003 has reduced the impact of planned outages. On average over the past 8 years use of generators has avoided 300 SAIDI minutes p.a., or 90% of the current level, p.a. over the period. The extent of this reduction cannot be seen in the statistics as pole replacement on spur 50kV lines, previously deferred, was undertaken between 2003 and 2008 without any impact on outage statistics.

Use of Live line technologies has avoided an average of 10 SAIDI minutes p.a. between 2001 and 2008. As a result of skill shortages in 2007 and 2008 and an increase in line renewal work over rugged terrain, the use of Live Line technologies is currently suspended.

While the targeted SAIDI is below the regulated limit a shift to renewal projects on lines not suited to generator support will increase planned SAIDI figures. It is likely that the regulatory limits will be exceeded in future due to this increase in necessary maintenance and renewals work on the rural or spur lines.

Significant weather events and environmental factors such as slips after long periods of rainfall, generally considered as normal, have the most significant impact on Eastland Network Limited's ability to achieve its targets. The impact of these events on the Eastland transmission spur assets, while likely to be rare, will have a significant impact.

The design on the Transmission lines with both circuits on the same tower was exposed to an N-2 event when a Plane impacted both circuits in 2016/2017. The saidi minutes from this single event were 4 times the annual target. This rare event has not been included in the graphs and is normalized out using regulatory reporting requirements.

The low proportion of planned to unplanned makes it difficult to control targets by manipulation of planned work. Where viable, multiple contractors are pooled into a collective group for shutdown work to minimise the need for multiple outages on a specific project. An example of this is a pole replacement project where seven separate companies were collectively engaged to minimise the number and length of outages for the project.

The steady decline in available field service contracting resources in New Zealand has resulted in critically low resource levels in the local region. Eastland Network Limited is actively contributing to training and development of new resource at the entry level to ensure improvement of its asset management activities in the long term.

Eastland Network Limited has a technology focus and is active in identification and development of equipment and systems designed to offset the effects of renewal investment and resourcing short falls.

# Contents

# 1. Background and objectives

## 1.1 Purpose of this AMP

The purpose of this AMP is to provide a management framework that ensures that Eastland Network Limited:

- Sets service levels for the electricity network that will meet owner, consumer, community and regulatory requirements;
- Understands what network capacity, reliability and security will be required both now and in the future, and what issues drive these requirements;
- Has a robust and transparent process in place for managing all stages of the network asset life cycle from conception to removal;
- Has adequately considered the classes of risk the network business faces, and has systematic processes in place to mitigate identified risks;
- Has made provision for funding phases of the network asset lifecycle while balancing levels of investment against allowable regulated revenue and return on asset value requirements;
- Makes decisions within systematic and structured frameworks at each level within the business, and that it especially doesn't make ad-hoc decisions;
- Has an ever-increasing knowledge of discrete asset components including locations, ages, conditions, performance and likely future behavior as components deteriorate, age and are required to perform at different levels.

Presentation of the AMP in this format also meets the requirement 24 of the Electricity Distribution Information Disclosure Determination 1 October 2012.

## 1.2 Interaction with other goals and drivers

All of Eastland Network Limited's assets exist within a strategic context that is shaped by a wide range of issues including Eastland Network Limited's Statement of Purpose and Vision, the prevailing regulatory environment, government policy objectives, commercial and competitive pressures and technology trends. Eastland Network Limited's assets are also influenced by technical regulations, asset deterioration, the laws of physics and risk exposures independently of the strategic context, and indeed these issues may constrain the strategic plan.

### 1.2.1 Corporate purpose and vision

Eastland Network Limited's statements of purpose and vision therefore communicate a strong focus on the development of the local economy.

Statement of purpose

Eastland Network will utilise existing assets to achieve an appropriate return for the shareholder while providing opportunities for business growth and improving the value delivered to customers.

Vision

> Eastland Network will provide returns on assets, growth on investments and operating performance which places it in an average position relative to other New Zealand electricity companies with similar geographic, demographic and loading and fixed asset investment characteristics.

Safe, reliable and optimally-priced delivery of electricity influences the competitiveness of local wealth creating businesses. If they don't create long-term sustainable wealth Eastland Network Limited loses out as well.

### 1.2.2 Vision for asset management

Eastland Network Limited's vision for asset management is:

Eastland Network's asset management function will strive to optimise its' investment in electricity distribution assets to provide levels of service that are acceptable to its customers and other stakeholders at a price that sustainably maximises economic efficiencies.

The key aspect of implementing this vision is through having well defined and robust processes for optimizing spend levels at all stages of asset lifecycles. These processes are discussed in Section 1.6 of this AMP.

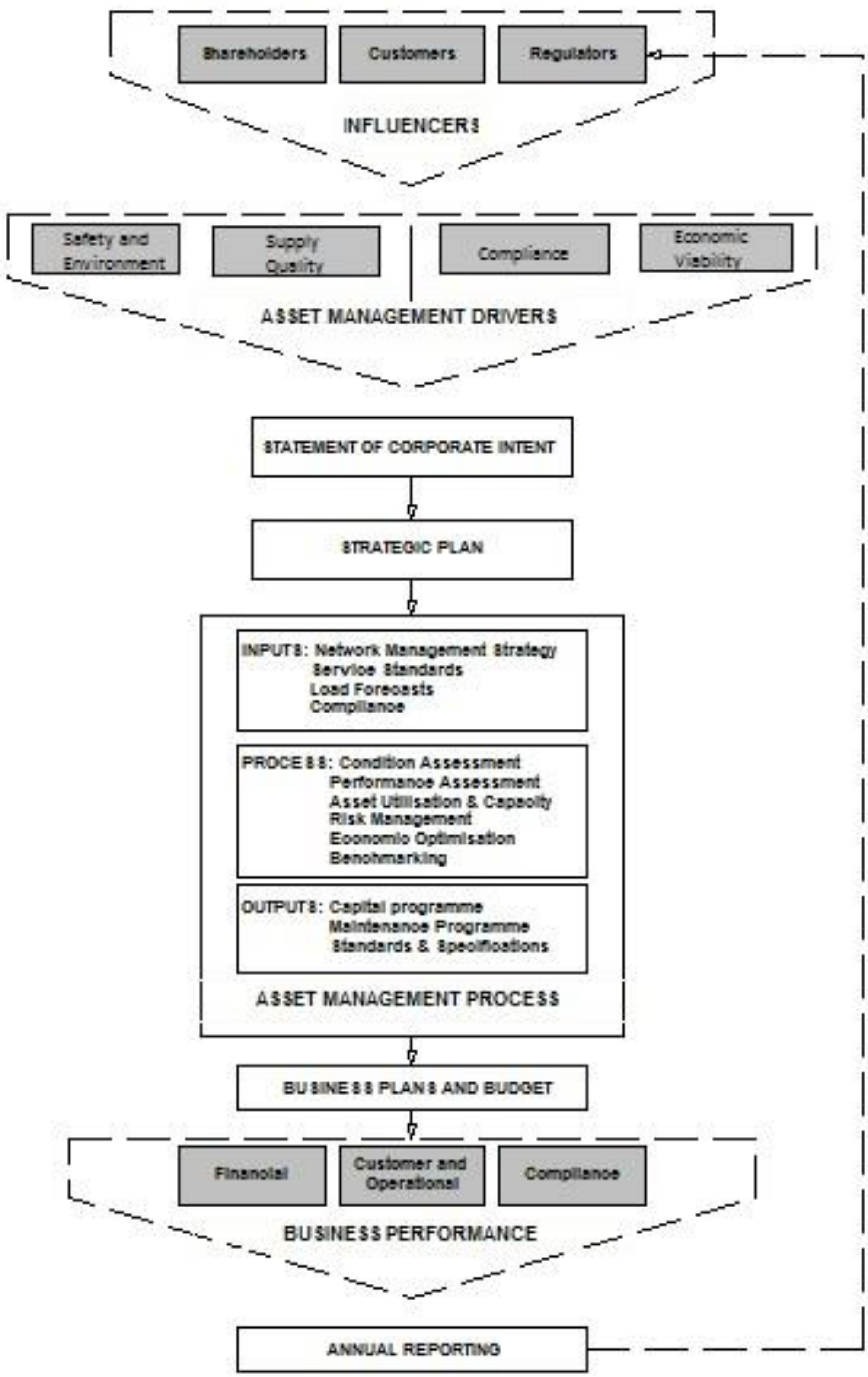
### 1.2.3 Overview of asset management strategy and delivery

Eastland Network Limited's core planning document is the Strategic Plan which considers all the strategic drivers depicted in figure 1.2.3(a). The Strategic Plan regularly examines these issues at intervals appropriate to how fast each issue moves and identifies the important things Eastland Network Limited must focus on to fulfill its Statement of Purpose and its Vision. A key influencer of Eastland Network Limited's Strategic Plan is the increasing level of regulation that the lines sector faces – not only are Eastland Network Limited's prices and supply quality regulated, but many of Eastland Network Limited's activities such as the preparation of this AMP and disclosure of performance indices are heavily prescribed.

The relationship of the AMP to the Strategic Plan needs to consider the following issues;

The physical degradation of Eastland Network Limited's assets due to age and operating characteristics is largely independent of Eastland Network Limited's chosen business strategy (notwithstanding decisions to spend on the assets) and of the regulatory framework.

Figure 3.1 - The ENL Asset Management Framework



The nature and configuration of Eastland Network Limited's assets reflects past business strategies and policy environments more strongly than present strategies, e.g. past rural electrification has resulted in segments of network considered uneconomic in the current environment.

The preparation of the AMP proceeds in parallel with the preparation of the Strategic Plan and is shaped by it rather than being absolutely dependent on it.

### 1.2.4 Interaction of key planning documents

Interactions of the key planning documents are as follows:

Statement of Corporate Intent. This document defines the Director's intentions and objectives for Eastland Network Limited for the next three financial years and is agreed with the owners. This encompasses planned business activities and objectives, values, performance targets and communication methods.

Strategic Plan/Business Plan. Annual plans and key initiatives are established in these documents to support the achievement of performance targets. Because the AMP is a tactical plan and a repository for detailed asset information, these documents are closely coordinated during the business planning cycle.

Ten Year Financial Plan. The Ten-Year Financial Plan identifies funding requirements necessary to achieve the capital and maintenance budgets as produced by the AMP, and any other business funding requirements. The Financial Plan identifies funding constraints that may affect the ability to achieve AMP objectives thereby influencing changes to the AMP and/or demonstrates that business performance and service objectives can be met.

Customer Relationship Management Plans. These plans record consultations with major electricity users regarding their current and future electricity supply requirements and their preferences for price and quality trade-offs. Eastland Network Limited also seeks to determine the needs of all electricity users from the Energy Retailers that represent them. The Energy Retailers have contractual arrangements with Eastland Network Limited that incorporate the desired requirements for energy delivery services to their customers. Eastland Network Limited focuses on the wealth-creating sector of the local economy and also consults with a number of other representative community groups such as Federated Farmers and Grey-Power as proxies for the mass-market.

The outputs from the asset management process are the operational, maintenance and capital work programs. These programs are contained within the AMP and include:

Operational Activities. The operational triggers and activities are described in Section 5.2.

Maintenance Plans. The trigger points and activities for maintaining the assets are presented Section 5.3.

Capital Replacement Plans. Analysis of asset performance age and condition result in optimal asset renewal programs presented in Section 5.4.

Development Plans. Analysis is undertaken to test growth and performance against service standards. A Network Development plan is then created in line with investment and risk policies. This is summarised in section 4.7.

Equipment and Design Standards. Detailed equipment and design specifications, based on the required functionality of the assets, are included in the Network Quality System. General standards and issues concerning quality and compliance are covered in the lifecycle management sections of this AMP.

# 1.3 Period covered by this AMP

This edition of Eastland Network Limited's AMP covers the 10 year period 1 April 2019 to 31 March 2029.

This AMP was prepared over the period August 2018 to March 2019 by Eastland Group's General Manager Networksand the Asset and Planning Manager.

The AMP was approved by the Eastland Network Limited Board of Directors on 31 March 2019 and publicly disclosed in accordance with Requirement 2.6 of the Electricity Distribution Electricity Information Disclosure Determination 2012.

# 1.4 Stakeholder interests

## 1.4.1 Stakeholder identification.

Eastland Network Limited defines its stakeholders as any person or class of persons that does or may do one or more of the following:

- Has a financial interest in Eastland Network Limited (be it equity or debt)
- Is physically connected to Eastland Network Limited's network.
- Use Eastland Network Limited's network for conveying electricity.
- Supply Eastland Network Limited with goods or services.
- Is affected by the existence, nature or condition of Eastland Network Limited's network.
- Have a statutory obligation to perform an activity in relation to the existence of Eastland Network Limited's network (such as request disclosure data or regulate prices).

## 1.4.2 Stakeholder interests

The interests of Eastland Network Limited's stakeholders generally fall into 1 of the 4 categories defined in Table 1.4.2(a) below:

*Table 1.4.2(a) – Key stakeholder interests*

| | Interests | | | |
|---|---|---|---|---|
| | Viability | Supply quality | Safety | Compliance |
| Shareholder | ✓ | | ✓ | ✓ |
| Bankers | ✓ | | | |
| Connected customers | ✓ | ✓ | ✓ | |
| Energy retailers | ✓ | ✓ | | |
| Mass-market representative groups | ✓ | ✓ | | |
| Industry representative groups | ✓ | ✓ | | |
| Staff & contractors | ✓ | | ✓ | ✓ |
| Public | | | ✓ | |
| Utilities Disputes Limited | | ✓ | ✓ | ✓ |
| Councils (excluding as a consumer) | | | ✓ | |

| | | | | |
|---|---|---|---|---|
| Land Transport | | | ✓ | ✓ |
| Ministry of economic development | | | ✓ | ✓ |
| Commerce Commission | | ✓ | | ✓ |
| Electricity Authority | | | | ✓ |
| Land Owners | | | ✓ | |

### 1.4.3 Determining stakeholder interests

Stakeholder interests are determined via the following mechanisms:

Shareholders – Regular business performance reviews are conducted by the shareholders. Correspondence and meetings are held between the shareholders and Eastland Network Limited's directors /Management team to review performance and consult on strategic plans.

Bankers – Communication via direct discussion and written correspondence at regular intervals ensures that the formal agreements and interests of the bankers are adhered to.

Customers and representative groups – The interests of these stakeholders are determined through direct discussion with large customers, meetings with consumer and industry representatives, and customer surveys (refer section 3.1). Eastland Network Limited representatives are involved with the civil defense, Gisborne chamber of commerce, Regional development groups and regional working groups. At an operational level customers communicate their interests directly with either Engineering staff or Eastland Network Limited's call centre.

Staff and contractors – Weekly meetings are held with contractors and staff which provide an open forum to determine and discuss individual interests and interests fed back from customers and the public via the individuals. All information is recorded and incorporated into revised plans where relevant.

Energy retailers – Currently there are seventeen retailers who trade on Eastland Network Limited's distribution network. As required formal engagement with these retailers is as per the appropriate section of the Eastland Network Limited's Use of System Agreement, (ENL UoSA). The ENL UoSA is tightly based on the Electricity Authoriy Model Use of System Agreement, September 2012. Outside of the formal engagement processes, Eastland Network tries to foster an open and less formal engagement process with retailers where matters of mutal interest can be readily tabled for discussion and appropriate action.

Public – Public interests are generally relayed via local media, other authorities and representative groups. Eastland Network Limited provides open access for the public to engineering and management staff at its main offices in Gisborne and via its call centre. Eastland Network is part of the Utility Disputes Limited (UDL) Scheme who contribute to public interests by providing a resolution process for unsatisfactory service. Eastland Network ensures complaints are dealt with in a timely and effective manner.

Councils and authorities – Monthly Utility meetings are held with representatives from Telecommunications, Gas, Council, Road Authorities and General contractors to determine both short and long term interests for incorporation into operational and long term asset management plans. In addition councils are consulted at all levels to establish the potential impacts of Eastland Network Limited strategies and activities.

Ministries and commissions – The interests of these groups are identified through legislation and regulation. Eastland Network Limited has engaged Price Waterhouse Coopers and Chapman Tripp to monitor and represent Eastland Network Limited in this area. Eastland Network has a dedicated team to provide information, review and revise systems to accommodate the steadily changing requirements.

Landowners – Eastland Network Limited engineering staff maintain a close relationship with Landowners and developers to determine their interests on an open and informal basis. At an operational level formal access and tree notification processes provide for feedback that is incorporated into Eastland Network Limited's asset management systems.

### 1.4.4 Accommodating stakeholder interests

Table 1.4.2(a) provides a broad indication of how Eastland Network Limited accommodates stakeholder interests:

| Interest | Description | Accommodating that interest |
|---|---|---|
| Viability | Viability is necessary to ensure that Eastland Network Limited's shareholder and providers of finance have sufficient confidence to retain ownership of Eastland Network Limited or provide finance to Eastland Network Limited. For users of line function services the prices must be affordable.<br><br>For other stake holders the activities conducted by Eastland Network Limited should minimise negative impacts on viability of their activities. | Eastland Network Limited accommodates its stakeholders' needs for long-term viability by delivering earnings that are sustainable and reflect an appropriate risk-adjusted return on employed capital<br><br>While net prices are controlled to maintain compliance, changes to prices are analysed to determine individual impacts and step changes are managed to maintain them within affordable limits.<br><br>Design standards and selection of assets for each application given careful consideration to ensure they are suited to the stakeholders needs. |
| Supply quality | Emphasis on continuity, restoration is essential to minimizing interruptions to Eastland Network Limited's customers businesses. | Eastland Network Limited accommodates stakeholders' needs for supply quality by focusing resources on continuity, provision of security and restoration which is what Eastland Network Limited's customers have said is important to them. |
| Safety | Eastland Network Limited's staff, contractors and the public at large must be able to live in close proximity to network assets and/or work on the network in total safety.<br><br>Lines and equipment on private land must be operated and maintained to minimise interference to other activities carried out on the land and avoid serious harm or damage to property. | Eastland Network Limited ensures that the public at large are kept safe by managing the network assets so that they are installed, operated and maintained to relevant regulations, codes of practice and standards relating to their structural strength, electrical safety and design functionality.<br><br>Eastland Network Limited ensures the safety of its staff and contractors through implementation of its Health & Safety Management System which prescribes the process and procedures for hazard identification/management, contractor management/auditing, staff/contractor training & |

| | | |
|---|---|---|
| | | competency assessment, the provision of safety equipment and safe work procedures.<br><br>The safety management system documents and processes to ensure safe operation of the network assets. |
| Compliance | Eastland Network Limited has a duty to comply with many statutory requirements ranging from safety to disclosing information and targeted threshold regimes for price, quality and customer consultation. | Eastland Network Limited ensures that all safety issues are adequately documented and available for inspection by authorised agencies.<br><br>Eastland Network Limited discloses performance information in a timely and compliant fashion.<br><br>Eastland Network Limited will restrain its net prices to within the limits prescribed by the price path threshold. |

### 1.4.5 Managing conflicting interests

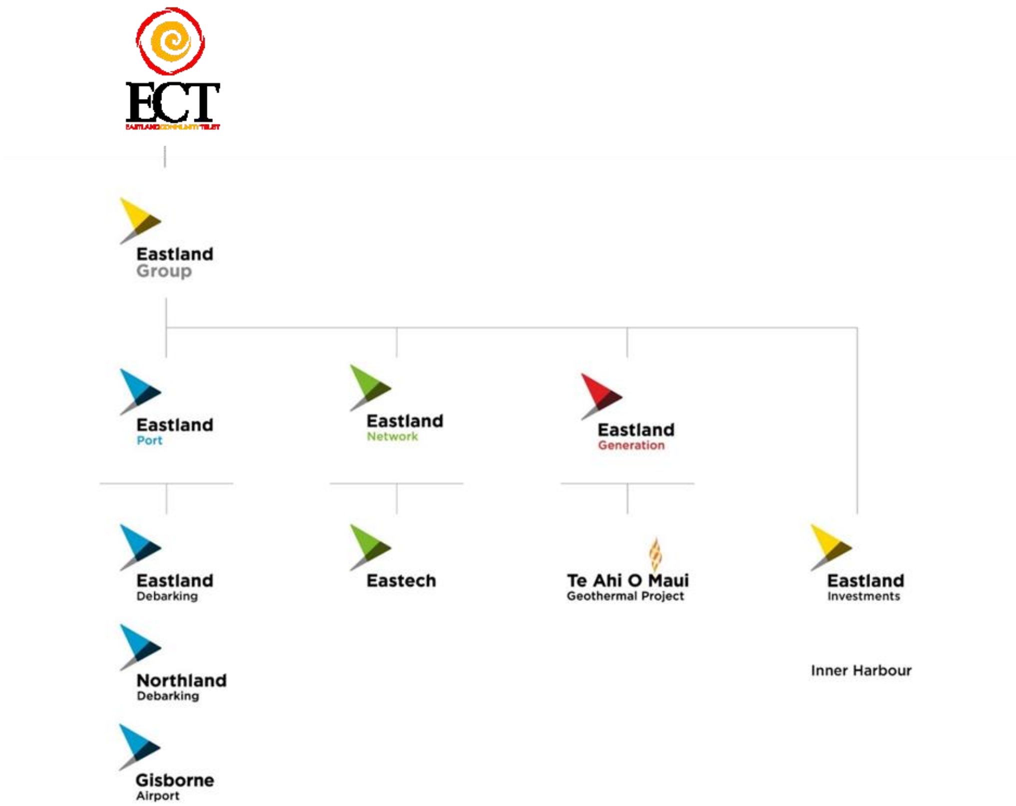
Eastland Network Limited's priorities for managing conflicting stakeholder interests are:

- Safety. Eastland Network Limited will give top priority to safety. Even if Eastland Network Limited has to exceed budget, the safety of staff, contractors or the public, (and their property) are a primary consideration.
- Viability. Eastland Network Limited will give second priority to sustainable financial viability because without it the business will cease to exist which makes supply quality and compliance pointless.
- Supply quality. Eastland Network Limited will give third priority to supply continuity and quality as this is what makes energy users, and therefore Eastland Network Limited, successful.
- Compliance. Eastland Network Limited has a duty to comply with all the regulatory requirements applicable to lines businesses and endeavors to meet those requirements. However Eastland Network Limited also understands that achieving compliance may on occasion be in tension with other interests such as financial viability. Under these circumstances Eastland Network Limited will decide a course of action that is sustainable and reflects a balanced view of all stakeholder wishes and expectations.

To achieve consistency regarding the management of conflicting stakeholder interests, the priority structure above is considered and applied during Eastland Network Limited's annual Strategic and Business planning cycles. The outcome is that the annual Business Plan provides at an operational level direction and detail on how prioritized objectives set out in the Strategic Plan will be realised and associated performance measured.

## 1.5 Accountabilities for asset management

The electricity assets of Eastland Network Ltd are 100% owned by the Eastland Community Trust (ECT). The ECT, originally the Eastland Energy Community Trust, was created in 1993 and took ownership of all the Poverty Bay Electric Power Board's assets following the implementation of the Electricity Companies Act and subsequent Acts. The trustees of the ECT are appointed by the Gisborne District Council, (GDC). The GDC is the ultimate capital beneficiary of the Trust.




The ECT also owns other companies forming the Eastland Group, as shown below:

Eastland Group Ltd manages Eastland Network Limited, Eastland Generation Ltd, Eastland Port Ltd and Eastland Investment Property Ltd. The Eastland Group also manages and operates Gisborne Airport on a long term lease from the Gisborne District Council. Eastech Ltd is owned by Eastland Group Ltd. Together these companies make up the Eastland Group.

Primarily, Eastland Group Ltd is a shared service provider to each of the companies within the Eastland Group. It employs management and operational staff required to operate the companies within the Group. Governance of the Eastland Group is provided by a common Board of Directors appointed by the ECT. This management/governance structure is illustrated below:

**Eastland Group Management Structure**

- Eastland Community Trust
  - Eastland Group Board of Directors
    - Eastland Group Chief Executive
      - Executive Assistant
      - General Manager Networks
      - General Manager Ports
      - General Manager Business Development
      - General Manager Generation
      - General Manager People and Performance
      - Chief Financial Officer
      - Marketing and Communications Manager
      - General Manager Energy Solutions

With respect to the management of Eastland Network Limited distribution network assets, Eastland Group Limited provides the services and resources required to carry out all financial management, planning, design and network operating activities. Since all physical installation and maintenance work carried out on network assets is contracted out, the network operating function includes significant responsibility for the management of accredited independent contractors.

Contractors tender for packages of maintenance activity and/or capital works projects. Contracts are awarded on the evaluated performance criteria of price, quality/safety and timeliness. Contract tendering, and management is carried out in accordance with NZS 3910:1998 "Conditions of Contract for Building & Civil Engineering Construction".

Eastland Network Limited believes that competitive tendering is beneficial for the business as it stimulates contractor innovation and results in field services being provided at the true market rate. As such Eastland Network Limited does not operate a system of preferred contractors. Any contractor is able to tender for Eastland Network Limited work provided that they are able to meet and maintain predetermined standards relating to demonstrating competency, the provision of quality, health & safety and financial management systems.

### 1.5.1 Accountability at governance level

Governance of Eastland Group is provided by a Board of Directors appointed by the Eastland Community Trust.

The inclusion of quality targets and EBIT targets in the Statement of Corporate Intent makes Eastland Network Limited's Board intimately accountable to the shareholder for these important asset management outcomes. The inclusion of revenue and financial performance targets in the statement makes the Board additionally accountable for overseeing the price-quality trade-off inherent in projecting revenue and network performance.

The requirement for the Strategic Plan, the Business Plan, (including capital and maintenance expenditure budgets), and the AMP to be approved by the Board of Directors on an annual basis adds a further accountability function. On a monthly basis the Board receives updates on progress against service level and financial performance targets. All large projects $150K or higher are identified to the Board for approval and all purchase contracts in excess of $250k are approved by the Board. Performance against Statement of Corporate Intent targets is reported annually to the Shareholder.

### 1.5.2 Accountability at executive level

Overall accountability to the Board of Directors for the performance of the electricity network, the port and the airport rests with Eastland Group's Chief Executive whose employment contract specifies *inter alia* the asset management outcomes to be created such as safety, reliability, revenue, profitability and compliance.

### 1.5.3 Accountability at Operational level

The General Manager Networks is accountable to the Chief Executive for the safe, reliable, profitable and compliant operation of the electricity network principally through his employment contract. Accountabilities of the General Manager Energy include overall responsibility for achieving compliance with all Eastland Group corporate policies and procedures, (including planning/reporting, human resource management, health & safety management, environmental management, contract tendering, contract management, regulatory disclosure management and financial/budgetary management).

The General Manager Network's activities, accountabilities, resources and responsibilities for achieving Eastland Group corporate policies and procedures are assigned as follows:

The long term planning function which undertakes asset planning and design work and includes the company's professional engineering resources and the drawing/information record keeping. Production of this AMP is a key accountability of the Asset and Planning Manager who reports to the General Manager Networks.

The real-time and short term system operations function implements work programs, operates the network, and manages contractors. Delivery of reliability, budget cost, and safety performance are the key accountabilities of this group who on an individual basis are assigned responsibility for the implementation of specific capital and/or maintenance activities and budgets as determined in the AMP. Contract and operation reviews provide additional feedback from contractors.

Close interaction between Planning and Operations is achieved through the stewardship of the General Manager Networks. Real-time, short term and long term planning roles are assigned to individuals based on skills and experience held. Typically all individuals are assigned responsibilities involving both the short term operational and long term planning functions. Group responsibility for real time operation of the control room and the achievement of network reliability, budgetary, safety and environmental performance targets is also shared between the Planning and the Operations people based on capability and experience.

A diagram showing the structure of Eastland Group for the Gisborne based operations is shown below. On the left hand side of the diagram roles primarily associated with the Asset management and operation of Eastland Network Limited are highlighted with the Light Green. This group is also responsible for Asset Management and operation of Eastland Generation Limited. Business support functions are provided by the Finance (Pink) and Shared Services (Green) groups.

#### 1.5.3.1 Planning and Operational Resource Development

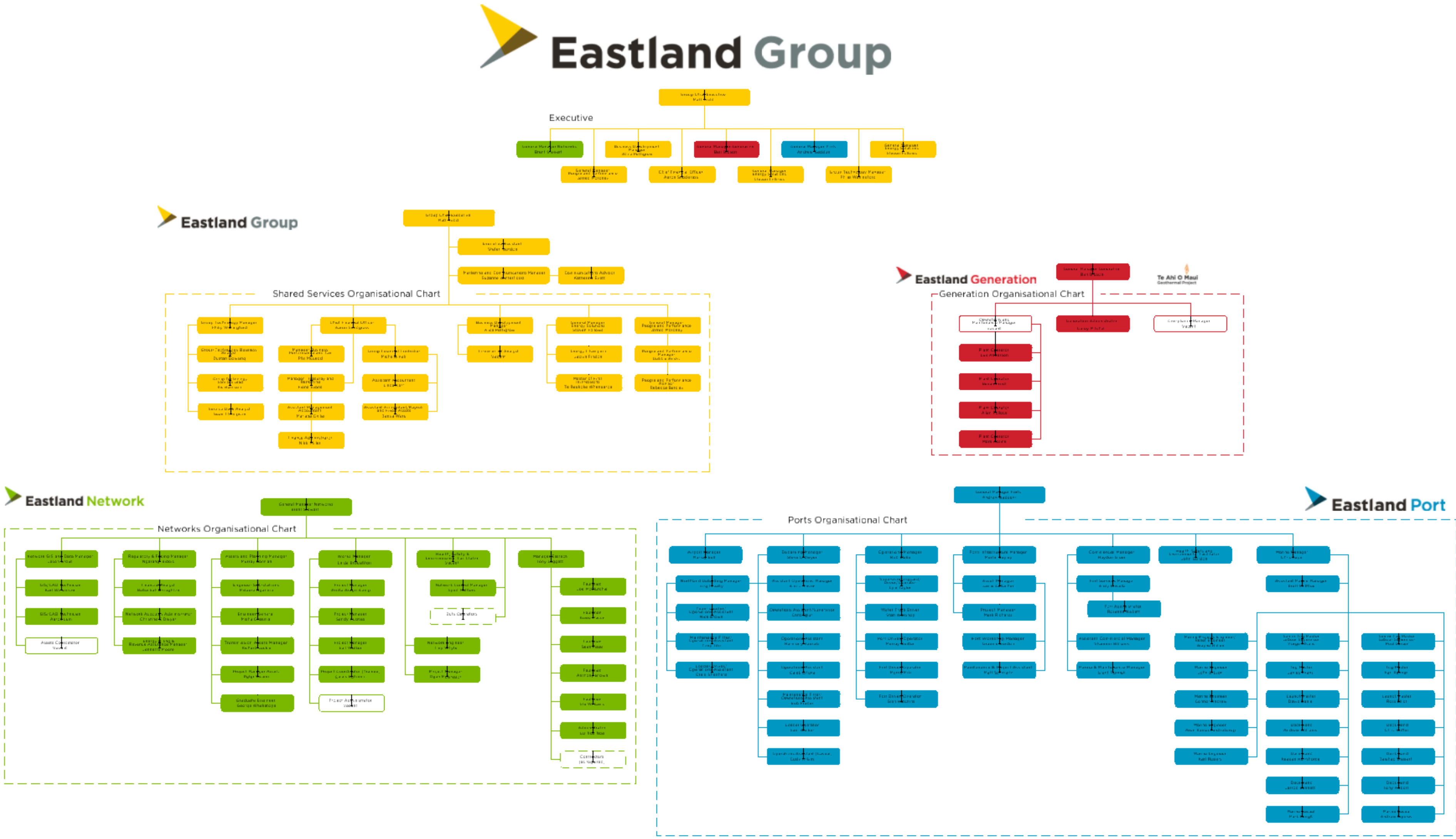
A periodic review of staffing levels including skill and competency requirements to best serve the operational needs of Eastland Network Limited has confirmed the following additional resource requirements:

- The design planning and asset management function of Eastland Network Limited and Eastland Generation Limited has expanded to a level where the current role needs to be split over additional resource. (Also identified during review of risk as a key role)
- Development of a role to cover Operations Management

Key drivers identified in the review included;

- Changes in requirements for on-going reviews, process change management, reporting and auditing associated with the Public Safety Management System.
- Increased levels of investigation into non asset solutions identified in this AMP and the business plan.

While proposals for additional resource are subject to business planning approval, expenditure relating to the changes is included in System Operations and Network Support forecasts.


Eastland Group
Executive
Eastland Group
Shared Services Organisational Chart
Eastland Generation
Generation Organisational Chart
Te Ahi O Maui
Eastland Network
Networks Organisational Chart
Ports Organisational Chart
Eastland Port

### 1.5.4 Responsibility for Business Support

Responsibilities associated with provision of business support services and financial services are assigned to Eastland Group's Chief financial Officer, by the Chief Executive Officer of Eastland Group.

### 1.5.5 Responsibility for Field Services

Responsibilities associated with field activities are monitored and managed by the Eastland Group personnel primarily associated with the Energy Business Asset management. Tasks carried out by these personnel include:

- Contractor resource planning
- Consents and approvals
- Public and Worksite Safety Management
- Shutdown planning and coordination
- Contract preparation, tendering, management and monitoring
- Work site auditing
- Contractor approvals
- Switching activities
- Fault response and repair coordination

To ensure competencies Eastland Network Limited matches the tasks undertaken with qualifications, personality and experience attributes of asset management personnel. Peer and managerial review processes are in place to develop and improve capabilities of all personnel.

In general all physical installation and maintenance work in the field is contracted out to service providers. Eastland Group personnel assist with the activities to provide the necessary knowledge and experience. This compensates for any skill or resource shortages. The following service providers are used by Eastland Group for physical installation and maintenance work.

| Service Provider | Key Services | Extent of Business Involvement |
|---|---|---|
| Eastech Limited (Eastland Group owned) | Primary Fault response, | 22% |
| Electrinet | Cables, Lines, Electrical, Technical maint & install | 30% |
| Broadspectrum | Ex-transmission assets,(lines & substns), maint & install | 8% |
| In Line Construction | Lines maint & install | 6% 1 Employee |
| JA Russell | Supply of goods/materials | 6% |
| Arborcare | Vegetation management | 4% |
| Roberts Tree Surgeons | Vegetation management | 3.8% |
| Eastland Tree Care | Vegetation management | 3% |
| Gisborne Helicopters | Fault Response, Lines install | 2% |
| Ideal | Supply of goods/materials | 2% |
| Colvins | Communications | 2% |
| Powerline Technologies | Fault Response, Asset Inspection, Lines maint & install | 1.7% 1 Employee |
| Cameron Mechanical Ltd | Mechanical Maintenance, Generators | 1% 1 Employee |

| | | |
|---|---|---|
| PBA | Substation maint, install & testing | 1% |
| Power Connections Ltd | Fault Response, Cables/ Lines maintenance, install, Inspection | 1% |
| Apex Power Systems Ltd | Fault Response, Lines/Cables maint & install | 1% 1 Employee |
| CR Taylor | Civil Construction | 0.3% |
| YourCall NZ | Fault response coordination/Call Centre | 0.1% |
| Other | | 5% |

In addition to physical work a number of these service providers are responsible for Design and planning activities associated with subdivisions, new connections, routine maintenance and asset renewal.

### 1.5.6 Competency and Skill analysis

Eastland Network Limited monitors the Skills, Competencies, and Experience of all persons involved in direct asset management activities at an individual level. A database is maintained of individual competencies and a supervision experience level is agreed between the individual and Eastland Network Limited. The level of attainment for any competency varies between individuals. In general 1 or 2 individuals can achieve a task unaided due to experience, while others need to refer to members of a team, and/or procedures/guides in order to complete the task. The competencies and supervision levels continually change and are reviewed as individuals gain new skills and experience or as the nature of an individual's regular activities or roles change. Audits and review processes are in place to ensure the desired accuracy of the competency database. The following charts summarise the key competencies in terms of the number of identified individuals that have attained the competency to identify any gaps in terms of risk management.

In all Eastland Network Limited has identified 114 key competency areas and approximately 98 individuals registered with at least 1 competency. A total of 2203 competencies are covered by the 98 individuals. The average of 22 competencies per individual indicates the high degree of multi skilling. This is further evident in the estimated 33 full time equivalent person-years p.a. paid to staff and contractors engaged in asset management activities.

The disadvantage of the highly multi-skilled workforce of which the majority is only involved with Eastland Network Limited activities for part of the time, is the limit on being able to do multiple tasks at the same time. i.e. while all the necessary skills exist in a few people there are insufficient people to get the work done at times.

Competency areas that are a constraint in exceptional events or afterhours include;

- Truck drivers (Generally limited by restrictions on work/driving hours)
- Cable jointers
- Crane operators
- Fault-electricians (Remote areas)
- Technicians
- Line Mechanics

Apprentice training programs are an option to secure future resourcing requirements. The programs implemented by Contractors are supported by Eastland Group

Given the steady state projections of asset renewal the current personnel levels are insufficient to carry out all of the work.

As the conductor renewal work increases further additional lines personnel will be required as the activity requires additional staffing over standard pole replacement activities.

# 1.6 Significant Assumptions

A number of significant assumptions have been made in order to determine likely outcomes of Eastland Network Limited's AMP. These key assumptions are summarised as follows:

Ownership - Eastland Network Limited's ownership is assumed to remain unchanged throughout the planning period.

Corporate Vision, Objectives and Targets – Eastland Network Limited's corporate vision, objectives and targets in section 1.2 are assumed to remain the same throughout the planning period.

Climate - Eastland Network Limited assumes normal climatic variation over the planning period including temperature, wind, snow and rain patterns consistent with its experiences since 2000.

Major disasters – The assumption has been made that major disasters will not exceed the capabilities of existing contingency measures over the planning period.

Stakeholder service levels – Eastland Network Limited has assumed the current stakeholder expectations regarding security and service levels in section 1.4 and section 3, will not alter significantly throughout the planning period.

Demand projections and Load Characteristics – Network loading and growth are assumed to occur in line with the demand forecasts in Section 4.3.

Individual large loads and embedded generation – Eastland Network Limited has not included large individual loads or significant embedded generation other than that identified in section 4.3. It is assumed that developments that have not already been identified will not occur over the planning period.

External regulations, legislation and technical industry standards and codes of practice – Eastland Network Limited has assumed the current environment will be unchanged over the planning period.

Transpower's obligations and commitments - Eastland Network Limited has assumed the current arrangements will be unchanged over the planning period.

Relative input costs and exchange rates and the cost of borrowing - Eastland Network Limited has assumed the current financial environment will be unchanged over the planning period. All financial projections are provided at current values.

Resource availability - Eastland Network Limited has assumed the availability of resources will be at adequate levels over the planning period.

Technological change - Eastland Network Limited has assumed that no significant technological change will occur over the planning period.

### 1.6.1 Proposed Changes to the Existing Business

The future for electricity distribution businesses is changing due to the increased pace of emerging technology development and reducing costs associated with distributed generation, (both small scale and urban scale DG), energy storage, electric vehicles and the degree of choice provided to consumers. The impending changes have resulted in significant and varying commentary on the threats and opportunities the emerging technology could place on the current electricity supply chain.

In the face of the change and associated commentary, in 2017 Eastland Network with the assistance of an external consultant, considered it timely to undertake a strategic review of the electricity distribution business. The primary objectives of the review were to;

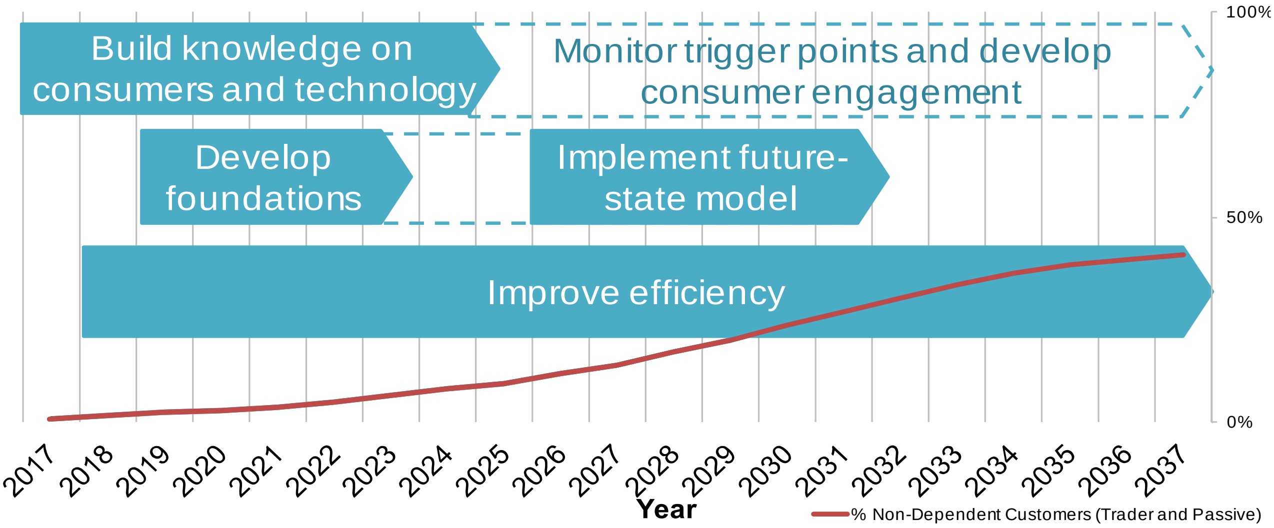
- Understand the possible long term risks facing Eastland Network due to emerging technology – ie. Consider future demand and sources of electricity, the electricity consumer of the futire and future market and regulator responses.

- Develop a strategy for Eastland Network that achieves a balance between financial returns, regional economic contribution, distribution network sustainability and relevant future risks.

The comprehensive review and accompanying recommendations on strategic direction were presented for consideration by the Eastland Network Board in October 2017. Following the presentation a broad plan to address future energy transformation risks faced by Eastland Network was endorsed and enabling actions included in business planning documentation. Key elements of the broad co-ordinated plan/strategy are;

- Become customer-centric. Eastland Network will build its knowledge on consumers, their future service requirements and energy transformation technology. This will allow it to gain an understanding of required changes to current business and operating practices, potential business opportunities and future business risks such as asset stranding. This will involve the development and consolidation of a "customer front end" in order to progress the introduction of new services, (such as localized demand side management), and service based pricing.
- Progress to a future state business model. Progress towards impliementation of a future business model where Eastland Network becomes an "energy intergrator/aggregator". This will allow consumers to adopt (and benefit from), new energy technology through development and alignment of business processors and systems with a changing customer value proposition. When developing a future state business model Eastland Network will consider the stranding of assets, (and subsequent under recovery of capital), due to emerging technology and/or consumer preferences.
- Continuously improve efficiency and effectiveness. Continue to build economies of scope within the Eastland Group, investigate the the outsourcing of activities where scale is a constraint to efficiency, and focus on continuous improvement.

The timing of the transition to a consumer concentric and future stste business model depends on the rate of energy transformational change. The anticipated strategic directional change overlaid against forecast consumer change is shown below.




Preliminary modelling suggests that a level of investment in distribution transformation and operational system augmentation will be required to meet energy transformation risks, (ie. enable the network to become "energy intergrator/aggregator and respond to a changing customer value proposition). Over the next 20 years it has been estimated that this investment may encompass;

- $8m for a new SCADA, Outage Management System (OMS)/ Distribution Management System (DMS)

- $10m – 13m for the upgrading of up to 10% of current LV systems and urban distribution transformers

- An additional $8m to operate and maintain the new control systems.

The above possible expenditure requirements have not been included in this edition of the AMP but will be appropriately considered in future editions as specific requirements and associated costs are crystallised as part of future work being undertaken to address energy transformation risks.

### 1.6.2 Basis for Assumptions

All the significant assumptions identified above are based on the premise that Eastland Network Limited's is operating in a steady state with current conditions unlikely to vary significantly in future. The principal source of information from which future assumptions have been derived is historical data contained in the various systems described in section 1.7 of this AMP. These systems include the:

Works Management System
Network Control Systems
Financials
Network Modeling
Asset Information Systems
Gentrack Billing System
Safety Management Systems

### 1.6.3 Sources of Uncertainty

The assumptions made in relation to sources of uncertainty are listed in above. The potential effect of each on the prospective information contained in this AMP is:

| Source of Uncertainty | Potential Effect of Uncertainty | Potential Impact of the Uncertainty |
|---|---|---|
| Ownership change | A change of ownership can potentially introduce new focus influencing primary inputs to the asset management plan. | Projected Expenditure may increase or decrease.<br>Performance levels may decline or improve |
| Corporate Vision, Objectives and Targets | Changes will influence the primary inputs to the asset management plan. | Projected Expenditure may increase or decrease.<br>Performance levels may decline or improve |
| New Acquisitions | New Acquisitions will affect service level asset value and financial forecasts | Projections will change in line with the change in scale and nature of the assets acquired. |
| Climate | A shift in weather patterns will influence the life cycle patterns of the assets and or design parameters of the network. | Projected Expenditure may increase or decrease.<br>Performance levels may decline or improve.<br>Load patterns may change. |
| Major disasters | Significant disasters may leave the network asset unviable requiring a new network to support a rebuild of the region. | Projected Expenditure likely to increase. Load patterns likely to be significantly altered. |

| | | |
|---|---|---|
| Stakeholder service levels | Stakeholders could change their demands for service and willingness to pay. | Either higher or lower service targets will be established with an associated impact on expenditure. |
| Demand projections and Load Characteristics | Demand growth beyond expected levels will erode security levels. Negative growth will reduce income and leave an under-utilised asset. | Projected Expenditure may increase or decrease. Performance levels may decline or improve. Regional Development may be limited or new opportunities may emerge. |
| Individual large loads and embedded generation | Additional asset not covered by current development plans will be required. Development timing for Transmission and Subtransmission assets will alter. | Projected Expenditure may increase or decrease. |
| External regulations, legislation and technical industry standards and codes of practice | Current and forecast capital and maintenance programs will alter to accommodate changed requirements. Asset management systems replaced/altered to accommodate changing information requirements. | Projected Expenditure may increase or decrease. Performance levels may decline or improve. Financial viability of the network business may improve or decline. |
| Transpower's obligations and commitments | Can alter forecast capital and maintenance programs, performance levels and revenue requirements. | Projected Expenditure may increase or decrease. Performance levels may decline or improve. Financial viability of the network business may improve or decline. Regional Development may be limited or new opportunities may emerge. |
| Relative input costs and exchange rates and the cost of borrowing | Alters capital and maintenance expenditure forecasts. | Projected Expenditure may increase or decrease. |
| Resource availability | Impacts on the ability to match resources to work programs. | Projected Expenditure may increase or Performance levels may decline. Viability of the network business may decline. |
| Technological Change | Typically improves accuracy requirements of information and analysis systems. Or improves characteristics of asset behavior. Technology complexity could lead to unexpected complex failure modes | Performance levels would typically improve but may incur a corresponding increase in expenditure. Performance may decline. |
| Changes to Standard Lives | Impacts on assumptions where age is used to indicate general condition across similar asset populations. | Changes Asset Renewal and maintenance programs in consideration of the timing over the revised asset lifecycle. |

### 1.6.4 Price Inflator Assumptions

In preparing the financial information disclosure in nominal New Zealand dollars, as required in the Report on Forecast Capital Expenditure (Schedule 11a.) and the Report on Forecast Operational Expenditure (Schedule 11b.), Eastland Network Limited has applied a price inflators.

The following price inflator assumptions for 2019 – 2020 are based on the NZIER Consensus Forecasts Sep 2017. The later years are based on the Comcom CPI forecasts used in the 2015 Default Price-Quality Path reset.

| Period | CPI |
|---|---|
| 2019/2020 | 0% |
| 2020/2021 | 2.0% |
| 2021/2022 | 2.0% |
| 2022/2023 | 2.0% |
| 2023/2024 | 2.0% |
| 2024/2025 – 2026/2029 | 2.0% |

Eastland Network Limited will continue to monitor inflationary advice and will update related information in future AMPs as required.

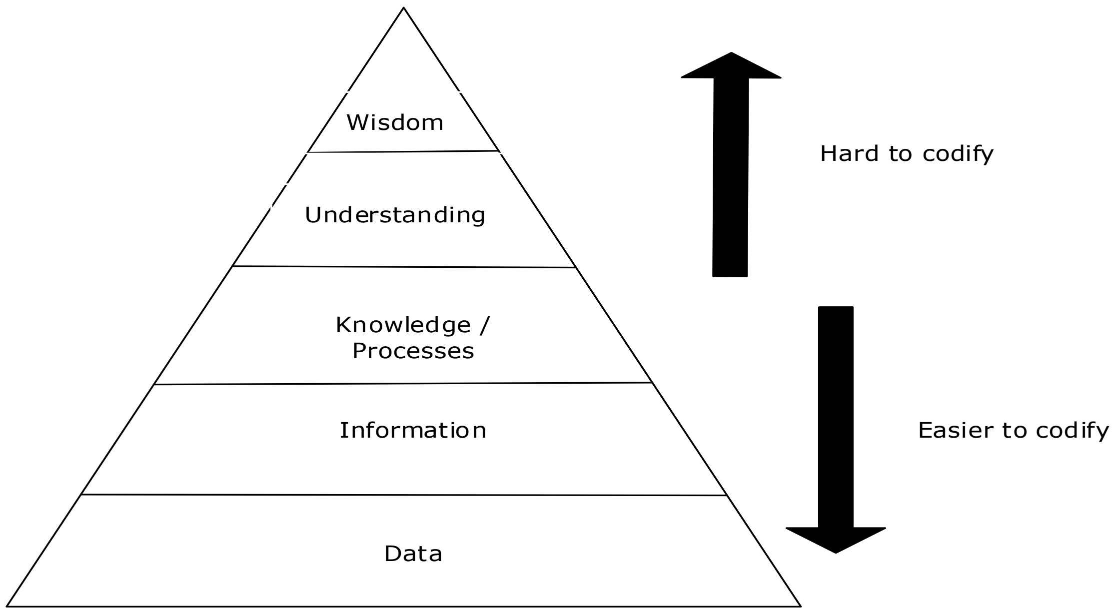
### 1.6.5 Factors that may lead to a Material Difference

Factors which may lead to a material difference between the AMP and future actual outcomes include any significant departure from the steady state trends or current conditions relating to the assumptions identified above.

## 1.7 Eastland Network Limited's processes and systems

The core of Eastland Network Limited's asset management activities lie with the detailed processes and systems that reflect Eastland Network Limited's thinking, manifest in its policies, strategies and processes and ultimately shapes the nature and configuration of its fixed assets. The hierarchy of data model shown in Figure 8(a) describes the typical sorts of information residing within the business which includes that held by employees by virtue of their skills and experience.

***Figure 8(a) – Hierarchy of data***




The bottom two layers of the hierarchy tend to relate strongly to the asset and operational data which reside in the GIS and SCADA respectively, and the summaries of this data that form one part of the decision making.

### 1.7.1 Asset Management Wisdom and Understanding

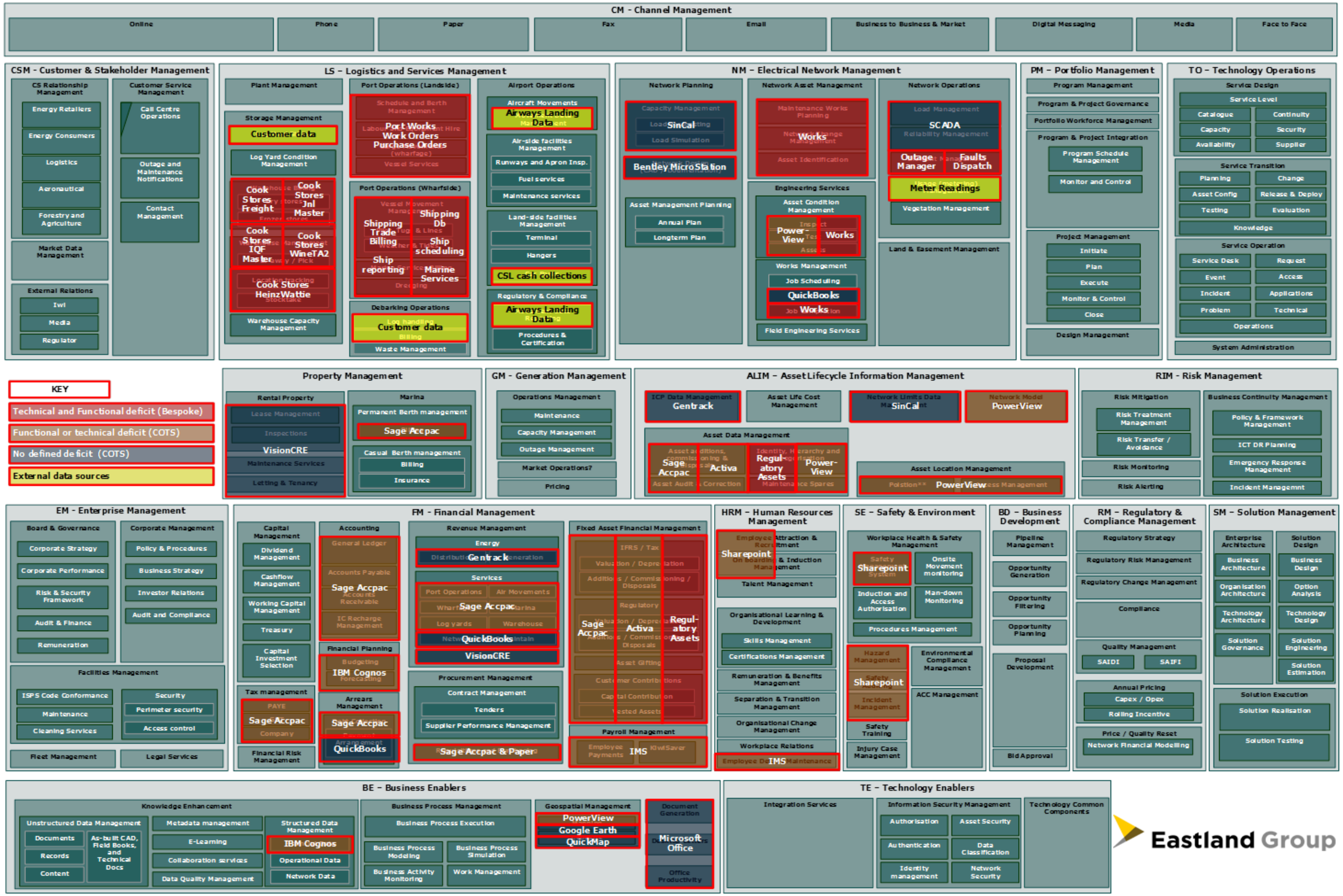
The top two layers of the data hierarchy tend to be very broad and are often difficult to define. It is at this level that key organisational strategies and processes reside at. As indicated in Figure 8(a) it is generally hard to codify these things, hence correct application is heavily dependent on skilled people. Eastland Group continually improves on these aspects of wisdom and understanding through its staff training and development programs. These layers provide Eastland Network Limited with the ability to establish key initiatives and produce optimum solutions forming the Network development plans in section 4 of this plan. In addition these layers are key to forming the strategies for managing the assets lifecycle in section 5 of this plan.

### 1.7.2 Asset management Knowledge and Processes

The third layer of the data hierarchy – knowledge and processes– tends to be more broad and general in nature. This layer encompasses accumulated knowledge in the form of processes. Development and review of Eastland Network Limited's processes is on-going and changes are triggered as needs arise.

The asset management processes collect data and information, identify actions, develop solutions and prioritises the programs for maintenance and asset development to ensure optimum customer service and operational efficiency. Implicit in the asset planning processes is an understanding and evaluation of the risks to operation and the consequences of failure. Also critical is the collection of information from which performance can be monitored and improvement targets set.

The block diagram below summarises the software systems used by Eastland Group to support the processes.



The systematic processes that make up the core of asset management practices are those that collect and analyse data. The main processes are:

Safety Management
Every asset and activity is assessed in terms of the design, hazards, control measures and residual risk. Processes to manage risks relating to Occupational Health and safety, Public safety, and Damage to property requirements are incorporated into all aspects of asset management.

Condition Assessment
Every asset has a condition assessment action included in its maintenance program. This is used to confirm the necessity of further maintenance, target maintenance expenditure and provide ageing data. (Refer Section 5.3)

Performance
Analysis of reliability statistics provides information on the performance of assets, the effectiveness of work practices, and helps target work programs which result in improved performance. (Refer section 3)

Asset Utilisation and Capacity
Load growth and changing profiles are obvious inputs into planning. However security risk and quality issues also require adjustment when load use patterns change. (Refer section 4)

Risk Management
Network related risks are identified and ranked by risk reduction outcomes to help prioritise work programs. (Refer section 6)

Economic Optimisation
The value of a network results from the asset management practices applied. Economic analysis can indicate whether valuation changes and lifecycle costs are in line with long-term sustainable objectives and therefore which tactics are appropriate for different network segments. Economic analysis is also applied to optimise the balance between capital and maintenance decisions across the life cycle of the network assets

Design
The design process ensures that all assets are installed to enable safe and reliable operation for an established range of operating conditions. New assets utilise design standards that take into account the past performance of previous standards and designs. Modification to designs and standards is managed to continually improve the effectiveness, performance and cost of the assets accommodating new technologies and innovations where appropriate. (Refer section 5.5)

Benchmarking
Analysis of disclosure information and industry benchmarks identifies the practices that are most effective and the performance levels that can be achieved given inherent network characteristics.

### 1.7.3 Information Management Data Systems

Processes for managing routine asset inspections and network maintenance are managed by the Works Management System which relates the budgeted activities described in section 5.3 of this plan to the physical activities undertaken.

As work is completed information is updated in the appropriate data stores and feedback as necessary into the design process or works management system for corrective actions.

Urgent actions are dealt with immediately while other data captured is fed into the decision process ultimately shaping future maintenance and/or capital strategies.

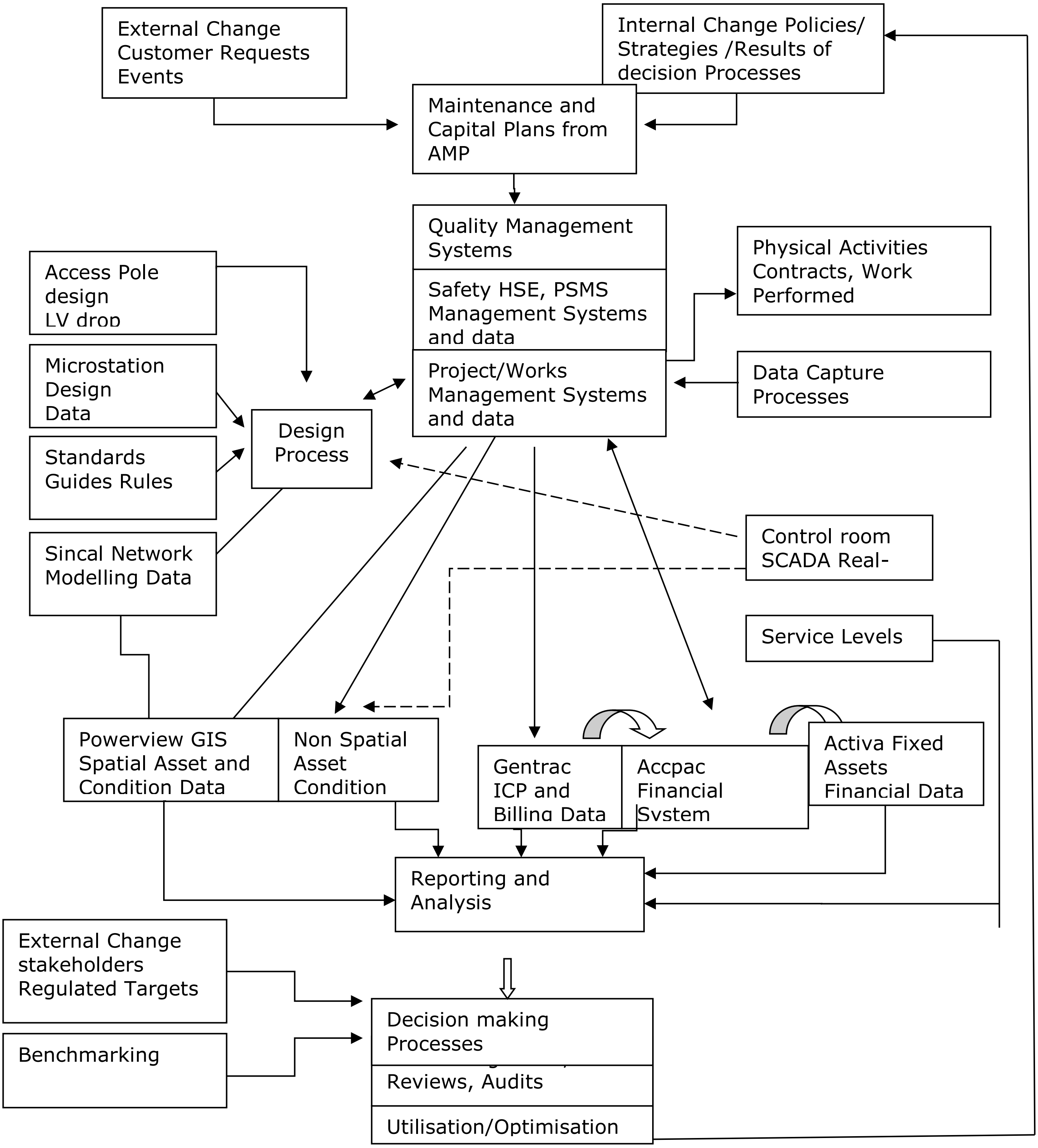
The processes used to analyse the data and identify changing data requirements are documented in the Asset Management System. Refer 1.7.7 below.

Real time data and data for determination of service levels a task associated with the Control room operations function. As the data is accumulated it is fed into the reporting systems and decision making process.

Data requirements associated with the safety management system required by the Electricity Act, Act amendments and Electricity (Safety) Regulations are closely linked to the works management system.

The linkage and co-ordination between Eastland Network Limited's asset management processes and systems involves storage of a wide range of data and a complex flow of information as shown below;

Asset Management System Information Flows



### 1.7.4 Asset Management Data

The following information systems are used to, store information on Eastland Network Limited's assets including relevant condition and performance information.

#### Works Management System

This system is used to:

- Manage routine asset inspections and network maintenance.
- Monitor the status of planning and network development projects
- Manage defect notification and safety management system corrective actions relating to assets.

The Works Database provides job cost functionality and is used to manage faults, defects, maintenance and the work management activities over the assets lifecycle described in section 5 of this plan. This is essentially a job and contract management tool with linkages to the GIS and Financial systems to provide cost reporting. It provides information on progress, commitments, forecasts and cash flow at job and project level.

#### Financials

The financial systems are key in providing information relating to network performance in terms of financial efficiency.

The company uses ACCPAC as its main financial management IT-platform. This is supplemented with Activa to maintain the financial asset register, which is separate to the engineering asset database.

The Works Database is reconciled with ACCPAC during monthly reporting.

Cognos software is used to provide Group Budgets and account consolidation to Group level.

#### Network Control and Monitoring

These Data Systems store information used to measure network physical performance. Systems include Outage Notification Management, Control Log, Outage Statistics and

The SCADA system provides real time operational data and enables remote control of key components of the network. Reporting functions for service levels and performance are also contained within these systems.

The Substation Management System provides remote access to the Major substations for download of log information and reconfiguration of equipment including Tap changer controllers, protection relays, and Battery System Controllers.

#### Network Modelling Data

Eastland Network Limited uses PSS Sincal (Power System Simulation/Utilisation) network modelling software to analyse the network and the impact of changes in utilisation and operation. The software is sufficiently sophisticated to permit advanced network optimisation and analysis and assist investment decision-making.

Internal Line design software solutions are used for structural engineering/line design.

LV Drop software is primarily used for Low voltage design.

#### Fixed Asset Data

The Powerview Geographical Information system operating on Microsoft Access Databases is used for management of asset data, maintenance and summary inspection records. A number of associated Microsoft Access Databases / applications are used in conjunction with the Powerview databases to manage non-spatial assets. The Powerview system is coupled to Google Earth and Quickmap mapping products to provide flexible alternatives to users of the information depending on their specific needs.

Microstation Draughting Software is primarily used to maintain information in Schematic form. Complex structural and circuitry design information is also stored in the Microstation format. Hard copy records include Maps, field record books, and Maintenance/ Commissioning Records. Tools have been developed that allow reconciliation of GIS information with the Schematic information to ensure consistency across data stores.

Gentrac is the product used to manage ICP records in an SQL Database format and linked to the GIS data. A software update/upgrade was completed in 2010.

Activa Software is used to manage the Financial Fixed asset register. The fixed assets spatially identified within the GIS system are reconciled with the Activa fixed asset register using tools developed in-house.

Microsoft Access is used to manage the Regulatory Fixed asset register which incorporates tools for reconciliation between GIS and the financial asset registers

### Filing Systems

A manual paper based filing system with cross indexing features is used for long term storage of historical asset management condition and maintenance information. New information can either be stored in this system or a computer based replica of the system.

### Data Accuracy

The following table indicates an assessment of the asset management data and information and accuracy. The percentage completeness indicates the confidence that the asset can be identified as existing as is recorded as existing, while the assessment of accuracy indicates an average confidence in attribute information for the asset. The attribute information for assets varies in significance depending on the nature of the information and how it is used. The assessment of accuracy typically covers key information used to make critical asset management decisions, e.g. Asset attributes, Install and Inspection dates. In general condition information that guides trends or “nice to know information” is maintained on field capture paper records with only summary, e.g. inspection date, information entered into databases.

| Data/Information | Completeness | Accuracy |
|---|---|---|
| Real time data | | |
| Analog loading substations | 98% of all Feeders monitored | +/- 10% |
| Discrete I/O Status | 100% all automatic switches monitored | 97% reliable indication |
| Asset Components | | |
| HV Conductor/Cable | 97% | 70% certainty in attribute information |
| Poles | 97% | 70% certainty in attribute information |
| HV Switchgear | 100% | 90% certainty in attribute information |
| Transformers | 100% | 90% certainty in attribute information |
| LV Conductor Cable | 90% | 80% certainty in attribute information |
| LV Switchgear | 85% | 75% certainty in attribute information |
| Service connections | 100% | 60% certainty in attribute information |
| Comms equipment | 90% | 80% certainty in attribute information |
| LV Pillars | 85% | 85% certainty in attribute information |
| Load control | 60% | 60% certainty in attribute information |
| Scada equipment | 99% | 99% certainty in attribute information |

| | | |
|---|---|---|
| Zone Sub Equipment | 99% | 80% certainty in attribute information |

### 1.7.5 Data Controls and Improvement Initiatives

The primary requirement in determining useful asset and condition data is the requirement to ensure the asset or assets are electrically safe in accordance with the definition in the Electricity safety regulations. Reviews and checks on the data are undertaken at all stages of the processes. Verification of field information is achieved by overlapping inspection and documentation procedures that bring inconsistencies to the attention of asset management personnel. Data entry is monitored by automatic data validation and exception reports incorporated into database systems. The degree of control on data accuracy and consistency varies depending on the value contained within the data. e.g. data relating to the existence of a high voltage switch that directly relates to safety has a higher significance than data relating to an asset make that can be easily verified by a second inspection if necessary.

All critical asset management decisions involving the assets a qualified by a field captured condition assessment prior to an action (refer section 5.3) hence there is no need to invest heavily in high data accuracy other than to meet regulatory reporting requirements.

The table below outlines the asset management system and data improvement initiatives for Eastland Network Limited. In defining these initiatives Eastland Network Limited has recognized a certain degree of incompleteness and inaccuracy of the asset data. However, the Eastland Network Limited asset data still represents a valuable reference source.

There is a trade-off in establishing a 100% accurate dataset and the required resource and Eastland Network Limited considers system and data improvements at each review of this plan.

| System/Data | Improvement Initiative | Timeframe | Budget |
|---|---|---|---|
| Transformer and HV switch assets | Transformer and HV switch assets are key in terms of safety for real time switching operations. The system mimic is verified against the GIS data on a regular basis to identify inconsistencies. In 2010 in- house development of software to automate verification of data between the key systems was developed | On-going | In system operations and network support forecast |
| All asset data | During field operations inconsistencies are easily identified and corrected as they are found. Historical date attribute information where it is recorded on the equipment is updated on an ongoing basis as it is collected during inspections. Where it is not recorded on equipment the dates typically align with historical records and have proven adequate for asset management decision making to date. | On-going | In system operations and network support forecast |
| LV switchgear LV Pillars and Load control relays | LV switchgear LV Pillars and Load control relays are currently incomplete record sets. Inspection and renewal programs (refer section 5.3.13) for these assets are enabling the accumulation of data for these assets. | On-going | In system operations and network support forecast |

| | | | |
|---|---|---|---|
| Regulatory Asset Register | Continue development of Regulatory asset register integration with Financial Asset register and GIS Asset information. | On-going | In system operations and network support forecast.<br>Refer 4.7.3 |
| Works Management Systems Software | Corporate review of systems may identify alternative systems to the systems currently in use to improve consistency across all Eastland group businesses in the area of works/asset management systems being used. | 2017 - 2020 | In system operations and network support forecast.<br>Refer 4.7.3 |
| Asset management system | Review asset management systems (GIS, works management system and drawing management system with consideration of the requirements for condition information stored in the databases and Closer integration with Works Management systems and asset registers. | 2017 - 2020 | In system operations and network support forecast.<br>Refer 4.7.3 |
| GIS System Software | As identified in Refer 2.3.14.2 the ability to support the software on new hardware/ platforms is declining. No software support options exist and development is in house. Options for replacement or integration into other systems are under consideration | 2018 - 2021 | In system operations and network support forecast. |

### 1.7.6 Asset Management System Integration

A high degree of interaction between the asset management processes and systems occurs at multiple levels depending upon the nature and urgency of the information.

With the exception of the real time SCADA system all data is initially captured using paper based systems. The asset databases focus on capture of asset attributes and install/inspection date information. To avoid excessive data entry condition records are summarised into work programs and maintained as paper records. i.e. not entered into databases.

### 1.7.7 Asset management System

Eastland Network Limited has a formal asset management system comprised of

#### Quality Management System

The Quality Management System documents policies, procedures, processes, design standards, contingency plans, risk analysis and links to relevant external documents and resources, relating to all aspects of Eastland Network Limited's operation including:

-Hazard Identification and control
-Contractor Management
-Legislative compliance
-Public Safety Management
-Project Management
-Workplace Hazard Management
-Incident Management
-Worksite activities Hazard management
-Customer Relationship Management

-Hazardous Substances
-Emergency Procedures
-Defect Notification
-System operational Procedures
-Works Management Procedures (Contracts, Verification, Quality Control)
-Product control and purchasing
-Risk Management
-Field Procedures
-Inspection Procedures
-Communication Procedures
-Inspection and Maintenance Procedures
-Information Reporting and Data Capture Procedures
-Purchasing Specifications
-Design Standards
-Equipment Standards
-Connection Standards
-Audit, Review and document control

Safety Management System

The safety management system documents the information and processes relating to hazards as defined by section 169A of the Act using the format defined by NZS7901.

The Safety Management system is essentially a subset of the Quality Management system containing documents procedures, processes and asset performance information relating to prevention of serious harm to the public and significant damage to property.

Technical Library.

A library of technical information is maintained to ensure information is readily available design, maintain and repair the network asset. The need for Eastland Network's own standards created in the past has steadily reduced as industry standards, codes and technical information has emerged. Development and review of standards is on-going and changes are triggered as needs arise.

### 1.7.8 Asset Management System Reviews

Review processes and procedures are incorporated into Eastland Network Limited's quality management system. The system documents the controls to ensure quality and accuracy of information. Internal reviews of the quality management system are undertaken on an on-going basis at appropriate frequencies.

The key external and internal reviews are discussed in section 8.4 to 8.6 of this plan.

### 1.7.9 Asset Management Communication and Participation

Eastland Network Limited has a number of processes in place to communicate asset management strategies, objectives, policies and plans to stakeholders that are involved in the delivery of the asset management requirements.

At an individual level an Employee Performance processes incorporate the asset management performance targets and efficiency measures into the individual performance assessments.

All external contracts to contractors and consultants have terms and conditions of contract that link to the asset management objectives relevant to the contracted service.

The Quality system and Public safety management system contain documented procedures covering distribution and control of standards, designs, inspection procedures. The distribution and communication of changes to external parties is also controlled in line with documented procedures. Meetings and reviews with employees and contractors forming the key asset management teams ensure timely communication when necessary.

The Employee participation program in place provides an alternative tool allowing any individual to contribute to performance and efficiency improvements either directly or indirectly related to Eastland Network Limited asset management strategies plans procedures and processes.

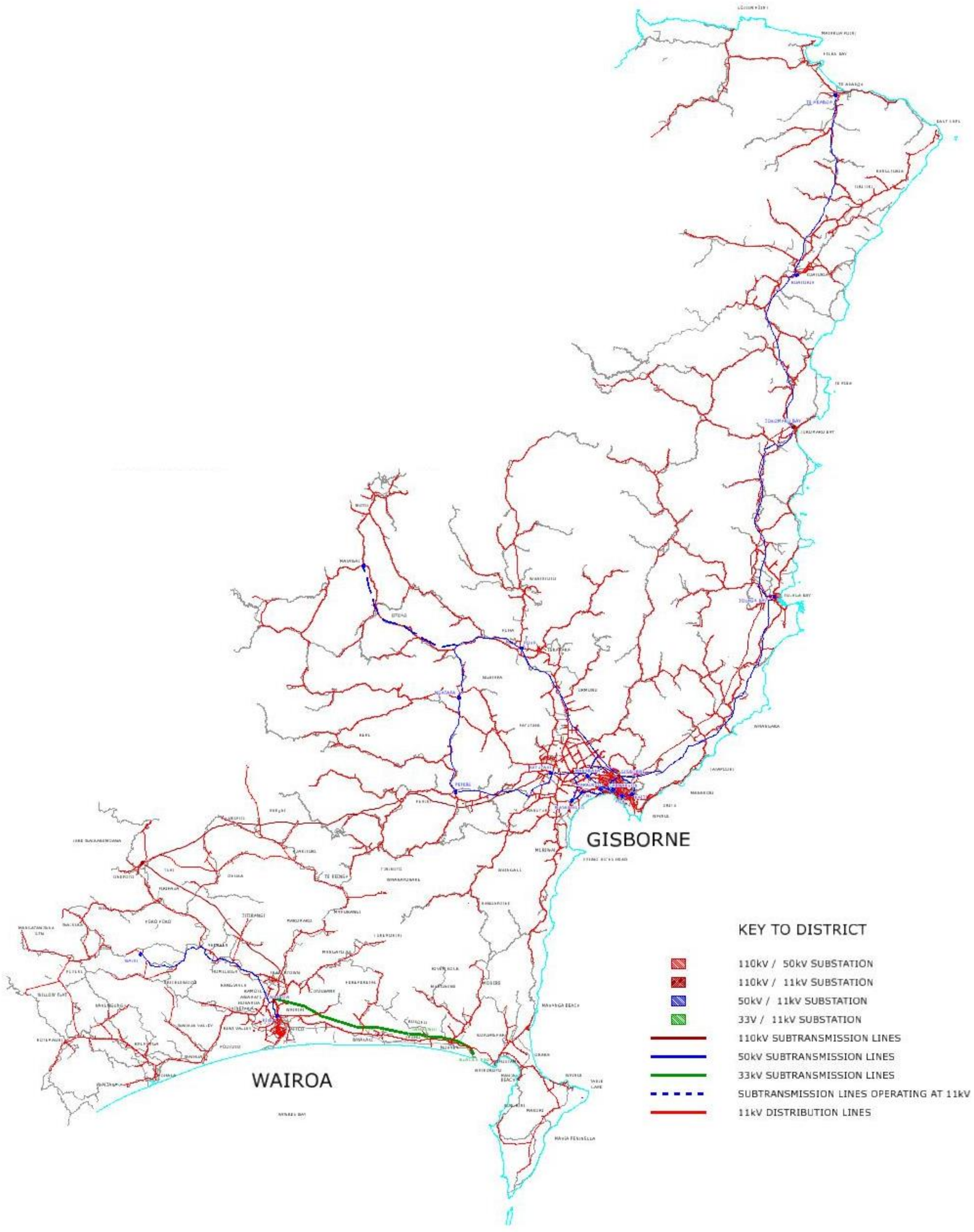
The above tools and methods to ensure communication options are available are internally reviewed and externally audited to ensure the processes are robust and meet the needs of the business.

# 2. Details of Eastland Network Limited's assets

## 2.1 Eastland Network Limited's distribution area

### 2.1.1 Geographical coverage

Eastland Network Limited's distribution area broadly covers the East Cape and Northern Hawkes Bay areas as shown below within the red ring. This area corresponds to the jurisdictions of the Gisborne District Council and the Wairoa District Council.




Topography ranges from fertile plains around Gisborne and Wairoa to rugged mountainous areas further inland. The 11kV(red) network generally consists of ties between substations supplied by the 50kV (blue) and 33kV (green) Sub-transmission, with radial feeds inland via river valleys and ridges.

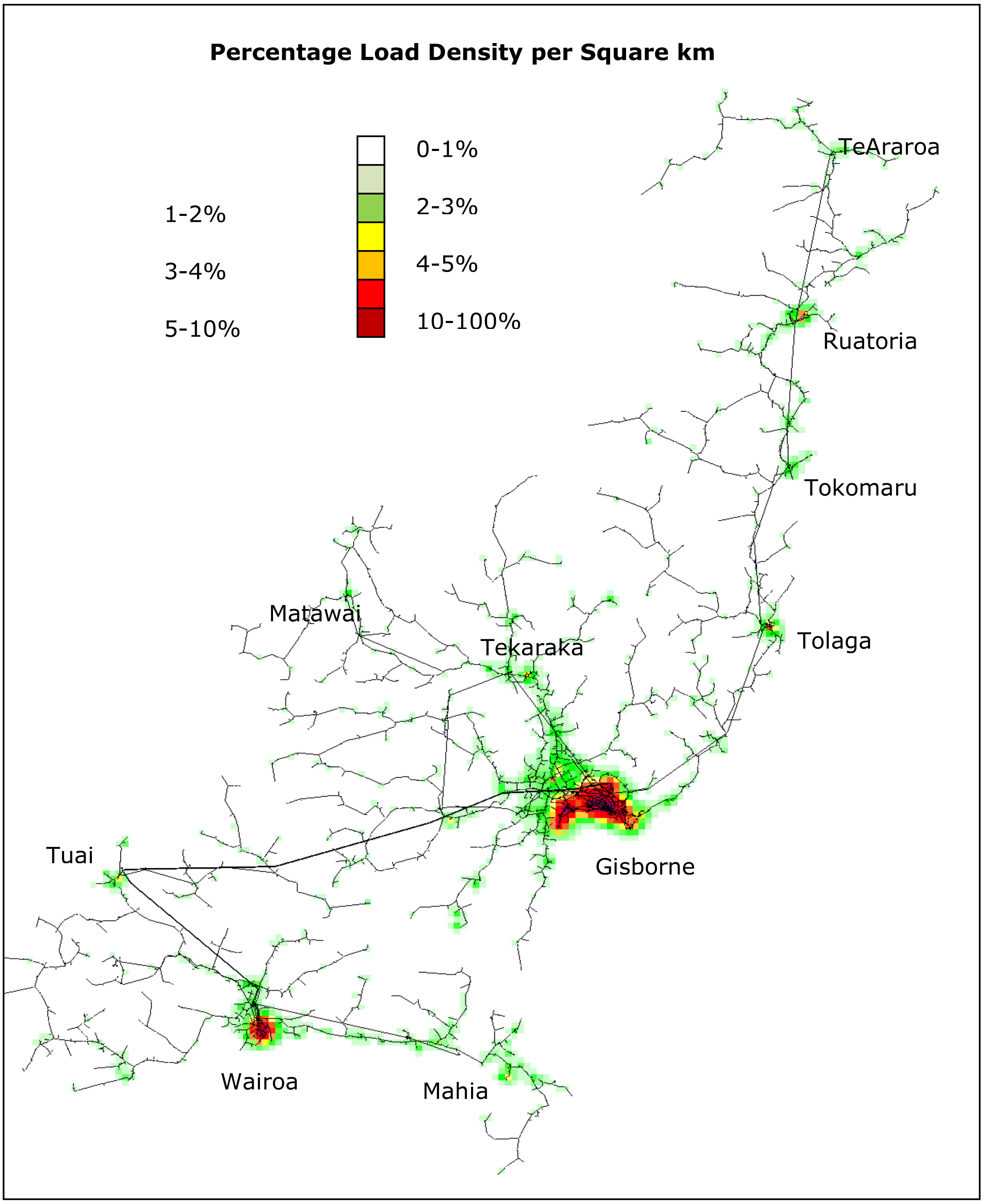
### 2.1.2 Demographics and Characteristics

The population of Eastland Network Limited's distribution area is approximately 53,000 of whom about 41,000 live in the urban Gisborne area and a further 5,000 live in the urban Wairoa area. The remaining 7,000 live in small settlements (such as Te Karaka, Tolaga Bay, Tokomaru Bay, Ruatoria, Matawai and Mahia) and in rural areas. The last three censi indicate slightly declining populations in both the Gisborne and Wairoa Districts.

It is a feature of the Eastland Network Limited network that 75% of ICPs are Domestic. Accordingly any expected contraction of max demand or network investment requirements due to the slight decline in population is likely to be more than off-set by decreasing occupancy rates (i.e. more dwellings but with fewer inhabitants), increased load (i.e. cheap electric heaters, cheap air-con units) and new connections over-taking a previous trend of rural ICP consolidation. ICP numbers since 2004 are;

| Year ending | ICPs | Change | Domestic | Non-Domestic |
|---|---|---|---|---|
| 31/03/04 | 24,849 | (-327) | 19115 | 5734 |
| 31/03/05 | 24,854 | (+5) | 19149 | 5705 |
| 31/03/06 | 24,871 | (+17) | 19228 | 5643 |
| 31/03/07 | 24,975 | (+104) | 19324 | 5651 |
| 31/03/08 | 25,196 | (+221) | 19513 | 5683 |
| 31/03/09 | 25,300 | (+104) | 19554 | 5746 |
| 31/03/10 | 25,432 | (+132) | 19691 | 5741 |
| 31/03/11 | 25,514 | (+82) | 19748 | 5766 |
| 31/03/12 | 25,567 | (+53) | 19850 | 5717 |
| 31/03/13 | 25,550 | (-17) | 19940 | 5610 |
| 31/03/14 | 25,353 | (-197) | 19298 | 6055 |
| 31/03/15 | 25,387 | (+34) | 19310 | 6077 |
| 31/03/16 | 25,410 | (+23) | 19331 | 6079 |
| 31/03/17 | 25,455 | (+45) | 19438 | 6017 |
| 31/03/18 | 25,566 | (+111) | 19,548 | 6018 |

Specific load characteristics for different parts of the region are described in 2.1.4. The following map showing the percentage load density per square km provides an overview of the region's characteristic. Most of the line assets are associated with load densities below 1% of the regions total demand per sq. km, while Gisborne and Wairoa Urban centers have the regions highest load density.




### 2.1.3 Key industries

Key industries relate strongly to the primary produce value chain – cultivation, harvesting, processing, storage and transportation of timber, root and leaf vegetables, pip and stone fruits, grapes, meat and fin fish. There are a number of significant processing and storage installations on the western outskirts of Gisborne, clustered in the Gisborne industrial estate, the Gisborne Port area and in Wairoa.

The companies located in these areas which have a significant impact on the regions demand are listed in the table below.

| Industry | | Demand |
|---|---|---|
| Juken NZ Limited | Timber Processing - Gisborne | 3.5MW |
| Affco | Meat Processing -Wairoa | 3.5MW |
| Leaderbrand | Food Processing - Gisborne | 2MW |
| Ovation | Meat Processing- Gisborne | 2MW |
| Tairawhiti Healthcare | Heath care provider- Gisborne | 2MW |
| Cedenco | Food processing- Gisborne | 2MW |
| Far East Saw Mill | Timber Processing- Gisborne | 2MW |

The nature and size of the operations carried out by these industries does not significantly impact on the network at an individual level. However, the combined consumption of these companies on average is 15% of the total energy conveyed and 25% of the total demand for the region. Direct contact is maintained with these companies to assess their needs and adequacy of current service levels.

There are no issues associated with the operations of these companies, e.g. changes in demand are not expected to have a significant impact on the network over the planning period.

A key issue arising from the nature of these consumers is the increasing requirement for continuity of supply, improved restoration times and less flicker and sag.

Eastland Group regularly engages with customers on all manners of business and common interest. An external advisor formally consults with the 25 largest, (by energy consumption) customers specifically on the issue of price and supply quality.

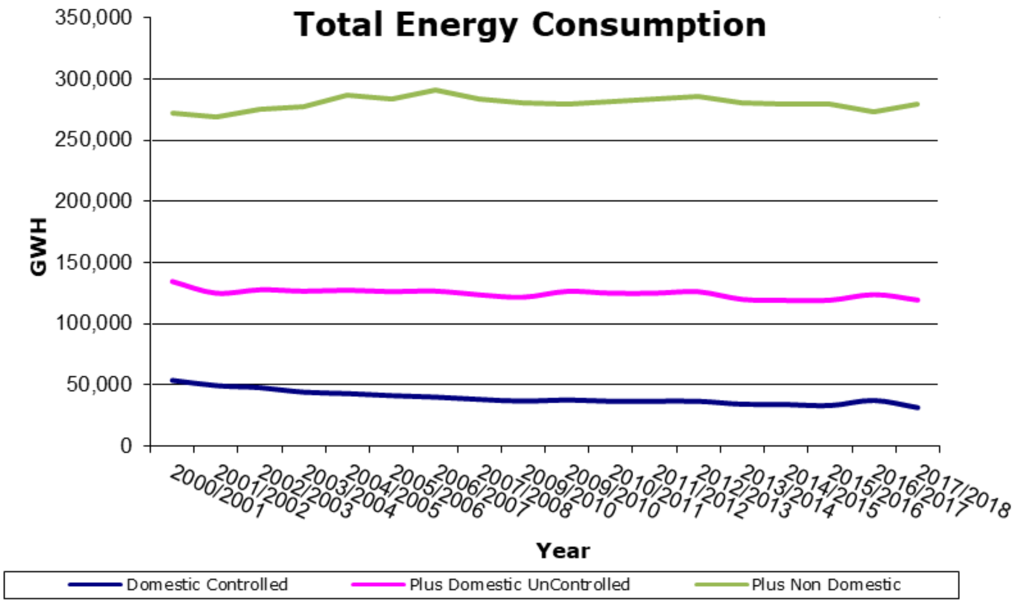
### 2.1.4 Energy & demand characteristics

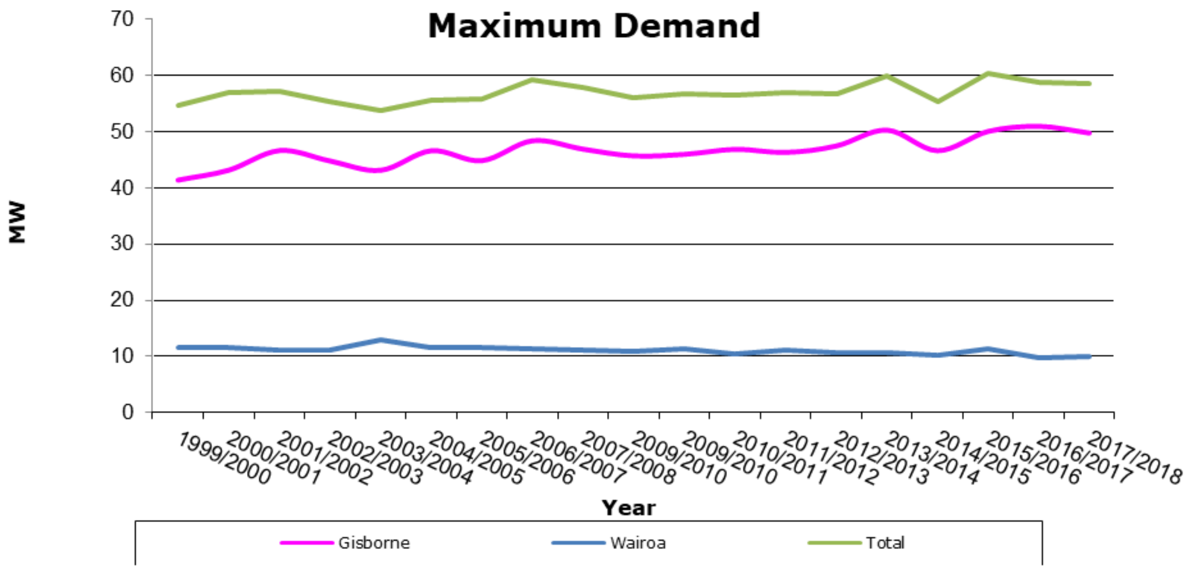
Key energy & demand figures for the 2017/18 year are as follows:

| Parameter | Value | Trend |
|---|---|---|
| Energy Distributed | 308,682 GWH | Annual variations due to weather patterns. Average increase of <0% p.a. |
| Maximum System demand | 58.65 MW | Average increase of <0% p.a. |
| Load factor | 0.61 | Conveyed Units/ Maximum Demand x Hours p.a. Stable trend with variation <1% |

The historical consumption p.a. shows <0% growth or variation due to weather patterns. The system demand trend was influenced by a change in Load control strategy over the period 2001 to 2004. Since 2004 the demand trend has displayed an annual variation of <0%.. An increase occurred in 2015/2016 due to relocation of Gird metering to Tuai increasing line losses attributed to the Transmission lines acquired in March 2015

Low figures for 2003/2004 were a result of a national energy crisis during which advertising to control energy usage and energy retailer requests for hot-water load control beyond that usually required for peak demand control had an impact on demand. During 2010 - 2011 Global financial instability indirectly influenced usage and growth behavior. This may account for the decline in this period however it is difficult to determine the impact of this on the trends. Annual variation due to climate is higher than the growth hence it is not possible to make definitive conclusions on the asset utilisation trends. The steady decline in domestic energy usage is noticeable in the trend and has had an impact on energy price over the years.



## 2.1.5 Summary of Key Statistics

| | | | | | |
|---|---|---|---|---|---|
| **Units in to Network (GWh)** | | | | 308,682 | |
| **Units Billed (GWh)** | | | | 279.48 | |
| **Network Revenue** | | | | $36,746,936 | |
| **Number of Connections** | | | | | |
| | Non Domestic | Domestic | Totals | | |
| **Gisborne** | 4370 | 16383 | 20753 | | |
| **Wairoa** | 1648 | 3165 | 4813 | | |
| **Total** | 6018 | 19548 | 25566 | | |
| **Number of Staff Employed** | Energy Business | | 21 | | |
| | Eastech Ltd | | 8 | | |
| | | | 29 | | |
| **Circuit Kilometres of ENL Lines & Cables (km)** | | | | | |
| **Overhead** | 110kV | | | 306.58 | **Subtransmi** |
| | 50 kV | | | 300.72 | 641.58 |
| | 33 kV | | | 34.28 | |
| | 11 kV - 3ø | | | 2300.97 | **Distributior** |
| | 11 kV - 1ø | | | 92.176 | 2393.146 |
| | 11 kV - SWER | | | 0.72 | |
| | 400/230 V | | | 511.14 | **LV Distribut** |
| | | | | | 511.14 |
| **Underground** | 50 kV | | | 1.34 | **Subtransmi** |
| | 33 kV | | | 0.07 | 1.41 |
| | 11 kV | | | 136.17 | **Distributior** |
| | 6.6 kV | | | 0.12 | 136.29 |
| | 400/230 V | | | 266.17 | **LV Distribut** |
| | | | | | 266.17 |
| **Streetlighting** | 400/230 V | Overhead | | 13.20 | **Streetlighti** |
| | 400/230 V | Underground | | 8.50 | 21.70 |
| **Circuit Kilometres of Private Lines & Cables (km)** | | | | | |
| **Overhead** | 11 kV | | | 371.1 | **Distributior** |
| | 11 kV - SWER | | | 2.14 | 373.24 |
| | 400/230 V | | | 306.95 | **LV Distribut** |
| | | | | | 306.95 |
| **Underground** | 11 kV | | | 20.79 | **Distributior** |
| | | | | | 20.79 |
| | 400/230 V | | | 52.54 | **LV Distribut** |
| | | | | | 52.54 |
| **Streetlighting** | 400/230 V | | | 69.40 | **Streetlighti** |
| | | | | | 69.40 |
| **Area of Supply (km²)** | Gisborne | | | 8,346 | |
| | Wairoa | | | 3,606 | |
| | Total | | | 11,952 | |
| | | | | | **Capacity (MVA)** |
| **Number of Substations** | 110/50 kV Subtransmission Substations | | | 1 | 120 |
| | 110/11 kV Subtransmission Substations | | | 2 | 23 |
| | 50/11 kV Zone Substations | | | 15 | 152.26 |
| | 33/11 kV Zone Substations | | | 2 | 3.00 |
| | | | **Total** | | 298.26 |
| | Waihi-Kiwi 50/11 kV & 11/50 kV Substations | | | 2 | 12.60 |
| | Wairoa 11/33 kV Step-Up Substations | | | 1 | 12.50 |
| | 50 kV Switching Stations | | | 2 | |
| | Voltage Regulators | | | 11 | 9.10 |
| | 11 kV/400 V Distribution Substations | | | 3721 | 262.98 |
| **Maximum Demand (MW)** | Gisborne - 22 August 2017 @ 18:30 | | | | 49.77 |
| | Wairoa - 1 August 2017 @ 18:30 | | | | 9.98 |
| | Combined - 13 July 2017 @ 18:00 | | | | 58.65 |

## 2.2 Eastland Network Limited's network configuration

To supply Eastland Network Limited's consumers Eastland Network Limited owns and operates an electricity network which includes Transmission assets (110kV), Subtransmission assets (50kV & 33kV), Distribution assets (11kV) and Reticulation assets (400V.230V).

Prior to 1999 the electricity network consisted of lines and cables in the Gisborne and East coast regions as Poverty Bay Electric Power Board, Eastland Energy Limited and Eastland Network Limited. Eastland Network Limited acquired the electricity network and generation business of Wairoa Power Ltd in 1999 which covered the Wairoa and Tuai regions. Prior to this Wairoa Power had sold its retail business to Trust Power and Eastland Energy had sold its retail business to Contact Energy Ltd. In April 2015 Eastland Network Limited acquired the Transmission assets from Transpower, linking the Gisborne, East Coast, Tuai and Wairoa regions.

### 2.2.1 Bulk Supply and Embedded Generation

#### 2.2.1.1 Tuai GXP

The Tuai Grid Exit Point is located near Lake Waikaremoana and provides the connection of Eastland Network Limited's electricity network to the North Island Transmission Gird owned and operated by Transpower. The Tuai GXP also provides for connection of Genesis Generation Assets in the area. Eastland Network Limited is supplied from this GXP via 4 x 110kV circuits. Two circuits supply Eastland Network Limited's 110kV lines to Wairoa and two circuits supply Eastland Network Limited's 110kV Lines to Gisborne. Supply to the Tuai area Transformer historically a 5$^{th}$ 110kV connection was reconfigured to be supplied from either of the Wairoa circuits in 2019.

#### 2.2.1.2 Embedded generation

Generation connected to Eastland Network Limited's electricity network provides additional sources of energy to the Region. In accordance with the Electricity Industry Participation Code 2010 Part 6 (Connection of Distributed Generation), Eastland Network Limited has entered into contractual agreements with Generators where there are benefits provided by the distributed generation. Agreements have been entered into with both Clearwater Hydro Limited and Eastland Generation Limited.

Clearwater Hydro Limited and Eastland Generation Limited also have contractual agreements directly with energy retailers regarding the sale of units from the generation;

Benefits to Eastland Network Limited derived from operating the generators include:

- Provision of alternative transmission to meet the requirements of grid emergency procedures
- Providing localised continuity of supply during outages due to sub-transmission and Distribution faults or as required facilitating network maintenance.
- Reduction of Eastland Network Limited's max demand at GXP's and contribution to the Regional Coincident Peak Demand by anything up to 10MW.
- Easing of constraints on transmission connections to and within Eastland Network Limited's network, thereby avoiding and/or deferring transmission and distribution asset upgrading investment.

#### Hydro Generation

Embedded in the Wairoa network Eastland Network Limited utilises the 5.0MW Waihi Hydro scheme which is owned by Eastland Generation Limited.

Waihi Hydro's has two 2.5MVA 6.6kV Generators connected to Eastland Network Limited's Waihi Substation via a 6.3MVA 6.6/50kV transformer. The Waihi Hydro scheme has enabled Eastland Network Limited to defer investment in 11kV/33KV assets in the Wairoa and Kiwi Substation area.

Contractual agreements covering the benefits provided to the Wairoa network through Eastland Generation Limited's 5MW Waihi Hydro scheme are in place.

Embedded in the Gisborne Network a 2x1MW induction Hydro generation facility was installed in 2009. This facility owned and operated by Clearwater Hydro Ltd depends on adequate river flows over a weir and is located in the Matawai area. This facility has increased the load on the Puha substation and increased the load on the Matawai feeder to 90 % of its rating during periods of the schemes maximum output.

A 100kVA induction hydro generator was completed in early 2018. The generator is located at the end of the Mata Road feeder, Tokomaru Bay. While operation of the generator has been proven it has not yet been put into operation.

Eastland Network Limited in accordance with the Electricity Industry Participation Code 2010 Part 6 (Connection of Distributed Generation) on an annual basis makes payments to Clearwater Hydro for Matawai Hydro's contribution to the avoided cost of transmission, (max demand peak reduction) on Eastland Network Limited's Network.

Currently no benefits to the network in the local area from the Matawai Hydro have been identified.

### Diesel Generation

Eastland Network Limited utilises six 1MW diesel generators throughout the Gisborne and Wairoa Regions, which are owned by Eastland Generation Limited. The units are housed in shipping containers and weigh about 23 tons each. These can be deployed anywhere in the network that is accessible to a large mobile crane and where up to 1MW can be injected at 11kV.

The 1MW generators are located and connected to the network at Mahia, Waihua-Raupunga, JNL Substation, Puha Substation, Ruatoria Substation, Te Araroa Substation and Tolaga Bay Substation on a semi-permanent basis.

A 200kVA mains parallel Generator was installed at Waihi Substation in 2019. This generator covers backup supply services at the power station and is capable of supporting the 11kV network in Wairoa's Cricklewood/Ruapapa area.

### Backup Generation

Generation is in common use throughout the region. Privately owned and operated units are used on a standby basis (i.e. during power outages). The units are not connected to the network.

While there is no mandate or systems in place to obtain information on generation of this type the known sites include:

| | |
|---|---|
| Gisborne waterworks | -1MVA,200kVA |
| Gisborne Sewage outlet | -200kVA,30kVA |
| Sewage Treatment Gisborne | -1MVA |
| Emerald Hotel | -300kW |
| Gisborne Hospital | -500kVA Est |

| | |
|---|---|
| Gisborne Airport | -5kVA |
| Gisnet ISP | 100kVA |
| Gisborne Exchange | -200kVA Est |
| Eastland Group | -14KVA |
| Pak-n –save Gisborne | -1000KVA |
| Eastland Port | -50kVA |
| Eastland Network various sites | -130kVA |
| Local Radio Stations various | 300kVA |
| Eastland Network truck mounted | 350kVA |
| Electrinet | -85kVA |
| Wairoa Pump station | -200kVA |
| Tolaga Bay Holiday Park | 65kVA |
| Lotton Point Motel | 30kVA |
| Mahia Rocket Labs | 500kVA Est |

There has been an increasing recognition in the community for the need to have independent backup generation to support essential services in significant/rare events.

In addition an estimated 15% of rural connections have access to petrol generators, 1 to 3 kW, for use during power outages.

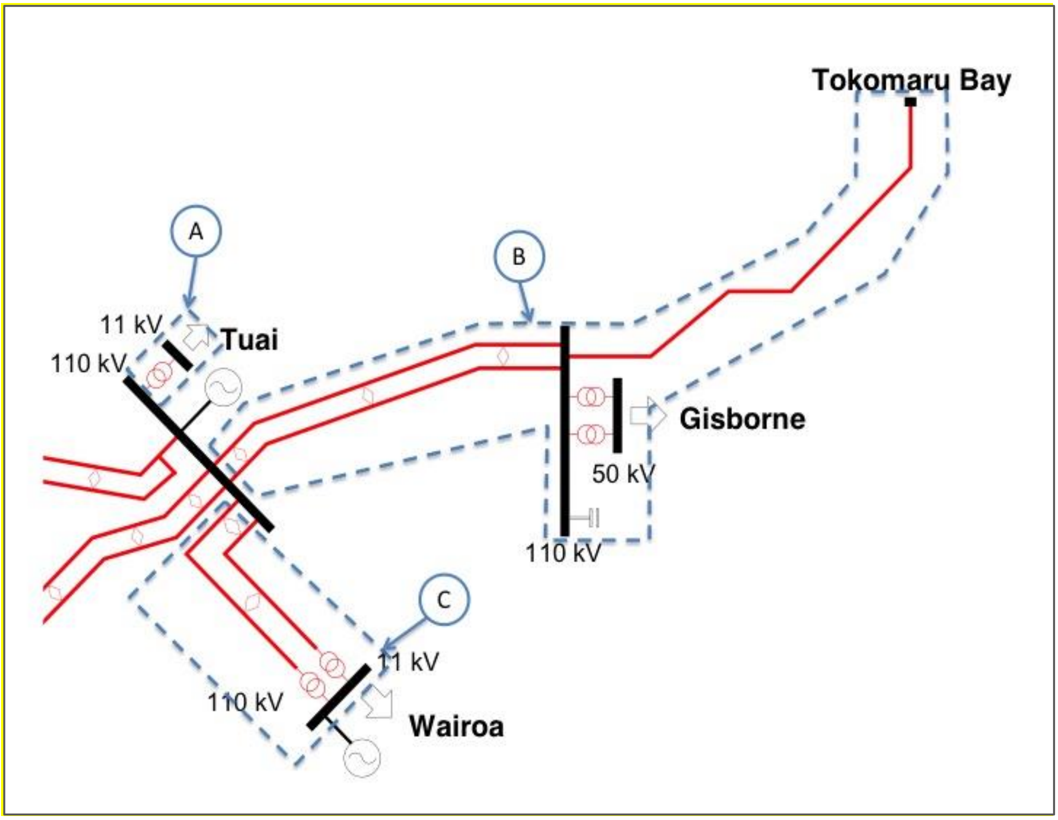
### 2.2.2 Transmission and Sub-transmission Assets

The diagram below illustrates the Eastland transmission Assets, which include:

a. The Tuai  Subtransmission substation supply:

b. The 110kV supply to Gisborne and Tokomaru Bay:

c. The 110kV supply to Wairoa:




The assets were acquired (as at 31 March 2015)

The following table summarises the lengths of the various classes of Transmission and Subtransmission lines

| Class | Voltage | Total Length (m) | Length Gisborne (m) | Length Wairoa (m) |
|---|---|---|---|---|
| OH EHV 110kV | 110 KV | 328300 | 254900 | 73400 |
| OH EHV 50kV & 33kV | 50 kV | 300466.3139 | 268106.11 | 32360.2 |
| UG EHV 50kV & 33kV | 50 kV | 1344.625 | 1344.625 | 0 |
| OH EHV 50kV & 33kV | 33 kV | 34322.6 | 0 | 34322.6 |
| UG EHV 50kV & 33kV | 33 kV | 65.236 | 0 | 65.236 |

In addition to the lines, Pole and Towers, Eastland Network Limited manages a variety of assets associated with access to the Lines. These assets include land/easements/agreements, Gates, Bridges, Tracks, Retaining Walls and Shelterbelt structures.

#### 2.2.2.1 Gisborne Region transmission

The Tuai Gisborne transmission Line consists of a double circuit 110kV tower line from Transpower's Tuai substation near Lake Waikaremoana. The route length of the Tuai/Gisborne 110KV lines is approximately 91.4km. It consists of 209 steel lattice tower structures, 105 Pi Pole structures. The line was commissioned, in 1957.

The Gisborne to Tokomaru transmission line consists of a single circuit 110kV tower line. The route length of the line is 71.5km. It consists of 205 steel lattice tower structures and 2 pi pole structures.

The two 110kV circuits are supplied by a ring-bus at Tuai that is coupled by a 110kV breaker. Bus zone protection was installed in 2010 reducing the risk of a bus fault at Tuai tripping both 110kV lines to Gisborne substation.

The double-circuit 110kV configuration in part installed on single structures while providing (n-1) electrical security does not give true (n-1) security. i.e. Failure of a single tower will interrupt supply via both circuits.

Trending of historical loss of supply events for the region prompted investigation of interphase spacers in 2017 interphase spacers were installed on one 110 kV circuit to prevent conductor clash when snow falls from the conductors.

The 110kV circuits into Gisborne substation are currently summer/winter rated at 49MW/60MW. The Gisborne worst-case forecast for peak load is expected to exceed the circuit's n-1 capacity around 2029. Local generation and load control/demand management during peak demand periods provide the means to maintain max demand within the circuit or transformer ratings. Ultimately load increases will require the consideration of the following options:

Additional capacitor bank(s) on the 50kV network to improve power factor.

Thermal upgrading or reconducting of the circuits.

The installation of a third Tuai/Gisborne line should be not be required as Eastland's' ability to load manage and upgrade should be sufficient unless there is unforeseen growth in demand or a change of n-1 security risk assessment by the network.

To meet max demand exceeding 60MW, will ultimately require the installation of a third Tuai/Gisborne line. It is noted that Transpower's efforts to obtain a line easement prior to 2000 for a third line were not completed and easement options have now lapsed.

Detailed condition assessment of the existing lines indicate the line is in generally good condition with a number of isolated assets and components at replacement criteria. Although the Tuai-Gisborne circuits are in excess of 60 years old, the basic structures and conductors are in good condition. Condition assessment reports have highlighted end of life in distinct groups. This is mainly related to foundation works (grillage) for wooden pole structures and insulators along with associated attachments. Renewal Programs are in place to manage these end of life asset components.

Options for development are in section 4.7 of this plan.

#### 2.2.2.2 Wairoa region transmission

The Wairoa transmission line consists of a double circuit 110kV tower line from Transpower's Tuai substation near Lake Waikaremoana. The route length is 36.7Km with 58 tower structures commissioned in 1976 and 16 concrete poles commissioned in 2001.

The two 110kV circuits are supplied by a ring-bus at Tuai that is coupled by a 110kV breaker. Bus zone protection was installed in 2010 reducing the risk of a bus fault at Tuai tripping both 110kV lines to Wairoa substation.

The double-circuit 110kV configuration in part installed on single structures while providing (n-1) electrical security does not give true (n-1) security. i.e. Failure of a single tower will interrupt supply via both circuits.

Detailed condition assessment of these Lines was completed in 2016 and the line is in excellent condition

Trending of historical and recent Loss of supply events for the region have indicated there are no issues that need to be considered in the planning period. There are no options for development within the planning period of this plan.

#### 2.2.2.3 Gisborne Region sub-transmission

The Gisborne Region sub-transmission network comprises the following asset configurations:

A 50kV spur from Massey Rd up the east coast that was originally constructed by the NZED as far as Tokomaru Bay (1955) then to Ruatoria (1964) and finally to Te Araroa (1971). Ownership of the Massey Rd – Tokomaru section of this line was transferred to the PBEPB in 1980 when the NZED completed its own 110kV tower line.

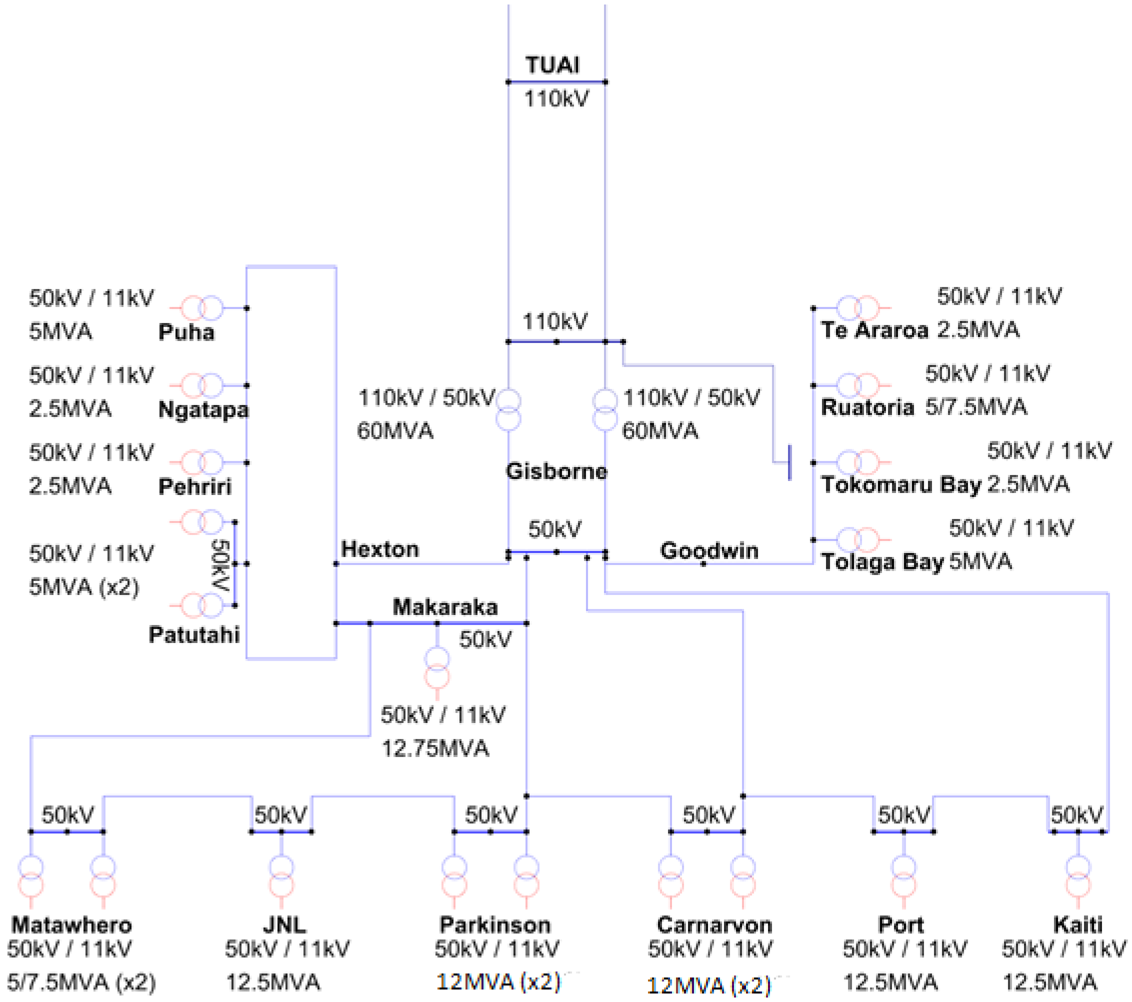
A switching station at Goodwin Rd was installed to prevent faults on the Massey Rd - Tokomaru 50kV line from causing tripping of the 50kV circuit to Kaiti and the Port. This consists of a SCADA-controlled circuit breaker with an associated isolator/earth switch and fence enclosure. It was constructed in 2002.

Two 50kV lines from Massey Rd to Makaraka.

A single open 50kV ring to the west of Gisborne supplied from half way along one of the Makaraka lines at the Hexton switching station to supply 50/11kV substations at Puha, Ngatapa, Pehiri, Patutahi and back to Makaraka. Between Puha and Ngatapa there is a 50kV spur supplying Matawai which operates at 11kV. The Hexton switching station was installed as part of the project to construct the second 50kV line into Makaraka from the Massey Rd – Puha circuit in 2001 to prevent faults in the Puha–Ngatapa-Pehiri-Patutahi segment of the 50kV ring from affecting supply to Makaraka, Matawhero and Parkinson St.

Two 50kV urban rings, one supplying 50/11kV substations at Kaiti, Carnarvon St and the Port from Massey Rd, and the other supplying Matawhero, JNL and Parkinson  from Makaraka. These rings can be connected between Carnarvon and Parkinson which occurs regularly to enable maintenance of Transpower assets on the 50kV structures at Massey Rd without loss of supply.

The figure below the Gisborne sub-transmission network:.



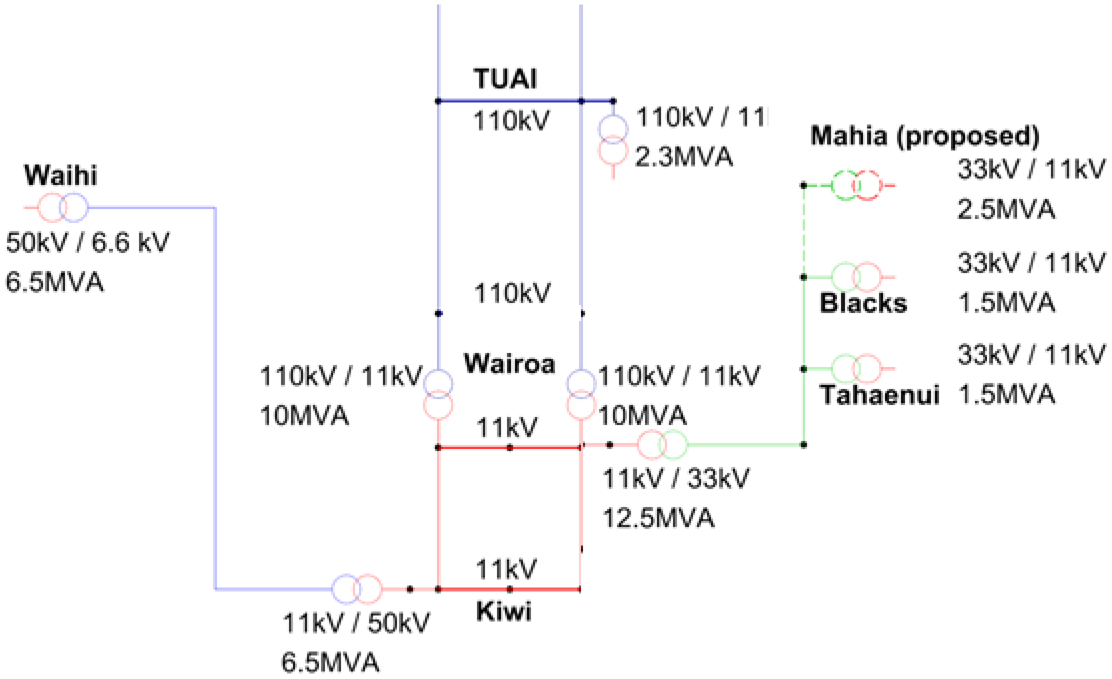

### 2.2.2.4 Wairoa Region sub-transmission

The Wairoa sub-transmission network comprises two main components:

A 33kV line stretching 35km from an 11/33kV step-up substation at Wairoa Substation to Blacks' Pad substation at the north end of the Mahia peninsula. Prior to 2000 this line was operated at 50kV despite parts of the line being only insulated to 33kV.

A 50kV line from Waihi hydro to Eastland Network Limited's Kiwi substation which includes some under-built 11kV in places. The 50kV line was originally built from Tuai to Wairoa as the original supply for Wairoa Substation and still utilises the original insulators which have begun to fail.

The figure below depicts the Wairoa sub-transmission network:




### 2.2.3 Major substations

#### 2.2.3.1 Gisborne Region Substations

Eastland Network Limited's Gisborne region substations are summarised in the following table and described more fully by the following narratives.

| Sub. | Area supplied | Description |
|---|---|---|
| Gisborne Substation | Transmission Substation Supplying 50kV Subtransmission Lines to the Region | Substantial two Transformer Transmission Substation |
| Carnarvon St Substation | CBD and central Gisborne. | Substantial two transformer urban sub. |
| Kaiti Substation | Residential Kaiti area, some load being shifted to Port. | Substantial single transformer urban sub with provision for second transformer. |
| Port Substation | Port area of Gisborne including taking residential load from Kaiti and CBD load from Carnarvon. | Substantial single transformer urban sub. |
| Parkinson Substation | Industrial estate in south-west Gisborne. | Substantial two transformer urban sub. |
| JNL Substation | Primarily supplies a single large consumer, likely to supply additional similar customers in the medium-term. | Single transformer industrial sub with provision for a second transformer. |
| Matawhero Substation | A number of large produce processing consumers about 8km west of Gisborne. | Substantial two transformer industrial sub. |
| Makaraka Substation | Semi-rural Makaraka area immediately west of Gisborne. | Substantial rural single transformer sub, also provides significant switching point for the 50kV ring and also for ripple injection. |

| | | |
|---|---|---|
| Patutahi Substation | Semi-rural area around Patutahi about 18km west of Gisborne. | Minimalist rural sub with two banks of three 1-phase transformers. |
| Pehiri Substation | Rural area around Pehiri about 30km west of Gisborne. | Single transformer rural sub. |
| Ngatapa Substation | Rural Ngatapa area and surrounding district about 30km west of Gisborne. | Minimalist single transformer rural sub. |
| Puha Substation | Mountainous rural area around Te Karaka, Whatatutu and Matawai about 40km north-west of Gisborne. | Three 1-phase transformer substantial rural sub supported by 1MW of diesel generation. |
| Te Araroa Substation | Small settlement of Te Araroa and surrounding district about 115km north of Gisborne. | Substantial single transformer rural sub supported by 1MWe of diesel generation. |
| Ruatoria Substation | Small settlement of Ruatoria and surrounding district about 90km north of Gisborne. | Substantial single transformer rural sub supported by 1MW of diesel generation. |
| Tokomaru Substation | Small settlement of Tokomaru By and surrounding district about 60km north of Gisborne. | Substantial single transformer rural sub. |
| Tolaga Substation | Small settlement of Tolaga Bay and surrounding district about 35km north of Gisborne. | Substantial three 1-phase transformer rural sub supported by 1MW of diesel generation. |

Gisborne Substation

The Gisborne substation is supplied by two 110kV Circuits from Transpower's Tuai GXP. The Substation is located in Massey Rd on the northern outskirts of Gisborne.

The substation previously owned and maintained by Transpower was acquired by Eastland Network Limited in March 2015

The buildings on the site are made up of Offices a relay room Eastland Networks Backup Control centre and a Crane house that is currently used for operational purposes along with spare equipment storage.

The substation has two 60MVA 110/50kV transformers (designated T1 and T2) which supply a 50kV bus via two 50kV incomers. The 60MVA units, installed in March 2007, replaced two 30 MVA transformers, overcoming a net maximum demand constraint.

One 110kV 10Mvar Capacitor Bank used to support voltage and correct power factor utilized when one line is out of service and during periods of peak load.

Gisborne substation also has a 110kV Circuit connected that runs to Tokomaru Bay Substation where it is disconnected but the Line is Utilized has additional Voltage support as it is Equivalent to a 2.5Mvar Capacitor.
The substation supplies four 50kV Subtransmission feeders, two on each side of the bus. Installation of Neutral Earthing resistors and on-load tap-changers and a 50kV bus upgrade were also components of the transformer upgrade.
The transformers are fitted with neutral earthing resistors to reduce fault levels on the Subtransmission network for compliance with step-touch/Earth potential rise regulations.
A spare 100/50kV 30MVA Transformer Bank, 110kV Circuit Breaker and 50kV Circuit Breakers are also located in the substation which could be utilised if necessary as a contingency.
Following acquisition it was identified that the 110kV Circuit Breaker SF6 insulation gas had a history of Loss due to corrosion of the CB Heads. The loss of Gas was at such a stage that 3 of the 6 Circuit Breakers needed urgent refurbishment works and were replaced and refurbished in 2016.
A spare replacement 110kV CB is held on site for the purpose of needing any future replacement CB's that will be identified by ongoing inspections.

Issues at this site::
.-The 110kV Bus and associated Gantry has components that meet replacement criteria and end of Life replacement and upgrade work will be required in the planning period.
-An option to expand the 50kV Bus increasing the number of feeders giving potential to reduce impact on key performance measures by reducing the number of affected customers in Subtransmission fault events has been identified.
50kV lines leaving the substation run across properties previously owned by Transpower that have been sold. Relocation of these lines to the access road has been identified as an improvement for access and risk.
Installation of a 50kV 10Mvar Capacitor Bank to help meet the forecast Load growth demand which will resolve the overloading issue within the forecast period beyond that Eastland Network Limited will need to consider thermal upgrading or reconducting of the Circuits.
Trending of Historical and Recent Events for the substation have indicated there are issues with the Loss of SF6 gas Loss and operational Failure of some of the disconnectors that need on going consideration during this reporting period.
110kV Disconnector and Earth switches have failed additional Maintenance has kept them operational but some of the switches will require replacement.

Options for development covering these issues are in section 4.7 of this plan

### Carnarvon St Substation



Carnarvon Comprises:
One 50kV line from Gisborne Substation in Massey Rd.
A second teed 50kV line from the Port Substation that can also connect to Parkinson Street Substation.

The 50kV bus at Carnarvon includes a 50kV circuit breaker allowing operation as a closed ring. There are two 3-phase 50/11kV 12.5MVA transformers, each 50% loaded.
The 11kV Reyrolle switch-board comprising 2 incomers, a bus tie and 9 feeders was upgraded to Vacuum CB trucks with SEL protection relays and improved operator safety features in 2014
The transformers were replaced in 2018 to enable refurbishment work and relocation of the old units. The new transformers maximise the Health index of this key site for the Gisborne CBD.

Issues at this site
Two pitch filled cable boxes remain on the switch board. At some point the cables will be re-terminated dependent on discharge analysis results.
The main roof beam has been identified as a vulnerability. Additional steel support bracing of this beam could potentially reduce earthquake failure risk.

### Kaiti Substation

The Kaiti area was originally supplied at 11kV directly from Massey Rd, but by the mid-1980's this load could no longer be adequately supplied at 11kV so in 1987 the PBEPB built a new substation.

Kaiti comprises:
An incoming 50kV line from Massey Rd.
An outgoing 50kV line to the Port.
A minimum oil 50kV circuit breaker providing incoming protection for the transformer and a 50kV bus breaker for closed ring operation.
A single 12.5MVA 50/11kV transformer (with provision for a second transformer).
An 11kV MerlinGerin switch-board with 2 incomers, a bus tie, a fuse switch and 7 feeders.
The Original feeder protection Relays were replaced with SEL351 relays in 2013 including the transformer protection and tap changer control unit.
The close proximity to houses means that transformer noise and vibration was a past issue. This issue was eliminated in 2018 when the original transformer was replaced.

Issues at this site:
-The 11kV Switchboard has issues with the reliability of trip and close solenoid operation. In spite of frequent maintenance, infrequent operation of the equipment results in failure of the solenoids to operate. A design modification is being considered or alternatively replacement of the switch-board may be required. The Switch gear is no longer supported and the model has been superseded by the manufacturer.
-Vandalism issues resulting in insulator damage and an accumulation of debris at the site may drive the need to improve perimeter fencing of the site.
-The transformer currently supplies load via incomer #2. The #1 incomer CB has been used to replace a failed CB If a second transformer is ever installed at the site a new switchboard would be required.

## Port Substation


Originally the Port of Gisborne was supplied via 11kV from Gisborne substation on the opposite side of the city. The Port substation was completed in December 2003 to supply the port load freeing up the cables across the city to provide for load growth at Kaiti and Carnarvon. This substation also provides the security provision for the Kaiti area.

Port comprises:
An incoming 50kV line from Kaiti.
A second 50kV line from Carnarvon.
A 50kV bus breaker to allow operation as a closed ring.
A 12.5MVA 50/11kV transformer.
An 11kV Reyrolle board with an incomer, a fuse switch and 4 feeders.

Issues at this site
None.

## Parkinson Substation


The industrial load in and around Parkinson St was originally supplied at 11kV from Gisborne Substation (similar to the domestic load in Kaiti) which was no longer adequate by the mid-1980's. In 1987 the PBEPB built a Zone substation in Parkinson St in an identical configuration to Kaiti. In 2004 a second transformer was added at Parkinson St.
Parkinson takes supply from a tee off the Makaraka – Carnarvon 50kV line and is also connected to the new JNL substation via a 50kV line.

Parkinson comprises:

Two 12.5MVA 50/11kV transformers. The first was installed in 1987 and the second is the former Carnarvon T1 that was refurbished and installed in 2004.
A 50kV bus breaker to allow operation as a closed ring.
An 11kV MerlinGerin switch-board with 2 incomers, a bus tie, a fuse switch and 7 feeders. The Original protection Relays were replaced with SEL351 relays in 2013. The transformer protection and tap changer control unit was also upgraded at this time
An SF6 RMU connected to one of the feeders to provide for the local service supply transformer.

Issues at this site:
-The 11kV Switchboard has issues with the reliability of trip and close solenoid operation. In spite of frequent maintenance, infrequent operation of the equipment results in failure of the solenoids to operate. A design modification is being considered or alternatively replacement of the switch-board may be required. The Switch gear is no longer supported and the model has been superseded by the manufacturer.

### JNL Substation


The JNL substation was constructed in 2005. Two 50kV supply options are available to the substation via lines from the Matawhero or Parkinson Substations. The 11kV switchboard primarily supplies load to JNL. The completion of this substation provided surplus capacity at Matawhero to be used to supply industrial load increases, (i.e. wood processing plants).

JNL comprises:
A 50kV Line from Matawhero Substation
A 50kV line from Parkinson St substation, completed in 2006/07
A 50kV bus CB to allow closed 50kV ring operation
1 3-phase 12.5MVA transformer bank with room for a second transformer
A Portacom switch room housing an 11kV Reyrolle switchboard with 1 incomer, 2 feeders, a fuse switch for local service and a bus coupler for future extension or generator connection.

Issues at this site:
None

## Matawhero Substation


Matawhero was built in 2000 as a single transformer substation primarily to supply JNL because the existing 11kV cables from Parkinson had become inadequate. In 2003 Eastland Network Limited augmented Matawhero with a second transformer, a second 50kV breaker and two additional 11kV feeders to supply the growing industrial load in this area.

Matawhero comprises:
An incoming 50kV line from Makaraka.
An outgoing 50kV line to the new JNL substation.
A 50kV bus circuit breaker to allow 50kV operation as a closed ring.
Two 5/7.5MVA 50/11kV transformers.
A Portacom switch room with an 11kV board comprising two incomers, a bus coupler, five feeders and a fuse switch. The bus rating at 11kV is 800A
A key vulnerability at Matawhero is the proximity of a major river. It is noted that failure of the river stop bank will flood the industry in the area as well as the substation. To minimise damage the Switch room is mounted 1 meter above ground level and 11kV support options not requiring the switch room exist.

Issues at this site
There is a reliability issue associated with close operations of the 11kV CB's on the T2 section of the Switchboard Spares availability is limited. This issue may trigger earlier replacement of the 11kV CB's however relocation of the CB control units to the top of the switchgear has solved the issue at this stage.
This substation is located in an area that is likely to have large industrial load growth requiring capacity upgrades of the 7.5MVA transformers to 12MVA with a corresponding upgrade of the 11kV switchboard to 1250A.
Refer development plans.

## Makaraka Substation


Makaraka was originally constructed in 1974 as a switching point for the Gisborne - Patutahi 50kV line which also teed off to Carnarvon. A second incoming 50kV line from Gisborne Substation, which has been tapped off the Gisborne - Puha line, was built in 2001. At this time Makaraka was upgraded from a switching station to a single transformer zone substation by the installation of a new 12.75MVA transformer.

Makaraka comprises:

Two incoming 50kV lines from Gisborne Substation (one via Hexton).

A 12.5MVA 50/11kV transformer capable of running off either side of a split 50kV bus.

A Portacom switch room with an 11kV Reyrolle switch-board comprising an incomer, 4 feeders and a fuse switch.

A 50kV load control injection coupling cell (outdoor).

A hut containing a load control static converter.

Three outgoing 50kV circuits to Patutahi, Matawhero and Parkinson.

A key vulnerability associated with the substation is the 2x 50-kV normal incoming circuits share the same structures with 2x 11kV feeder circuits from the substation (approx 10 spans). Future growth designs in the Makaraka area include contingency provision for a structure failure on this section of line.

Issues at this site:
The static converter is the only unit used for streetlight control and load control in the Gisborne area there is no redundancy.

Patutahi Substation
Patutahi was built in 1929 by the State Hydro Electric Department as the main bulk supply point to the Gisborne area. The following upgrades have taken place over the years:.
The original transformers were replaced with other ex-NZED transformers dating from the 1940's.
The original brick building was considered an earthquake risk and was replaced in 1991.
The original 11kV board was replaced in 2000 with second-hand Reyrolle LMT panels and new VCB's.
The 50kV air operated breakers were replaced in 2006.

Patutahi comprises:
An incoming 50kV line from Gisborne Substation via Makaraka.
An incoming 50kV line from Gisborne Substation via Makaraka, Hexton, Puha, Ngatapa and Pehiri.
A 50kV line breaker for isolating faults from Pehiri.
Two banks of 50/11kV 1.67MVA 1-phase transformers. There are also two spares, one of which has failed in service and is considered uneconomic to repair.
A single 11kV incomer, four feeders and one fuse switch.
An outdoor structure consisting of mostly steel lattice and concrete poles with copper wire bus bar.

Issues at this site"
The key issues is that the original design standards for earthing, construction, drainage and oil containment have been overtaken by modern standards. These will be addressed as part of a planned conversion of Patutahi to a single transformer substation that will be secured by off-loading capacity to Matawhero and Makaraka.

## Pehiri Substation

The PBEPB built Pehiri in 1964 along with Ngatapa as part of the 50kV ring extension from Puha to Patutahi.
Eastland Network Limited upgraded Pehiri in 1998 to include a 2.5MVA transformer with an on-load tap changer.
If this transformer needs to be removed from service Eastland Network Limited can supply most of Pehiri's load via the 11kV from Patutahi and using an old 11kV regulator at Pehiri to boost the voltage.
Previous issues were corrected in 2011 by installation of a new 50KV CB to protect the Transformer and removal of the old 50kv line CB

Pehiri comprises:
An incoming and an outgoing 50kV line which forms part of the 50kV ring from Makaraka to Hexton.

A 2.5MVA 50/11kV transformer.
An 11kV voltage regulator.
An 11kV incomer and four 11kV feeders on an outdoor bus.

Issues at this site:
The outdoor pole mounted PMR Reclosers are prone to failure 2 of the 5 units were replaced between 2017 and 2018. The condition and vulnerabilities associated with the outdoor bus are driving the need to upgrade to an indoor 11kV switch room.

### Ngatapa Substation

The PBEPB built Ngatapa in 1964 as part of closing the 50kV ring between Puha and Patutahi. In 2008 the two 500kVA transformers and outdoor 11kV bus were replaced eliminating previous issues associated with the site.

Ngatapa comprises:
An incoming and an outgoing 50kV line forming the 50kV ring from Makaraka to Hexton (which also supplies the Patutahi, Pehiri and Puha Substations).
One 2500kVA 50/11kV transformer. An 11kV regulator is used to regulate voltage for the backup supply via Patutahi.
A Portacom switch room with an 11kV Reyrolle switch-board comprising one incomer, three feeders and a fuse switch.
Ngatapa substation has also been identified as an alternative supply to Matawai and some support to Puha. To achieve this an 11kV line would need to be upgraded along Hihiroroa Rd then extended under the 50kV line to the top of Otoko Hill with dog conductor.

*Issues at this site*
None.

### Puha Substation

The PBEPB built Puha in 1960 to supply the Te Karaka, Whatatutu and Matawai areas to the north-west of Gisborne. Originally Puha was supplied by a single 50kV line from Gisborne Substation, but in 1963 Puha was

given a second supply when the 50kV ring was closed. Since the original construction the following upgrades have been carried out:
Earthing and transformer bunding upgrades.
Replacement of the outdoor 11kV bus and breakers with an ABB Safeplus SF6 indoor board.
Installation of a new 50kV Merlin Gerin SF6 breaker on T1.

Puha comprises:
An incoming and an outgoing 50kV line forming the 50kV ring from Makaraka to Hexton.
Three 1.67MVA 50/11kV 1-phase transformers.
An 11kV board comprising a single incomer, a fuse switch and four feeders.
One of Eastland Network Limited's 1MW diesel generators to augment the limited transformer capacity for which an RMU is being installed.

*Issues at this site*
Max demand cannot be fully off-loaded to other substations via the 11kV. In addition to operating one of Eastland Network Limited's 1MW diesels at Puha, this is also being addressed by providing for Matawai to be supported via an upgrade at Ngatapa, extending the Ngatapa feeder to Otoko Hill and possibly reinforcing the Lavenham feeder from Patutahi.
Increased loading from an embedded Induction generator at Matawai.
There is no oil separator facility for the bunded area. Work on this has been deferred to coincide with replacement of the transformer bank.

### Te Araroa Substation

The PBEPB built Te Araroa in 1971 to supply the wider Te Araroa area including Hicks Bay, Horoera and Awatere Valley. Recent upgrades include:
In 1998 Eastland Network Limited replaced the original 11kV switchgear with second hand Reyrolle LMT panels and new VCB's and also installed a 2.5MVA transformer with an on-load tap changer with bunding and oil containment facilities.
In 2001 a MetroVick 50kV bulk oil breaker was installed on the transformer to remove the earth throw switch originally used for transformer protection.
The voltage regulator that was used for security was also removed after it failed in service. Security is provided by the 1MW generator on site.
In 2011 the MetroVick 50kV bulk oil breaker was replaced.
In 2018 the end of life Multilin Protection was replaced with SEL relays

Te Araroa comprises:
A single incoming 50kV line from Ruatoria.
A single 2.5MVA 50/11kV transformer.
An 11kV board comprising a single incomer, a fuse switch, three feeders and a generator connection point.
A 1MW diesel generator.

*Issues at this site*
None .

### Ruatoria Substation


The PBEPB built Ruatoria in 1965 to supply the wider Ruatoria area including Whareponga, Kopuaroa and Whakawhitira.:
In 1998 Eastland Network Limited installed two refurbished MetroVick 50kV bulk oil breakers, a new 50kV bus and four new $SF_6$ pole-mounted 11kV breakers. In 2011 and 2012 The MetroVick 50kV bulk oil breakers were replaced with SF6 ABB Circuit Breakers
In 1999 a new 5/7.5MVA 50/11kV transformer was installed with upgraded bunding, and earthing.
In 2001 the four pole-mounted 11kV breakers were replaced with an indoor Safeplus SF6 board in a Portacom. This enabled removal of the outdoor 11kV structure and reduction of the yard size as well as improving the earthing and yard surface.

Ruatoria comprises:
An incoming 50kV line from Tokomaru Bay.
A 5MVA 50/11kV transformer.
An 11kV board comprising a single incomer, a fuse switch, three feeders and a generator connection point.
A 1MW diesel generator.

Issues at this site
None.

## Tokomaru Bay Substation

The PBEPB built Tokomaru in 1958 adjacent to the Transpower GXP to supply the surrounding area including Te Puia Springs and Mawhai Point. The Transpower GXP at Tokomaru Bay was supplied by a 110kV single-circuit tower line from Gisborne Substation.

Eastland Network Limited relinquished supply from this GXP in 2000 and instead supplied this area from its own 50kV sub-transmission network. Supply security is provided by diesel generators as required.

In March 2015 the Transpower Tokomaru Bay substation was acquired from Transpower. The site is immediately adjacent to Eastland Network Limited's Tokomaru Bay Subtransmission/Zone Substation

The 110kV line between Gisborne and Tokomaru Bay is currently left energised to provide capacitive voltage support for Gisborne Substation. It is disconnected at Tokomaru Bay by an open 110kV incoming isolator. The 110kV/ 50kV transformers from the site were removed in 2004 while the site was owned by Transpower.

Due to the proximity between the 110kV and 50kV Circuits at both Gisborne Substation and Tokomaru Bay Substation, It is feasible to disconnect the 110kV line and jumper the line to the 50kV network at each end as a contingency strategy. Alternatively the 30MVA single phase transformer bank, currently not in service at Gisborne, could be used at Tokomaru bay.

In 1998 a new 2.5MVA transformer was installed with an on-load tap changer including upgrades to bunding and earthing.

In 1999 the 11kV switchgear was replaced with a second hand Reyrolle LMT board with new VCB's. and Multilin protection.

In 2001 an oil separator was added.

In 2011 and 2012 Eastland Network Limited Replaced the MetroVickers 50kV bulk oil breakers with ABB SF6 Circuit Breakers.

In 2016 the transformer was swapped with a similar unit from Matawhero substation to enable rust repairs and repairs to the Tapchanger.

In 2018 the multilin protection relays were replaced with Sel relays

Tokomaru comprises:

A single incoming 50kV line from Tolaga Bay.

A single outgoing 50kV line to Ruatoria.

A single 2.5MVA 50/11kV transformer.

An 11kV board comprising a single incomer, a fuse switch and three feeders.

Issues at this site:

Two stay wires from the 50kV bus in the substation extend across a river through trees to a Depot yard. The stays are considered an unnecessary vulnerability.

### Tolaga Bay Substation

The PBEPB built Tolaga Bay in 1963 to supply the surrounding area including Hauiti and Wharekaka.
In 2000 Eastland Network Limited installed a MetroVick 50kV bulk oil breaker to provide transformer protection. The earthing for the remaining substation yard was upgraded as part of the project. This CB was replaced with An SF6 CB in 2013.
In 2001 Eastland Network Limited undertook a significant rationalisation that included erecting a switch-room and installing an indoor Safeplus $SF_6$ board, removing and scrapping the spare 50/11kV transformer, removing the outdated 11kV outdoor bus and halving the size of the yard.

Tolaga comprises:
A single incoming 50kV line from Goodwin Rd switching station.
A single outgoing 50kV line to Tokomaru.
A 5MVA 50/11kV bank comprising three 1.67MVA transformers and a spare.
An 11kV board comprising a single incomer, a fuse switch and four feeders.
A 1MW diesel generator.

Issues at this site:
There is currently no oil separation. Installation has been deferred to coincide with replacement of the transformers.

### 2.2.3.2 Wairoa Region Substations

Eastland Network Limited's Wairoa substations are summarised in the following table and described more fully by the following narratives:

| Sub. | Area supplied | Description |
|---|---|---|
| Blacks Pad | Opoutama, Kaiwaitau and the Mahia peninsula. | Minimalist single transformer rural sub supported by 1MWe of diesel generation over Christmas and Easter. |
| Kiwi | Urban Wairoa including AFFCO plant. | Substantial switching station supplied at 11kV from Transpower and houses the 50/11kV step-down transformer for the Waihi line. |
| Tahaenui | Semi-rural area around Nuhaka and Morere, also back-feeds to Blacks Pad. | Minimalist single transformer rural sub. |
| Waihi | Step-up substation at 5MW hydro station. | Minimalist single transformer sub. |
| Wairoa | Substantial Supply substation for the Region | Two Transformer Substation plus |

| | | |
|---|---|---|
| | Plus Step-up substation for supply to Mahia | single step up transformer. With ripple injection Plant |
| Tuai | Rural Area covering Waikaremoana and Ruakituri | Single Transpower without door 11kV CB's |

Blacks Pad Substation

Blacks Pad is located at the north end of the Mahia peninsula. Initially the substation included three 50/11kV single-phase transformers totaling 5MVA supplied by a 50kV line from Wairoa. In 2000 the 50kV line was formally converted to 33kV to improve reliability and the transformer replaced with a single 1.5MVA 3-phase transformer. Other equipment includes 33kV drop-out fuses and an 11kV pole-mounted circuit breaker. Bunding, fencing and earthing upgrade work was all completed in 2000 in conjunction with the transformer change. The transformer does not have on-load tap changer capability.

A key issue with Blacks Pad is that the Christmas and Easter load at Mahia often exceeds the 1.5MVA transformer rating which has been relieved by operating one of Eastland Network Limited's diesel generators at Mahia beach. Loading in general at Mahia is increasing in conjunction with beach front subdivision activity and as more holiday homes become permanent residences.

Development actions include the Mahia 33kV extension project which will address future Mahia load increases issues. In 2008 due to potentially permanent delays in easement negotiations the extension project was deferred. As a result no new load can be connected to the existing lines in the area. In addition as load disconnects reconnection is not permitted until the load can be supported by the network without the need for the generator.

## Kiwi Substation

Kiwi was built as part of the Waihi hydro station in 1983 and takes supply as follows:
Via a 6.3MVA 50/11kV transformer from Waihi.
Via three 11kV feeders from the Wairoa Substation.
The 11kV board includes three incomers, a bus tie and six out-going feeders.

Issues at this site:
The risk of minor flooding which happens occasionally and places supply to almost the Wairoa city at risk. Stop logs are installed at the doorways to the switch-room to reduce this risk.
Oil capture and separation facilities would be required for the 50/11kV transformer
A 50kV phase to phase fault thrower switch is installed as part of the protection for the Waihi 50kV line. This is considered an out dated design approach
The transformer and fault thrower could be removed as part of a long term 33kV development plan.

## Wairoa Substation

Supply to the Wairoa Substation is by a double-circuit 110kV line from Transpower's Tuai GXP near Lake Waikaremoana. Three of the 11kV feeders from this substation feed directly to Kiwi Substation approximately 3 km away.
The Wairoa substation previously owned and operated by Transpower was acquired by Eastland Network Limited in March 2015.
In 2018 the previously disconnected 11kV feeders from the substation were reinstated and the initial sections of 11kV line undergrounded to improve reliability by eliminating multiple circuits on the same structures.

Wairoa comprises:
-Two banks of 3 x 110/11kV 10MVA single phase transformers
-An 11kV Reyrolle switch board comprising two incomers, a bus tie and eight feeders.
-A 12.5MVA 11/33kV step-up Transformer that supplies the Mahia Peninsula.
-A 33kV outdoor CB for the step up transformer.

-A load control plant injecting at 11kV.

Issues at this site:
Transpower had identified that the 110/11kV transformers might be near end of life and had them scheduled for replacement in 2016/19. Subsequent detailed asset condition assessment undertaken by ENL has shown that this is not the case and accordingly replacement, (subject to continuing asset condition monitoring results), has been deferred.
There is potential for between 20MW and 40MW of gas-fired generation near Frasertown hence renewal of the transformers needs to consider this potential load.
The proximity of the 50kV line from Eastland Network Limited's Waihi power station to Eastland Network Limited's Kiwi substation lends itself to rationalising the whole supply to both Wairoa and Mahia.

## Tuai Substation

There is approximately 600kVA of load in and around Lake Waikaremoana and the Ruakituri area
The Assets comprising the Tuai Substation are contained within the Genesis/Transpower Tuai GXP Site These assets were acquired by in April 2015.
The 2 11kV KFE Outdoor Circuit Breakers were replaced with an indoor 11kV switch board in 2019
The 110kV/11kV 6MVA supply transformer comprising 4 x 2.25MVA single phase transformers was replaced by a new 3 phase unit in 2019. The transformer replacement to a new location on the site freed up a 110kV Bay that was needed by Transpower to reconfigure a tied 110kV Transmission Line to Hawkes Bay.

Tuai comprises:
A structure providing 110kV connection to either of the Wairoa 110kV transmission lines
A single 110kV Circuit Breaker
A single 5MVA 110/11kV transformer.
A Portacom control building
An 11kV Reyrolle switch board comprising a single incomer, and four feeders.
Local service supply is provided from Transpower

Issues at this site:
None

### Tahaenui Substation

Tahaenui was built in 2001 and is located between Wairoa and Blacks Pad and comprises incoming 33kV drop out fuses, a 1.5MVA 3-phase transformer with manual tap settings, a pole mounted 11kV circuit breaker and an 11kV RMU. Tahaenui is used primarily to supply Morere and also provide limited 11kV back-feeding capability to Blacks Pad.

Issues at this site
None

### Waihi Substation

This site comprises a 6.6kV to 50kV step-up transformer installed to enable connection of the Waihi Power Station Generators.
Waihi Power Station is a 5MW hydro power station located off the highway between Frasertown and Tuai.
Assets at the site that come within the scope of this AMP include the 6.3 MVA 6.6/50kV transformer and the 50kV line from Waihi to Kiwi. The transformer installation includes oil separation facilities.
Manual rest trip relays were replaced with remote reset devices in 2010.
Waihi is ideally located to provide an 11kV supply to the immediate area and could back feed into the far ends of the Raupunga and Frasertown 11kV feeders. Plans have been developed to rationalise the 50kV line and 6.6/50kV transformer at Waihi with distribution assets. Until trigger levels are reached (eg transformer renewal) the use of diesel generation to support the area is in use as necessary.

Issues at this site
The transformer protection will activate a phase to phase 50kV throw switch to isolate the 50kV line between Waihi and Kiwi. This is considered an out dated design approach

### 2.2.3.3 Substation Security

The levels of security that are applicable to each substation depend on the Purpose and size of the load supplied by the substation. The security levels applicable and impacts of future load for each substation are provided in section 4.2.2.4.

The methods to achieve the current Transmission and Subtransmission/Zone substation security levels are as follows:

| Subtransmission/Zone Substation Support Capacity | | |
|---|---|---|
| Location | % Load Support | Security/Contingency Method |
| Gisborne Substation | 100%* | Dual Transformers and Dual Incoming Circuits. *Note Circuits on Same Towers. |
| Te Araroa Substation | 100% | Generator 100% or Ruatoria 30% via 11kV |
| Ruatoria Substation | 100% | Generator 100%or TeAraroa 30% and Tokomaru 35% via 11kV |
| Tokomaru Bay Substation | 100% | Ruatoria 50% and Tolaga 50% via 11kV |
| Tolaga Bay Substation | 100% | Generator 100% or Tokomaru Bay 40% and Kaiti 40% |
| Kaiti Substation | 100% | Load supplied from Port Substation and Carnarvon St via 11kV |
| Carnarvon Substation | 100% | Dual Transformers or Port 50% and Parkinson 50% |
| Parkinson Substation | 100% | Dual Transformers or Carnarvon 50% ,JNL 30% and Makaraka 20% |
| Makaraka Substation | 100% | Carnarvon 50% ,Matawhero 20% Patutahi 10% &Parkinson 20% |
| Patutahi Substation | 100% | Matawhero 50%, Pehiri 20%,Makaraka 20% and Puha 10% |
| Pehiri Substation | 100% | Patutahi 100% (Uses Voltage Regulator) |
| Ngatapa Substation | 100% | Patutahi 100% (Uses Voltage Regulator) |
| Puha Substation | 100% | Generator 80% and Makaraka/Patutahi 20% |
| Matawhero Substation | 100% | Dual Transformers or JNL 100% |
| Port Substation | 100% | Carnarvon 50% and Kaiti 50% |
| JNL Substation | 100% | Matawhero 100% |
| Wairoa Substation | 100%* | Dual Transformers and Dual Incoming Circuits. *Note Circuits on Same Towers. |
| Kiwi Substation | 100% | Waihi 50% or Three supplies at 11kV |
| Blacks Pad Substation | 100% | Generator 100% |
| Tahaenui Substation | 100% | Kiwi Sub 100% |
| Waihi Substation | 0% | Connection point for Generation. 200kVA Diesel Backup on site |
| Tuai Substation | 0% | Relocatable generator required. |

#### 2.2.3.4 Substation Demand

The current and future demand predictions for each substation are provided in section 4.3.4.2.

### 2.2.4 Distribution network

### 2.2.4.1 Coverage

Eastland Network Limited's distribution network is clustered mainly along the east coast from Te Araroa in the north to Raupunga in the south-west. Isolated inland areas such as Matawai tend to be fed by spur lines that traverse rugged uninhabited areas. The distribution network is solely 11kV (no 6.6kV or 22kV) and comprises the following:

| | Gisborne | Wairoa | Total |
|---|---|---|---|
| 3 Phase Overhead | 1648050 m | 665878 m | 2313928 m |
| 1 Phase Overhead | 69027 m | 17580 m | 86608 m |
| Underground | 116067 m | 17626 m | 133693 m |

Note the above lengths exclude 374364 m of privately owned overhead line and 4209 m of privately owned underground cable.

### 2.2.4.2 Configuration

In rural areas the configuration is predominantly radial with only some meshing between feeders and between adjacent zone substations. A high degree of meshing exists in the urban Gisborne and Wairoa areas via either ABS's or RMU's.

### 2.2.4.3 Construction

Eastland Network Limited's network construction differs between rural and urban as follows:

Rural areas are predominantly wooden pole, flat construction with wooden cross-arms and pin insulators.

Urban areas are predominantly concrete pole with wooden cross-arms.

Cable network is concentrated in the CBD and newer subdivisions.

Eastland Network Limited's past standard of 11kV line construction uses a range of conductors as shown in the following table. Copper conductors used historically are progressively substituted with Aluminium conductors for new construction. Galvanised steel conductors are still used for large spans.

| Conductor Type | Length km (approx) | % Population |
|---|---|---|
| 7/14 Cu OH | 507.47 | 21.1% |
| 7/16 Cu OH | 434.27 | 18.1% |
| 7/16 St OH | 372.47 | 15.5% |
| 3/12 St OH | 240.71 | 10.0% |

| | | |
|---|---|---|
| Gopher OH | 154.17 | 6.4% |
| Ferret OH | 139.11 | 5.8% |
| Dog OH | 124.95 | 5.2% |
| Rango OH | 54.02 | 2.3% |
| 19/14 Cu OH | 46.20 | 1.9% |
| Racoon OH | 43.48 | 1.8% |
| 19/16 Cu OH | 37.16 | 1.5% |
| Weke OH | 35.02 | 1.5% |
| No 8 Cu OH | 28.99 | 1.2% |
| Magpie OH | 27.19 | 1.1% |
| 7/.118 Cu OH | 24.98 | 1.0% |
| 7/.093 Cu OH | 19.57 | 0.8% |
| Flounder OH | 17.33 | 0.7% |
| Shrike OH | 14.19 | 0.6% |
| Robin OH | 13.60 | 0.6% |
| No 8 St OH | 11.93 | 0.5% |
| 3/128 Cu OH | 10.65 | 0.4% |
| 19/17 Cu OH | 8.80 | 0.4% |
| Mink OH | 8.03 | 0.3% |
| Swan OH | 5.32 | 0.2% |
| Rabbit OH | 3.88 | 0.2% |
| Squirrel OH | 3.42 | 0.1% |
| Swallow OH | 3.25 | 0.1% |
| 7/14 St OH | 2.62 | 0.1% |
| 19/18 Cu OH | 2.56 | 0.1% |
| 3/12 Cu OH | 2.41 | 0.1% |
| 7/12 Cu OH | 0.74 | 0.0% |
| 16mm Cu OH | 0.39 | 0.0% |
| Kutu OH | 0.29 | 0.0% |
| Cockroach OH | 0.20 | 0.0% |
| 25mm Cu OH | 0.10 | 0.0% |

Cable types used are medium sized conductors. Paper insulated cables are preferred for most circuits with XLPE conductor being only used on short runs such as tails from fuse-switches to transformers. For new work the larger 185 and 300 sq. mm Aluminum conductors are generally used.

| Conductor Type | Length km (approx) | % Population |
|---|---|---|
| HV 3c-95mm Al PILC UG | 27.779821 | 20.76% |
| HV 3c-70mm Cu PILC UG | 18.219997 | 13.61% |
| HV 3c-16mm Cu PILC UG | 16.153169 | 12.07% |

| | | |
|---|---|---|
| HV 3c-95mm Al PILC HDPE UG | 14.051223 | 10.50% |
| HV 3c-300mm Al XLPE UG | 8.221223 | 6.14% |
| HV 3c-300mm Al PILC HDPE UG | 8.053523 | 6.02% |
| HV 3c-95mm Al XLPE UG | 8.05117 | 6.02% |
| HV 3c-185mm Al PILC UG | 6.879097 | 5.14% |
| HV 3c-16mm Cu PILC HDPE UG | 5.46482 | 4.08% |
| HV 3c-16mm Cu XLPE UG | 3.512079 | 2.62% |
| HV 3c-185mm Al XLPE UG | 3.238066 | 2.42% |
| HV 3c-0.0225 Cu PILC UG | 3.032512 | 2.27% |
| HV 3c-185mm Al PILC HDPE UG | 2.811228 | 2.10% |
| HV 1c-25mm Al XLPE UG | 2.398696 | 1.79% |
| HV 3c-185mm Cu PILC UG | 2.189817 | 1.64% |
| HV 3c-25mm Al XLPE UG | 1.206013 | 0.90% |
| HV 3c-16mm Al PILC HDPE UG | 0.758613 | 0.57% |
| HV 3c-150mm Cu PILC UG | 0.672284 | 0.50% |
| HV 3c-25mm Cu XLPE UG | 0.205977 | 0.15% |
| HV 1c-300mm Cu XLPE UG | 0.198758 | 0.15% |
| HV 3c-120mm Cu PILC UG | 0.179524 | 0.13% |
| HV 1c-95mm Al XLPE UG | 0.262358 | 0.20% |
| HV 3c-25mm Cu PILC UG | 0.075549 | 0.06% |
| HV 3c-95mm Cu PILC HDPE UG | 0.070821 | 0.05% |
| HV 3c-35mm Cu PILC UG | 0.067511 | 0.05% |
| HV 1c-185mm Al XLPE UG | 0.032064 | 0.02% |
| HV 1c-25mm Cu XLPE UG | 0.016794 | 0.01% |
| HV 1c-16mm Cu XLPE UG | 0.011358 | 0.01% |
| HV 1c-95mm Al PILC UG | 0.00785 | 0.01% |
| LV 1c-300mm Al XLPE PVC UG | 0.002472 | 0.00% |

#### 2.2.4.4 Per substation basis

On a per substation basis the split of distribution network is presented in the following sections. Customer density is obviously a strong driver of viability and significantly influences Eastland Network Limited's allocation of time, effort and funds.

Gisborne

| Substation | 11kV length approx (km) | Total ICP's | ICP density per km |
|---|---|---|---|
| Te Araroa | 123.11 | 488 | 3.96 |
| Ruatoria | 168.54 | 792 | 4.70 |
| Tokomaru Bay | 165.84 | 590 | 3.56 |
| Tolaga Bay | 171.68 | 661 | 3.85 |
| Kaiti | 120.88 | 3041 | 25.16 |

| | | | |
|---|---|---|---|
| Carnarvon | 45.97 | 4622 | 100.53 |
| Parkinson | 30.84 | 1812 | 58.76 |
| Makaraka | 167.39 | 3086 | 18.44 |
| Patutahi | 206.59 | 1186 | 5.74 |
| Pehiri | 138.13 | 274 | 1.98 |
| Ngatapa | 104.64 | 251 | 2.40 |
| Puha | 336.49 | 1091 | 3.24 |
| Matawhero | 25.46 | 237 | 9.31 |
| Port | 26.41 | 2724 | 103.14 |
| JNL | 0.1 | 2 | 20 |

Wairoa

| Substation | 11kV length approx (km) | Total ICP's | ICP density per km |
|---|---|---|---|
| Tuai | 116.11 | 368 | 3.17 |
| Wairoa | 8.89 | 1 | 0.11 |
| Kiwi | 443.38 | 3382 | 7.63 |
| Tahaenui | 82.28 | 871 | 10.59 |
| Blacks Pad | 50.29 | 276 | 5.49 |

#### 2.2.4.5 Terrain

As the terrain in the region is generally characterised by hilly terrain with relatively narrow weaving river valleys many rural lines tend to be constructed on steep hillsides away from the road edge. Feeders typically begin in rural townships or urban centers and supply both urban and rural customers. The lines pass over the open flats on main transport routes from the townships and quickly transition into the rugged hilly terrain frequently passing over small pockets of rural land with good access. The split of 11kV and LV line length over the various areas is indicated in the following table:

| Location | Total (m) | Gisborne (m) | Wairoa(m) |
|---|---|---|---|
| Urban Only | 58934 | 50640 | 8294 |
| Rural Only | 1276772 | 1027097 | 249675 |
| Remote Only | 298467 | 234792 | 63675 |
| Urban Rugged | 1287 | 1287 | 0 |
| Rural and rugged | 545005 | 329408 | 215597 |
| Remote and Rugged | 222689 | 75290 | 147400 |

Remote lines are defined as being more than 75 km direct line from the main works depot and rugged lines are lines with a span length greater than 130 meters.

### 2.2.5 Distribution Substations


Just as Subtransmission substation transformers form the interface between the 50kV or 33kV and 11kV networks, distribution transformers form the interface between Eastland Network Limited's 11kV and LV networks. These distribution substations range from 1-phase 15kVA pole-mounted transformers to 3-phase 1,500kVA ground-mounted transformers dedicated to single customers.

Distribution substations fit into 1 of the following typical arrangements or classes:

Single pole mounted transformer installations up to 100kVA. A few older 'pole with half pole' sites still exist in the Wairoa district. These installations are protected with minimal fuse protection. There are no 2-pole substations over 100kVA on the network.

Green metal enclosed pad mount installations 30kVA+. These installations are typically located on private property for single customer installations, Eastland Network Limited land adjacent to road reserves and on grass berms in road reserve. Installations of this type may have in some cases a secondary enclosure consisting of a mesh fence, concrete block wall or wooden fence. In overhead areas minimal overhead fusing is used while in underground areas 11kV fuse switches provide the protection.

5 to 30 KVA pole style transformers with secondary plastic or metal covers. Only a few installations of this type exist.

There are approximately 10 Eastland Network Limited owned Kiosk type building installations housing larger ground mount transformers. A small number of the customer only substations are also located within concrete block building arrangements similar to the kiosks. Note for the purposes of valuation substations are considered with two major components being the Transformer and the site works i.e. earth-mat and pad / building.

| Rating | Number (includes 108 private transformers) | | | |
|---|---|---|---|---|
| | Gisborne | | Wairoa | |
| | Ground (509) | Pole (2300) | Ground (106) | Pole (804) |
| 1 kVA | | 4 | | 12 |
| 5 kVA | | 57 | | 5 |
| 10 kVA | | 456 | | 164 |
| 15 kVA | 1 | 945 | | 235 |
| 20 kVA | | 1 | | 86 |
| 25 kVA | 3 | 130 | | 49 |
| 30 kVA | 39 | 452 | 4 | 150 |
| 50 kVA | 17 | 160 | 7 | 62 |
| 75 kVA | 2 | 1 | | 2 |
| 100 kVA | 47 | 53 | 21 | 29 |
| 150 kVA | | 1 | | 2 |
| 200 kVA | 109 | | 37 | 6 |
| 250 kVA | 49 | 1 | | |
| 300 kVA | 147 | | 22 | 2 |
| 400 kVA | 1 | | | |
| 500 kVA | 48 | | 6 | |
| 750 kVA | 3 | | 3 | |
| 1000 kVA | 40 | | 6 | |
| 1500 kVA | 3 | | | |

For management purposes Eastland Network Limited also classifies its nine 11kV voltage regulators as distribution transformers. The regulators are ground mounted and have wire mesh fence enclosures.

| Location | Purpose |
|---|---|
| Pehiri | Security |
| Kopuaroa (between Ruatoria and Tokomaru) | Security |
| Tatapouri (between Kaiti and Tolaga) | Distance boost |
| Ngatapa | Security |

| | |
|---|---|
| Matawai | Distance boost |
| Waingake | Support water works |
| Muriwai | Distance boost. |
| Waihua (west of Wairoa) | Distance boost |
| Mahia | Distance boost |

### 2.2.6 Distribution Switchgear

The distribution switchgear associated with the underground distribution network substations is predominantly ABB SD series Oil filled switchgear or ABB Safeplus SF6 gas filled switchgear. Switchgear installations are pad mounted and either located adjacent to or a short distance away from the substation installations.

For the overhead network pole mounted 3 phase Air Break Switches are widely used. In more remote locations single phase links or fuses are used to isolate spur lines.

There are a number of pole mounted Circuit Breakers and SF6 Switches also in use on the network.

Goritt ZW32 Vacuum - SEL

Hawker Sydley PMR

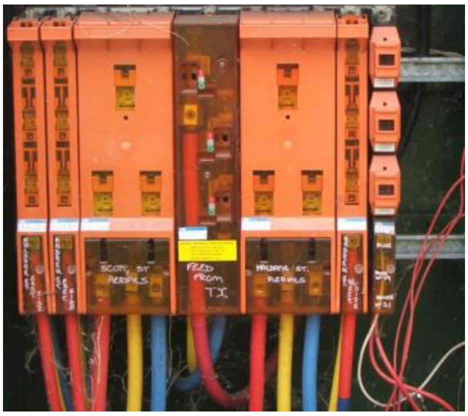
Hawker Sydley GVR

Cooper Systems KFE

Jin Kwang SF6 SW

Age profiles and further related information is provided in section 2.3.

### 2.2.7 LV network



#### 2.2.7.1 Coverage

Eastland Network Limited's LV networks are predominantly clustered around each distribution transformer. The coverage of each individual LV network tends to be limited by volt-drop to about a 200m radius from each transformer hence LV coverage is not as extensive as 11kV.

| Class | Length Gisborne m | Length Wairoa m | Length Total m |
|---|---|---|---|
| OH LV 400V | 390278 | 136418 | 526297 |
| UG LV 400V | 201930 | 47892 | 249822 |
| OH SL 400V | 12379 | 161 | 12541 |
| UG SL 400V | 7255 | 315 | 7570 |

#### 2.2.7.2 Configuration

The LV networks are almost solely radial with minimal meshing even in urban areas.

#### 2.2.7.3 Construction

Construction of LV network varies considerably and can include overhead LV only, LV under-built on 11kV, LV under-built on 50kV, PILC cables, XLPE cables or conjoint PILC – XLPE cables.

The conductor types used are shown in the tables below:

| Conductor Type O/Head | Length km | % Population |
|---|---|---|
| 7/14 Cu OH | 261.662 | 48.58% |
| 7/16 Cu OH | 88.110 | 16.36% |
| 7/16 St OH | 46.504 | 8.63% |
| Ferret OH | 21.824 | 4.05% |
| 19/14 Cu OH | 18.569 | 3.45% |
| Rango OH | 17.493 | 3.25% |
| Gopher OH | 11.987 | 2.23% |
| LV 1c-4mm Cu N/S OH | 11.023 | 2.05% |
| 19/17 Cu OH | 8.875 | 1.65% |
| Weke OH | 7.346 | 1.36% |
| Dog OH | 6.538 | 1.21% |
| 3/12 St OH | 5.743 | 1.07% |
| 16mm Cu OH | 5.238 | 0.97% |
| No 8 Cu OH | 4.727 | 0.88% |
| LV 95mm Al PVC Covered OH | 4.210 | 0.78% |
| 19/16 Cu OH | 3.820 | 0.71% |
| 70mm Cu OH | 2.637 | 0.49% |
| Wasp OH | 1.632 | 0.30% |
| LV 2c-6mm Cu N/S OH | 1.280 | 0.24% |
| LV 7c-2.5mm Cu SWA OH | 1.258 | 0.23% |
| 7/18 Cu OH | 0.858 | 0.16% |
| 25mm Cu OH | 0.664 | 0.12% |
| 19/18 Cu OH | 0.662 | 0.12% |
| Swan OH | 0.563 | 0.10% |

| | | |
|---|---|---|
| Kutu OH | 0.510 | 0.09% |
| 25mm Al OH | 0.482 | 0.09% |
| Mink OH | 0.477 | 0.09% |
| LV 3c-16mm Cu N/S OH | 0.415 | 0.08% |
| 3/12 Cu OH | 0.357 | 0.07% |
| LV 35mm Al ABC Covered OH | 0.313 | 0.06% |
| No 8 St OH | 0.307 | 0.06% |
| No 10 Cu OH | 0.304 | 0.06% |
| 7/14 St OH | 0.301 | 0.06% |
| 7/.118 Cu OH | 0.298 | 0.06% |
| 7/.093 Cu OH | 0.295 | 0.05% |
| 3/128 Cu OH | 0.268 | 0.05% |
| LV 1c-16mm Cu N/S OH | 0.260 | 0.05% |
| Poko OH | 0.233 | 0.04% |
| Magpie OH | 0.175 | 0.03% |
| Racoon OH | 0.111 | 0.02% |
| 7/12 Cu OH | 0.084 | 0.02% |
| Squirrel OH | 0.083 | 0.02% |
| LV 3c-25mm Cu N/S OH | 0.039 | 0.01% |
| LV 2c-4mm Cu N/S OH | 0.034 | 0.01% |
| Rabbit OH | 0.019 | 0.00% |
| LV 2c-16mm Cu N/S OH | 0.014 | 0.00% |

| Conductor Type Underground | Length km | % Population |
|---|---|---|
| LV 1c-106mm Al (Beetle) UG | 154.8945 | 59.258% |
| LV 1c-150mm Al (Weta) UG | 20.16751 | 7.715% |
| LV 1c-185mm Al (Huhu) UG | 16.89864 | 6.465% |
| LV 4c-95mm Al XLPE PVC UG | 14.24534 | 5.450% |
| LV 3c-16mm Cu N/S UG | 6.396104 | 2.447% |
| LV 1c-16mm Cu N/S UG | 5.532862 | 2.117% |
| LV 2c-4mm Cu N/S UG | 5.325591 | 2.037% |
| LV 3c-35mm Cu N/S + P UG | 5.215365 | 1.995% |
| LV 4c-150mm Al XLPE PVC UG | 3.082402 | 1.179% |
| LV 1c-70mm CU XLPE PVC UG | 3.034754 | 1.161% |
| LV 3c-95mm Al N/S UG | 2.794585 | 1.069% |
| LV 4c-70mm Cu PILC UG | 2.427373 | 0.929% |
| LV 1c-50mm Al (Kutu) UG | 2.342381 | 0.896% |
| LV 1c-25mm Cu XLPE PVC UG | 2.00711 | 0.768% |
| LV 1c-35mm Cu XLPE PVC UG | 1.733074 | 0.663% |
| LV 3c-25mm Cu N/S UG | 1.413677 | 0.541% |

| | | |
|---|---|---|
| LV 1c-185mm Al XLPE PVC UG | 1.260898 | 0.482% |
| LV 1c-4mm Cu N/S UG | 1.254988 | 0.480% |
| LV 3c-35mm + P N/S UG | 1.224826 | 0.469% |
| LV 1c-95mm Cu XLPE PVC UG | 1.176572 | 0.450% |
| LV 4c-185mm Al XLPE PVC UG | 0.872915 | 0.334% |
| LV 2c-16mm Cu + P N/S UG | 0.827969 | 0.317% |
| LV 3c-70mm Cu + P N/S UG | 0.706337 | 0.270% |
| LV 3c-70mm + P N/S UG | 0.676519 | 0.259% |
| LV 1c-25mm+ P N/S UG | 0.547507 | 0.209% |
| LV 2c-6mm Cu N/S UG | 0.541544 | 0.207% |
| LV 2c-16mm Cu N/S UG | 0.530252 | 0.203% |
| LV 3c-120mm Cu N/S UG | 0.40047 | 0.153% |
| LV 3x1c-19/.052 + 1c-7/.036 UG | 0.371102 | 0.142% |
| LV 3c-35mm Cu + P N/S UG | 0.340987 | 0.130% |
| LV 4c-35mm PILC UG | 0.339238 | 0.130% |
| LV 1c-25mm Al XLPE PVC UG | 0.334061 | 0.128% |
| LV 1c-6mm Cu N/S UG | 0.328036 | 0.125% |
| LV 3x19/105 Al PVC UG | 0.299214 | 0.114% |
| LV 3c-35mm Cu N/S UG | 0.294783 | 0.113% |
| LV 4c-70mm Cu + P PILC UG | 0.28956 | 0.111% |
| LV 4c-300mm Al XLPE PVC UG | 0.238582 | 0.091% |
| LV 1c-120mm Cu Cantol UG | 0.210907 | 0.081% |
| HV 3c-95mm Al PILC UG | 0.162093 | 0.062% |
| LV 1c-70mm Cu PVC UG | 0.120229 | 0.046% |
| Unknown | 0.11259 | 0.043% |
| LV 4c-95mm Al PVC UG | 0.110914 | 0.042% |
| LV 1c-300mm Al XLPE PVC UG | 0.048168 | 0.018% |
| HV 3c-95mm Al PILC HDPE UG | 0.044248 | 0.017% |
| LV 1c-185mm Cu XLPE PVC UG | 0.041678 | 0.016% |
| LV 4c-70mm Al XLPE PVC UG | 0.03616 | 0.014% |
| LV 3c-35mm +P N/S UG | 0.034371 | 0.013% |
| LV 4c-185mm Cu PILC UG | 0.032506 | 0.012% |
| LV 3c-16mm Cu N/S OH | 0.026921 | 0.010% |
| HV 3c-25mm Al XLPE UG | 0.020719 | 0.008% |
| LV 2c-7/0.064 + 1c-7/0.036 N/S UG | 0.010792 | 0.004% |
| LV 2c-10mm Cu N/S UG | 0.00583 | 0.002% |
| LV 4c-25mm Cu PILC UG | 0.004112 | 0.002% |
| LV 1c-16mm Cu N/S OH | 0.001308 | 0.001% |

Approximate populations of various construction types are presented below:

| Description | Length (m) | |
|---|---|---|
| | Overhead | Underground |
| LV Only | 77007 | 166635 |
| LV Only Remote | 14227 | 70 |
| LV Only Roadside | 139979 | 21815 |
| LV Only Roadside Remote | 13146 | 214 |
| LV Only Rugged | 5972 | 0 |
| LV Only Rugged Remote | 2887 | 0 |
| LV Under built | 101193 | 56054 |
| LV Under built Remote | 20713 | 0 |
| LV Under built Roadside | 122880 | 6485 |
| LV Under built Roadside Remote | 20099 | 0 |
| LV Under built Rugged | 3955 | 0 |
| LV Under built Rugged Remote | 2825 | 0 |

#### 2.2.7.4 Per substation basis

On a per substation basis the split of LV network is laid out in the following sections. Similar to the distribution network, customer density is a strong driver of viability and influences Eastland Network Limited's allocation of time, effort and funds.

Gisborne

| Sub. | LV Line length (km) | Customers (ICPs) | Customer density |
|---|---|---|---|
| Te Araroa | 18.6 | 488 | 26.22 |
| Ruatoria | 37.7 | 792 | 21.02 |
| Tokomaru Bay | 24.1 | 590 | 24.53 |
| Tolaga Bay | 26.3 | 661 | 25.14 |
| Kaiti | 70.6 | 3041 | 43.09 |
| Carnarvon | 85.8 | 4622 | 53.85 |
| Parkinson | 32.6 | 1812 | 55.51 |
| Makaraka | 102.1 | 3086 | 30.22 |
| Patutahi | 60.7 | 1186 | 19.53 |
| Pehiri | 14.0 | 274 | 19.63 |
| Ngatapa | 11.4 | 251 | 22.02 |
| Puha | 46.7 | 1091 | 23.36 |
| Matawhero | 13.6 | 237 | 17.38 |
| Port | 48.7 | 2724 | 55.96 |
| JNL | 0.0 | 2 | 1 |

Wairoa

| Sub. | LV Line length (km) | Customers | Customer density |
|---|---|---|---|
| Tuai | 9.9 | 368 | 37.33 |
| Wairoa | 0.0 | 1 | 1.00 |

| | | | |
|---|---|---|---|
| Kiwi | 128.5 | 3382 | 26.32 |
| Tahaenui | 27.7 | 871 | 31.48 |
| Blacks Pad | 17.3 | 276 | 15.97 |

LV Switchgear for control and protection of the LV underground network is generally housed in Transformer enclosures as an LV Frame, In Link boxes or as part of a Distribution box. For overhead installations the switchgear typically exists in the form of pole mounted fuses at transformer sites. The underground enclosures are installed with the LV reticulation usually at the subdivision development stage.

Eastland Network Limited has the following Distribution boxes and Link Boxes as part of the LV Network:

| Type | Number |
|---|---|
| DB Other | 2503 |
| DB Black Plastic | 954 |
| DB Central Metering | 100 |
| DB Concrete SS Lid | 55 |
| DB Fiberglass Box | 107 |
| DB Galvanised Box | 594 |
| DB Green Shear | 817 |
| DB In-Ground Pit | 569 |
| DB Meter box-Metal | 22 |
| DB Verandah Box | 5 |
| Link Box Other | 219 |
| Link Box Aluminium | 210 |
| Link Box Black Plastic | 33 |
| Link Box Built-In | 1 |
| Link Box Concrete | 1 |
| Link Box Fiberglass | 9 |
| Link Box Galvanised Box | 6 |
| Link Box Green Shear | 32 |
| Link Box Montrose Box | 19 |
| Link Box Polycarbonate | 7 |
| Link Box Verandah Box | 4 |
| PoC Point | 253 |
| TOTAL | 6520 |

### 2.2.8 Customer connection assets

Eastland Network Limited has 25,567 consumer connections - Eastland Network Limited gets its income by providing electricity conveyance services to these connections for the energy retailers. All of the network assets are used to convey energy to these consumer connections, and essentially are a cost that has to be matched by the revenue derived from the consumer connections. The control points at the consumer connections generally involve assets ranging in size from a simple fuse on a pole or in a suburban distribution pillar to dedicated lines and transformer installations supplying single large consumers. Quantities of customer owned private line quantities are summarized as follows:

11kV Overhead lines 377km

11kV Underground Cables 17km

400V Overhead Lines 314km

400V Underground Cables 33.4km

In most cases the fuse forms the demarcation point between Eastland Network Limited's network and the consumers' assets (the "service main"), and this is usually located at or near the physical boundary of the consumers' property. However in some cases a single consumer is supplied by a length of line or cable (often on public land) configured as a spur off Eastland Network Limited's network which is referred to as a "service line" (noting that successive revisions of the Electricity Supply Regulations in the late 1970's and early 1980's confused the two definitions). In such cases ownership of the service line has been passed to consumers, who are now responsible for funding and maintaining its safety and connectively to Eastland Network Limited's network.

| Type of service connection | Gisborne | Wairoa |
|---|---|---|
| Domestic | 16483 | 3367 |
| Non Domestic | 4243 | 1474 |
| Total | 20726 | 4841 |

### 2.2.9 Load control assets

Eastland Network Limited currently owns and operates the following three load control transmitter facilities for control of ripple relays…

Valley Road –11kV injection at 315 Hz (not in service).

Makaraka – 50kV injection at 315Hz.

Wairoa – 11kV injection at 1,250Hz.

Historically the majority of controllable load in the urban Gisborne area was controlled by a cascade pilot wire network consisting of 10 pilot feeders.

Due to issues related to the pilot systems functional inflexibility, reliability and expense, in 1992 a ripple load control system was installed on the Gisborne network. The pilot and ripple systems were operated in tandem.

As reliability has become more of issue due to age deterioration of the pilot assets, Eastland Network Limited has phased out the existing Gisborne city overhead pilot system in favor of ripple relays installed at customer's premises. This has been achieved through a ripple receiver installation program started in 2002 and completed in 2008. Eastland Network Limited owns the signal receivers installed on the Gisborne network. An opportunity to replace some pilot with ripple receivers in conjunction with an energy retailer initiated metering upgrade program, (smart meter install) commencing in 2014/15 is being currently being considered.

The Wairoa urban centre uses a pilot wire system with a small quantity ripple relays deployed in the wider area. The customer relays are owned by the incumbent energy retailer. The retailer has decommissioned the load control relays used in Mahia due to signal attenuation issues. The 8 channel pilot wire system in the urban centre is triggered via SCADA from a central point at the A-Park substation which was installed in 2009. The remaining controllable load operated by the ripple transmitter is insufficient to justify replacement of the transmitter hence it is likely that the focus will be on maintaining the pilot wire system in the urban centre only.

An approximate assessment of the controllable capability of the system is shown in the following table:

| Channel | | Interruptible load (kW) |
|---|---|---|
| 1 | Te Araroa | 300 |
| 2 | Ruatoria | 600 |
| 3 | Tokomaru Bay | 400 |
| 4 | Tolaga Bay | 500 |
| 5 | Wainui/Whangara | 700 |
| 6 | Tamarau | 1,000 |
| 7 | Kaiti #1 | 900 |
| 8 | Kaiti #2 | 600 |
| 9 | Town | 500 |
| 10 | West End #1 | 1,100 |
| 11 | West End #2 | 700 |
| 12 | Te Hapara #1 | 600 |
| 13 | Te Hapara #2 | 500 |
| 14 | Matawhero/Makaraka | 400 |
| 15 | Whataupoko #1 | 500 |
| 16 | Whataupoko #2 | 600 |
| 17 | Mangapapa #1 | 900 |
| 18 | Mangapapa #2 | 700 |
| 19 | Westpark/Matokitoki | 300 |
| 20 | Patutahi/Waipaoa | 400 |
| 21 | Waimata | 600 |
| 22 | Muriwai/Te Arai | 600 |
| 23 | Pehiri | 200 |
| 24 | Ngatapa | 200 |
| 25 | Matawai | 300 |

| | | |
|---|---|---|
| 26 | Puha | 500 |
| | Wairoa 00 | 381 |
| | Wairoa 01 | 216 |
| | Wairoa 02 | 327 |
| | Wairoa 03 | 352 |
| | Wairoa 04 | 308 |
| | Wairoa 05 Night store (not used) | 25 |
| | Wairoa 06 | 311 |
| | Wairoa 07 | 345 |
| | Wairoa 08 | 319 |
| | Wairoa 09 (not used) | 37 |
| | Wairoa 16 Night store (not used) | 48 |
| | Wairoa 17 (not used) | 168 |
| | Wairoa 18 (not used) | 179 |
| | Wairoa 19 (not used) | 197 |
| | Wairoa 30 Flood Pump (not used) | 118 |
| | Wairoa 31 Spa Pool (not used) | 30 |
| | Wairoa 32 Cold Store (not used) | 60 |

### 2.2.10 Protection & control

#### 2.2.10.1 Key protection systems

Eastland Network Limited's network protection includes the following broad classifications of assets:

CB protection relays which have always included over-current, earth-fault, sensitive earth-fault and auto-reclose functions. More recent equipment also includes voltage, frequency, directional; distance and CB fail functionality in addition to the basic functions.

Transformer and tap changer temperature sensors..

Surge sensors

Explosion vents.

Oil level sensors.

There is a mix of electro-mechanical, discrete component and microprocessor based equipment on Eastland Network Limited's network.

#### 2.2.10.2 Voltage control equipment

Tap changer controls for dual transformer installations, are configured in a master-follower arrangement at older substations and balancing load IsinØ control algorithms are used for new installations. The controllers are predominantly microprocessor based. Voltage regulator controls are predominantly mechanical and are being progressively replaced with PLC controllers that allow operation of voltage regulators in either direction where appropriate.

Controls are an area in which technology advances make such controls a viable option even for the smallest substations.

#### 2.2.10.3 DC power supplies

Batteries, battery chargers, and battery monitors provide the DC supply systems for CB control and protection functions as follows:

110V DC supplies are primarily required for 50kV CB operation and in a number of substations are used for 11kV CB operation and protection.

24V DC supplies are typically used for SCADA RTU'S emergency lighting, protection and CB control at newer installations.

The radio communication systems are typically supplied via 12DC systems.

### 2.2.11 SCADA & Communications

The SCADA system is used for real-time monitoring and control of the network. Frequency Voltage Current and temperature information is obtained from remote sites, and stored at 30 minute intervals. This information is used to report load trends for planning and alert operations staff of abnormal conditions.

Real-time status information is collected to alert operations staff of faults and potential issues with the network. Controls are available to turn sections of the network on or off, to minimise outage times, eliminating delays associated with manual switching.

The original GPT master station and data-term RTU's were replaced between 2000 and 2002 with the current Abbey system.

An alternative Control Facility was established in 2017/18 at the Gisborne Substation. The facility has backup generator supply, Communications, Data storage and operational Mimic. Point of supply load control functions are also carried out using the SCADA.

#### 2.2.11.1 Master station

Eastland Network Limited's SCADA master station is located at the head office in Carnarvon St and comprises an Abbey Systems dual master / backup master station configuration which was installed in 1999. Regular upgrades have been made to the master station and software updates to improve functionality include.

DNP and Modbus support for intelligent devices in 2001
SMS Text Messaging upgrade to replace paging system for remote alarming in 2002
Remote access upgrade 2003.
SQL database linking for historical trend storage in 2005.

Aspex Gui interface upgrade incorporating improved windows look and feel, improved graphics and improved real-time/historical graphing and trending in 2006.
Support for communications via TCPIP networks in 2007.
Support for historical data storage at remotes with occasional forwarding to the Master Station in 2010.
Addition of a Network TCPIP monitoring system in 2011.
Renewal of Computers, Software and Master Station communication ports hardware in Jan 2013 incorporating IP connectivity.
Support for TCPModbus in 2013
Upgrade to 2017 Software with Modbus Slave/Master TCP improvements and Database storage Improvements
There are 9 communication ports in use from the Master Station:

| | |
|---|---|
| Port 1 | - 2 wire Cable circuit (Gisborne city). |
| Port 2 | - UHF Radio repeater (Gisborne city for Patutahi substation). |
| Port 3 | - Makaretu circuit (Puha / Matawai area). |
| Port 4 | - Coast radio circuit (Tolaga – Tokomaru). |
| Port 5 | - Kinikini/Mahia radio circuit |
| Port 6 | - 4 wire Cable circuit (Gisborne city). |
| Port 7 | - Wairoa radio circuit. |
| Port 8 | - Coast radio circuit (Eastcape from Tokomaru Bay. |
| Port 201 | -IP comms circuit for Town Substations, Radio site Backbone and Port/Marina Scada facilities |

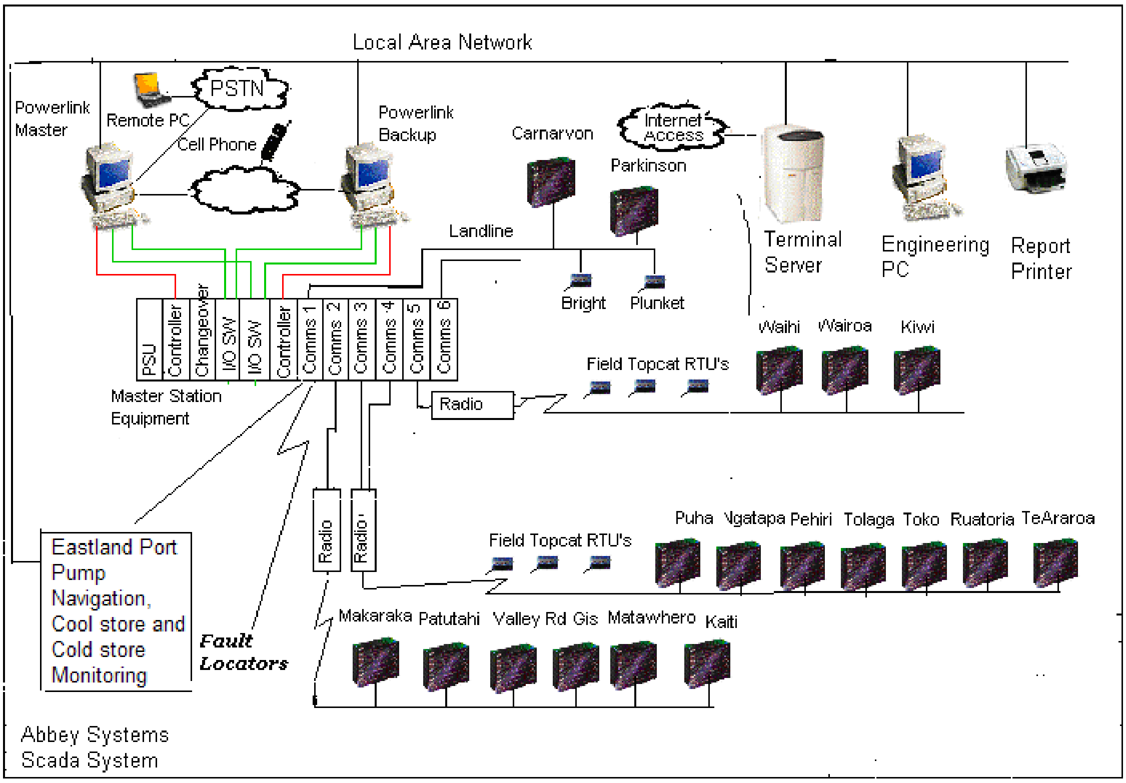
The Substation Management System was installed in 2013/2014. The system provides direct IP connectivity to intelligent devices in substations. For older devices that do not support IP directly IP to serial connectivity has been established.

### 2.2.11.2 Remote stations

There are 16 Abbey Systems Full RTU installations located at each of Eastland Network Limited's major substations and 155 Abbey Systems Topcat installations at remote control switches or monitoring and control sites. The majority of Topcat installations were established between 1999 and 2008 as part of the rural automation program which was completed in 2008. The rural automation program covered in previous AMP's was developed and successfully implemented giving the following results:

Enhanced data for improved planning and operational decisions
Reduced outage times
Optimised restoration times
Reduced costs associated with manual switching operations in the field.
Incorporated into the system are 4 sites linked to Fanuc PLC RTU's located in the Gisborne Port area, 10 Generators (2 Portable), and 4 Wind/Water Monitoring sites. Six Moxa I/O units linked via Modbus are also used for switching equipment.
A summary of remote Input and Output information passing through the system excluding virtual I/O is as follows.

| | |
|---|---|
| Digital Inputs | 15000 |
| Built-in Digital Inputs | 2049 |
| Control Outputs | 4795 |
| Measurements | 3235 |
| Analog Outputs | 243 |




Current issues associated with the SCADA system are:

Limited redundancy in equipment on a per site basis.

A high dependence on the communications network.

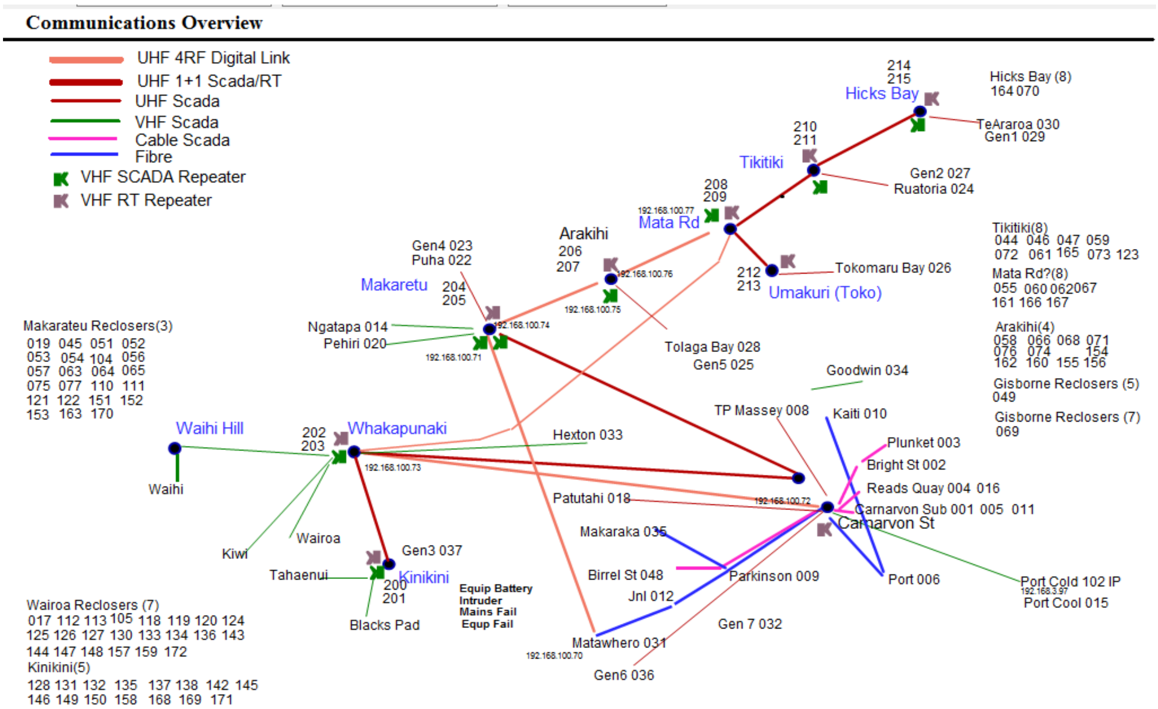
### 2.2.11.3 Communications

A number of communications media and protocols are used to provide voice and data information for operation of the network.

Systems include VHF Radio, UHF Radio and Copper or Fibre Cable.

Data communication is via IP, RS232/485/422Serial and Audio.

Protocols associated with data communication include, Modbus, DNP3, Abbey Systems (HTLC).




## Backbone Links

Eastland Network Limited currently owns and operates the following communications links:

Digital Links from 4RF are installed, forming the main back bone.

- Between Matawhero Sub Fiber termination and Makaretu -2002
- Between Carnarvon Street and Whakapunaki -2003
- Between Makaretu and Arakihi -2009
- Between Arakihi and Mata Rd -2010
- Between Mata Road and Whakapunaki 2011
- Between Mata Rd and Tikitiki 2012
- Between Tikitiki and Hicks Bay 2012
- Between Whakapunaki and Kinikini 2012

These Digital Links are generally configured with 1 to 8 Channels for Scada traffic and the remainder of the Bandwidth is available for low speed IP Data which links the Tait DMR system.

The 4RF Digital Link installed between Whakapunaki and Mata Rd can be used to facilitate contingent rerouting.

An IP 700MHZ link between Mata Rd and Umakuri, installed in 2016 for Tait DMR linking and future IP scada to Tokomaru Bay Substation

A short UHF point to multipoint link established in 2002 to provide SCADA coverage to the Waihi Power station and a remote switch site.

Fiber optic Communications cables were installed in 2005 between Carnarvon Street and Kaiti, Port, Parkinson, Makaraka, JNL, Matawhero substations. The cables provide SCADA, Telephone, Protection and IP services for the Substation Management System. Additional Circuits to Eastland Port Log Yard and Eastland Group offices in Gladstone Rd were installed in 2013 to 2015 to provide Management IT services.

Copper circuits using SHSDL were established in 2015 from Kaiti substation and Carnarvon Street to Gisborne substation to provide redundant routes to key sites.

### 2.2.11.4 Scada Repeaters

Eight VHF and Two UHF point to multipoint repeaters are also used for SCADA communications to substations and field recloser sites. This equipment was installed between 1999 and 2001 and consists of a mix of new and reused equipment.

- Makaretu VHF1
- Makaretu VHF2
- Arakihi VHF
- Mata Rd VHF
- Tikitiki VHF
- Hicks Bay VHF
- Whakapunaki VHF
- Kinikini VHF
- Waihi Hill UHF (Connects to Waihi and Remote Switch W1040)
-Opatama VHF (Repeater for Tuai Substation Scada)
- Makaretu-Puha UHF
- Carnarvon, Gisborne City UHF

### 2.2.11.5 Wifi Network

A network of WiFi 2.4GHZ radios was deployed in 2005 and integrated to the Eastland Network Limited Scada system, which provides monitoring of PLC controllers for access security, sewer-pumps, Navigation systems, Cranes and compressor cooling systems relating to operations associated with Eastland Port. The network was upgraded to 5G in 2016.

- Cook Stores to Carnarvon St 2x5G
- Reads Quay to Tatapuri Sewer pump, Marina Security, Port Offices Backup and Boat Shed 5G
- Matawhero Sub to Port Log Yard 5G
-Town Hill Gisborne Linking Carnarvon St and Gisborne Substation With backup links to Kaiti, Makaraka and Patutahi Substations 5G
-Mata Rd to Umakuri-Tokomaru Bay Substation
-Whakapunaki to Wairoa Substation

### 2.2.11.6 Voice Radio Telephone Network

The voice communications system consists of Nine VHF E-band 25W repeaters operating Digital Mobile Radio (DMR). The repeaters installed in 2014 and 2015, are all coupled together via the IP network of the 4RF backbone between Wairoa and Te Araroa. One repeater operates from Carnarvon St primarily for coverage around Eastland Network Limited's offices. Redundant IP paths are established through third party providers.

In 2014/15 and 2015/16 a digital Tier 3 Tait repeater network was installed. The repeaters are connected via the IP backbone provided by the 4RF links. Two DMR Sun servers were installed to manage the digital RT network in 2014/15. Approximately 140 Vehicle Digital radios and 40 Portable radios were installed in 2014 /15 replacing the old analog wideband RT's. All RT units are fitted with a GPS receiver and provide GPS positioning and logging which is presented in real time on Google maps or Google Earth along with GIS asset data. This allows improved staff response and coordination associated with faults dispatch. The new GPS capable digital system also provides one tier of Eastland Network Limited's working alone monitoring system for employees.

### 2.2.11.7 Substation Management System

The Substation Management System is complementary to the SCADA system and provides the ability to access intelligent devices to fine tune configuration and operating parameters or retrieved detailed logs and event data when necessary. The system uses an IP based communications network which has been established using a mix of in-house and third party communications links. The Network allows connectivity for Camera Monitoring development, Intelligent (SMART Grid) Protection equipment, Access to information systems and Meter reading. There are approximately 180 intelligent devices with direct IP connectivity currently deployed.

The following locations have back up communications via third party Internet service providers to support the substation management system function:

- Te Araroa Substation (Gisborne.net.nz)
- Ruatoria Substation (Gisborne.net.nz)
- Tokomaru Bay Substation (Gisborne.net.nz)
- Tolaga Bay Substation (Gisborne.net.nz)
- Patutahi Substation (Gisborne.net.nz)
- Puha Substation (Gisborne.net.nz)
- Ngatapa Substation (Gisborne.net.nz)
- Pehiri Substation (Gisborne.net.nz)
- Kiwi Substation (Gisborne.net.nz)
- Mahia Generator Site (Vodafone)
- Gisborne Substation (Gisborne.net.nz
- Wairoa Substation (Gisborne.net.nz)
- Waihi Substation (Gisborne.net.nz)
- Kinikini Radio Site (Gisborne.net.nz)

This Substation Management System communications network is separate in terms of utilising different equipment but common dependencies exist at transmitter sites which share common power supplies and masts with Eastland Network Limited's communications equipment.

Current issues associated with the various communications system are:
-Limited redundancy in equipment and communication routes.
-Occasional interference in adverse weather. e.g. snow build up on antenna.

#### 2.2.11.8 Radio Huts

A summary of the Radio sites is given in the Table below

| Location | Description | |
|---|---|---|
| Kinikini | Container (QRS) and Concrete Tank (ENL) | Shared Facility with QRS and Gisnet |
| Whakapunaki | Container (ENL) | Leased site Also occupied by others |
| Cricklewood Rd Pump Site | Pump Shed | Occupied via Agreement |
| Makaretu | Container (ENL) | Easement also occupied by others |
| Arakihi | Container (ENL) | Easement also occupied by others |
| TeKuri Hill | Solar Frame and Cabinet | Occupied via Agreement |
| Mata Rd | Old Hut New Cladding 2018 (ENL) | Easement also occupied by others |
| Umakuri | Old Hut New Cladding 2018 (ENL) | Easement also occupied by others |
| Tikitiki | Old Hut New Cladding 2018 (ENL) | Leased Site also occupied by others |
| HicksBay | Portable Building (not ENL) | Leased Site |

The roof and wall cladding of the Radio Huts at Mata Rd, Tikitiki and Umakuri were replaced in 2018 to remove asbestos from the sites.

### 2.2.12 Other assets

#### 2.2.12.1 Land and Buildings

In addition to the land and buildings associated with Zone substations, Distribution substations, Radio Sites and Underground cables Eastland Network Limited utilises the following significant Land and Building assets.

North Clyde Wairoa, Land owned by Eastland Network Limited for Zone Substation Growth (refer Development Plan).

Wairoa Depot. This site was traditionally owned by Wairoa Electric Power. The site was operated as a depot until around 2009. The site is considered strategic in terms of Emergency preparedness and in the long term it has potential to re-establish it as an operational Depot. T

Tokomaru Bay Depot- This site was traditionally owned by Poverty Bay Electric Power Board and since 2000 has been leased to third parties. The site is directly adjacent to the Tokomaru Bay Substation and is strategic in terms of contingency for an operational base.

Carnarvon Street. These lands and buildings were partially owned Eastland Investment Properties Limited and Eastland Network Limited. Due to the close integration of the buildings with the adjacent Zone substation the ability to lease the entire facility has been limited. As the current tenant's contract regulated services to Eastland Network Limited maximum efficiencies in terms of communication and asset management functions are realised. As of 1 April 2016 all of these properties will be transferred to Eastland Network Limited. These assets will be directly attributable to regulated services.

The management and costs associated with these properties are addressed in relevant non-network assets sections of this asset management plan.

#### 2.2.12.2 Generators

Small diesel Standby generators are installed at critical locations to ensure Eastland Network Limited's SCADA and Communications network can be sustained in contingent events. 15kVA units are installed at Carnarvon Street and Gisborne Substation for Control Centre contingency supply.

Smaller units ranging from 1.5 to 8KVA are located at Tikitiki, Mata Rd, Arakihi, Makaretu, Whakapunaki, and Kinikini radio repeater Sites .

3 Mobile generators based at Carnarvon Street Depot and a 200kVA generator at Waihi Substation are also available for emergency or shutdown use.

#### 2.2.12.3 Software

Eastland Network Limited commissioned the Powerview GIS mapping System in 2002 which contains the network Line, cable, Distribution Substation, Switchgear and connection location, connectivity inspection and condition information.

Electronic Mobile Data Capture (offline and online) utilises Open Data Kit applications which are linked to the GIS or MS access data stores.

Quickmap software is used to integrate Powerview GIS data with aerial photography and Google earth data to aid with planning and design.

Network modeling design software including Load flow and protection coordination uses the PSS Sincal software package.

Low voltage design is carried out by engineering staff using LV Drop software.

The Visim line design package was initially purchased from Foleys in 1997 and is used to validate Structure and line design. Eastland Network Limited then developed in house software to replace the Visim line design software In 2018 .the CATAN software package was adopted for pole design.

Design drawings and plans are prepared using Bentley Microstation products.

ICP and billing information is managed via the Talgentra Gentrac system. This system was upgraded in 2010-2011 and again in 2018.
Fault dispatch functions are carried out using Microsoft exchange and Gmail to provide the link between Retailers, the Dispatcher and Fault contractors. Garmin products are used to assist with dispatch in the field. A tier3 Tait RT system is used to provide real time tracking and location feedback of field staff.

PLC Configuration Software is used to Analyse and setup intelligent devices installed on the network.

Financial Reporting and Works management functions are carried out using a combination of Sage Accpac ERP and Microsoft Access database applications

Activa Software is used to manage the Financial Fixed assets register.

Miscellaneous communication and data storage functions are predominantly carried out using Microsoft products linked to open value software assurance to maintain currency.

Impac Riskmanager is used to manage Health and Safety activities including – Risk identification and control, Incident reporting, Contractor authorisation and competency, Safety equipment management and testing and Health and safety reporting.

Payroll and Property management software packages are used to manage the payroll and property management functions of Eastland Group.

Powerlink and Aspex Software packages enable the Real time Supervisory Control and Data Acquisition functions of the Abbey system SCADA system.

In general specialised software specific to Eastland Network Limited's operation is managed by the Eastland Network Limited Engineering team. Software related to financial activities, general business activities and general communication is provided and managed by Eastland Group's corporate services business, with cost allocations divided over the various Eastland Group businesses and incorporated in Business Support allocations.

### 2.2.12.4 IT Infrastructure and Business communications

The specialised infrastructure specific to Eastland Network Limited's operation is covered in section 2.3.13 SCADA and Communications. The IT and Business communication systems include equipment under the following categories:

Personal Computers
Functional Computers
Servers
Switches / Hubs /Routers /Firewalls
PABX systems
Telephones
Office Security and Access Systems
Cameras and calculators
Meeting and conferencing equipment, (Screens Projectors etc.).

Quantities of end-user Technology tools in use are indicated below:

| Technology Type | Quantity Deployed |
|---|---|

| | |
|---|---|
| Laptop Computers | 17 |
| Desktop Computers | 36 |
| Printers | 15 |
| Phones | 23 |
| Tablets | 4 |
| UPS Supplies | 12 |

The management functions associated with IT and Business communication assets are carried out by the Eastland Group's corporate services business, with cost allocations divided over the various Eastland Group businesses and incorporated in Business Support allocations.

#### 2.2.12.5 Test Equipment

Key test equipment maintained by Eastland Network Limited to ensure availability when required includes:

Cable fault location equipment
Insulation testing Equipment
Voltage monitoring loggers
Protection testing Equipment
High voltage phasing equipment
Communications testing Equipment
Equipment for testing and calibration of transducers
Equipment for testing ripple injection performance
Switchgear test attachments

#### 2.2.12.6 Safety Equipment

A minimum level of Safety equipment is maintained by Eastland Network Limited at key locations to ensure availability when required. The equipment is considered as key in terms of emergency preparedness.

Equipment includes:

Personnel protective equipment
Portable earthing equipment
Barriers and Warning Signs
Specialised Lifting Equipment
Water/food storage (basic emergency preparedness)
Medical and first aid equipment
Firefighting equipment

#### 2.2.12.7 Plant and equipment

A minimum level of specialised plant is maintained by Eastland Network Limited at key locations to ensure availability when required. The equipment is considered as key in terms of emergency preparedness.

Equipment includes:

Fuel and oil Storage facilities
Fuel and oil handling equipment
Oil separation facilities to ensure environmental compliance
Survey Equipment
Cable location equipment.
Portable Generators
60Tonne Compression Tool
Specialised hand/power tools and equipment used for asset construction and maintenance.

#### 2.2.12.8 Furniture and fittings

In order to maintain the business operation Eastland Network Limited owns and utilises non network assets such as:

Office furniture, Desks Chairs
File storage facilities
Office fittings, partitioning systems and Window coverings
Food and drink preparation/storage equipment
The equipment is considered key in terms of maximising staff productivity

These assets are supplied by the Eastland Group as part of a Business Support operational expense allocation.

In general the management functions associated with these assets are carried out by the Eastland Group's Corporate Services Business.

#### 2.2.12.9 Transportation assets

Eastland Network Limited utilises a fleet of 13 vehicles to enable efficient management of the Network assets.

The vehicles utilised by Eastland Network Limited are generally specialised to meet needs associated with emergency preparedness.

Eastland Network Limited's engineering team oversees the management functions associated with these non-network assets.

Costs of these vehicles can be found in Systems Operation and Network Support costs.

## 2.3 Age & condition of assets

Eastland Network Limited approximates asset condition by age for asset categories with large populations and similar performance characteristics. The life cycle activities described in Section 5 of this AMP qualify the relevance of the age/condition approximation and ultimately determine the rate at which each asset category ages. A summary including average age and values for each asset category is shown below.

### 2.3.1 Summary of assets with values

| Asset description | Approx Qty | Unit | Avg Age | Condition Summary | RAB 2018 ($000) | Book Value 2018 |
|---|---|---|---|---|---|---|
| 01. Sub Transmission Line | 641 | km | 48 | Ageing | $2,607 | $6,115 |
| 02. Sub Transmission Poles | 2,666 | each | 35 | Average | $11,377 | $10,737 |
| 03. Sub Transmission Cable | 1 | km | 12 | Good | $9,769 | $359 |
| 04. Other Sub Transmission Assets | | | | Good | $1,464 | $1,413 |
| 05. Zone substation assets | | | | New/Good Condition | $8,978 | $9,842 |
| 06. Major Transformers | 52 | each | 43 | Average | $6,152 | $8,360 |
| 07. Distribution Line | 2,298 | Km | 49 | Ageing | $9,499 | $8,109 |
| 08. Distribution Poles | 24,745 | each | 30 | Average | $36,771 | $34,509 |
| 09. Distribution Cable | 134 | km | 26 | Above Average | $13,838 | $11,945 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 10. Distribution Substations | 3,589 | each | 25 | Average | $5,209 | $6,165 |
| 11. Distribution transformers | 3,589 | each | 25 | Average | $10,968 | $12,006 |
| 12. Switchgear | 7,231 | each | 33 | Average | $12,727 | $12,181 |
| 13. Load Control Equipment | | | | Average | $2,090 | $1,915 |
| 14. Other Distribution Assets | | | | Average | $617 | $332 |
| 15. LV Lines incl Street Lighting | 496 | km | 50 | Ageing | $2,073 | $3,588 |
| 16. LV Poles | 6,150 | each | 39 | Average | $6,642 | $5,413 |
| 17. LV Cable incl Street Lighting | 268 | km | 28 | Average | $8,535 | $9,379 |
| 18. Connection Assets | | lot | 11 | Customer Drives Upgrades | $3,172 | $3,942 |
| 19. Communications | | lot | 10 | Technology Determines Condition | $1,421 | $1,410 |
| 20. SCADA & System Control | | lot | 12 | Technology Determines Condition | $185 | $381 |
| 21. Non System | | lot | 12 | | $9,540 | $10,654 |
| **Totals** | | | 28 | | **$163,000** | **$159,000** |

## 2.4 Justification for assets

Eastland Network Limited creates stakeholder service levels by carrying out a number of activities (described in Section 5) on its assets, including the initial step of actually building assets such as lines and substations. Some of these assets obviously need to deliver greater service levels than others e.g. Carnarvon substation in industrial Gisborne has a higher capacity and security level than Tahaenui substation in rural Wairoa. Hence a greater level of investment will be required that generally reflects the magnitude and nature of the demand.

Ideally an asset can be justified if the service level it creates is equal to the service level required. In a practical world of asymmetric risks, discrete component ratings, non-linear behavior of materials and uncertain future growth rates Eastland Network Limited considers an asset to be justified if its resulting service level is not significantly greater than that required subject to allowing for demand growth and discrete component ratings.

Eastland Network Limited matches the level of investment in assets to the expected service levels required as follows:

Designs are developed by personnel with an understanding of how asset ratings and configurations create service levels such as capacity, security, reliability and voltage stability.

The asymmetric nature of under-investment and over-investment is considered in line with relevant risk factors identified in section 6.2.3 to obtain an optimum balance. i.e. Over-investing creates service levels in excess of what is needed, but under-investing can lead to service interruptions (which typically costs about 10x to 100x as much as over-investing).

Standards are used that define discrete 'sizes' of the many classes of components that need to be recognised. The use of a minimum range of standard sizes for transformers poles and conductors reduces costs associated with stock holdings and spares and maintenance, which is also factored into the overall investment cost. In some cases capacity can be staged through use of modular components.

Experienced personnel are involved to confirm predictions made to accommodate future demand growth, (noting that the ODV Handbook now prescribes the number of years ahead that such growth can be accommodated).

A key practical measure of justification is level of optimisation required in the derivation of Eastland Network Limited's ODV. The ratio of Eastland Network Limited's ODRC to DRC from Eastland Network Limited's 2009 Valuation was 0.99, with a ratio close to 1 indicating a high level of justification. In addition the levels of investment in growth performance and security between 2000 and 2007 indicate a catch up suggesting insufficient investment previously.

Areas where over investment have previously required optimisation as per ODV definitions were:

The predominant optimisation relates to Distribution Transformer capacity to obtain 0.3 demand capacity ratio. As there are a large number of small transformers in the rural network and the minimum economic size of each item is higher than that required to provide the required service levels the actual installed capacity results in a ratio lower than the allowable limit.

Some 300mm cables (Heavy) were technically optimised to 185mm (Medium) however the cost difference between the two sizes at the time of installation was so small the actual over investment had been negligible.

# 3. Service levels

## 3.1 Consumer-oriented service levels

Bex Eastland Network Limited's overriding objective in setting service levels is to deliver customer value by matching the performance of its assets and all asset activities to the performance customers expect and are willing to pay for, and the returns on investment required by the shareholder. The targets are established to reflect average performance within a benchmark group of utilities of similar size, customer density, urban/rural split, and transmission remoteness.

As part of on-going engagement with its customers, Eastland Network Limited formally surveys and consults with stakeholder and customer representative groups on an annual basis. The most recent survey was undertaken in December 2018. The primary outcome of this years' consultation process was for Eastland Network Limited to receive feedback from customers on their understanding of electricity distribution pricing and how customers would respond to potential changes to prices. Responses received are then considered by Eastland Group's management team and significantly influence the setting of service levels.

To ensure objectivity is maintained, the consultation process is undertaken by an independent consultant.

Stakeholder/customer groups included in consultation were;

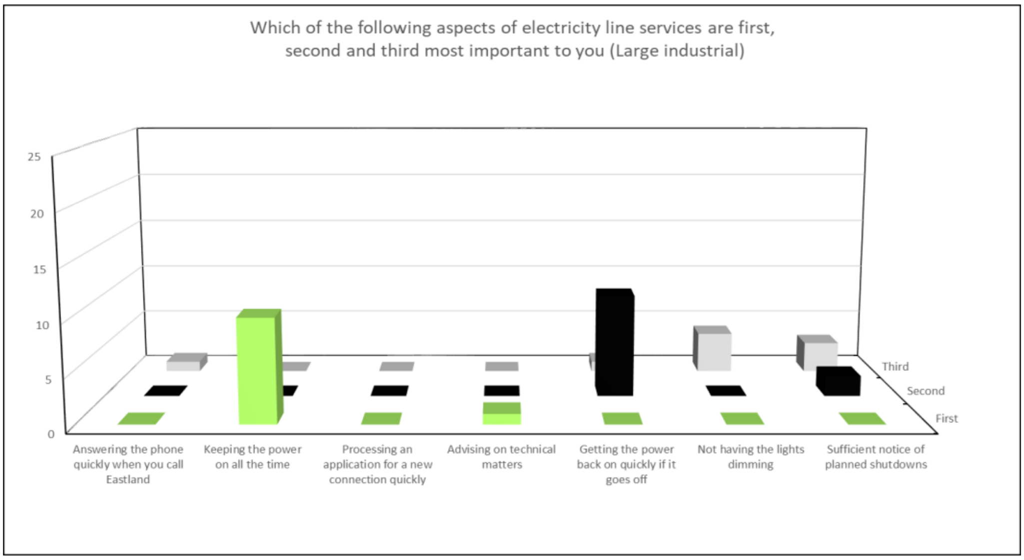
Eastland Network Limited's 25 largest customers, (by energy consumption)

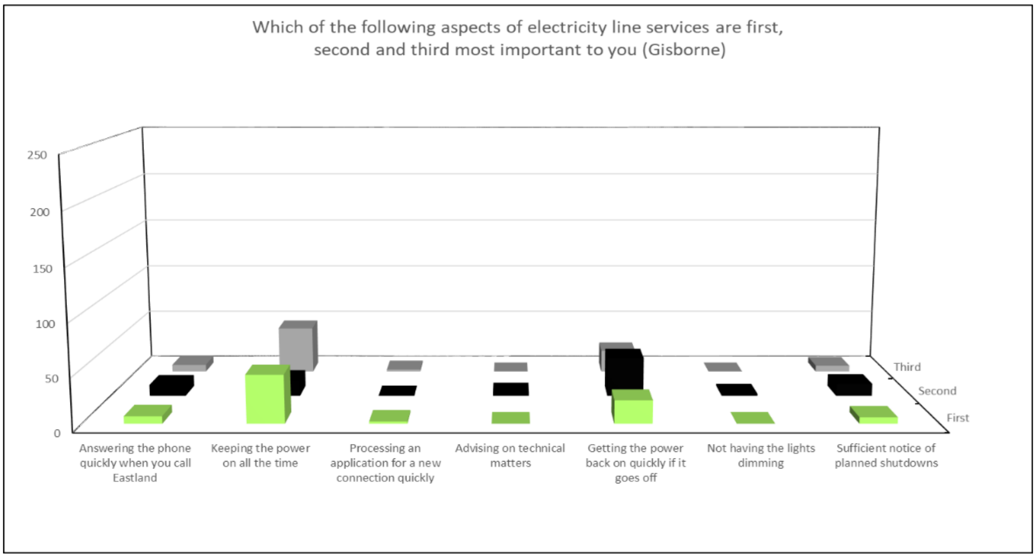
A random selection of 2%, (368), of the mass market consumers pro-rated between Gisborne (262) and Wairoa (106).

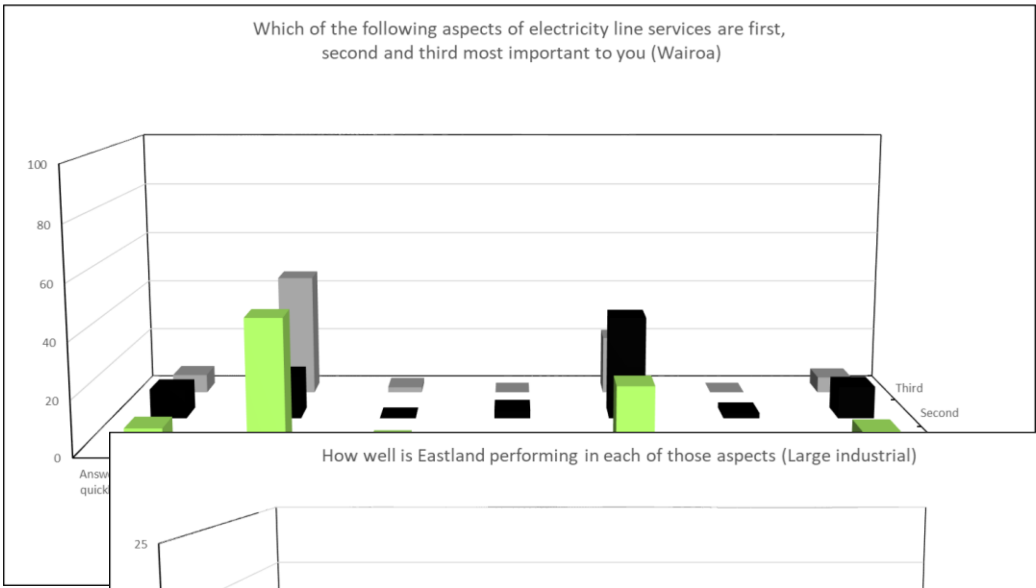
The following groups were also consulted:

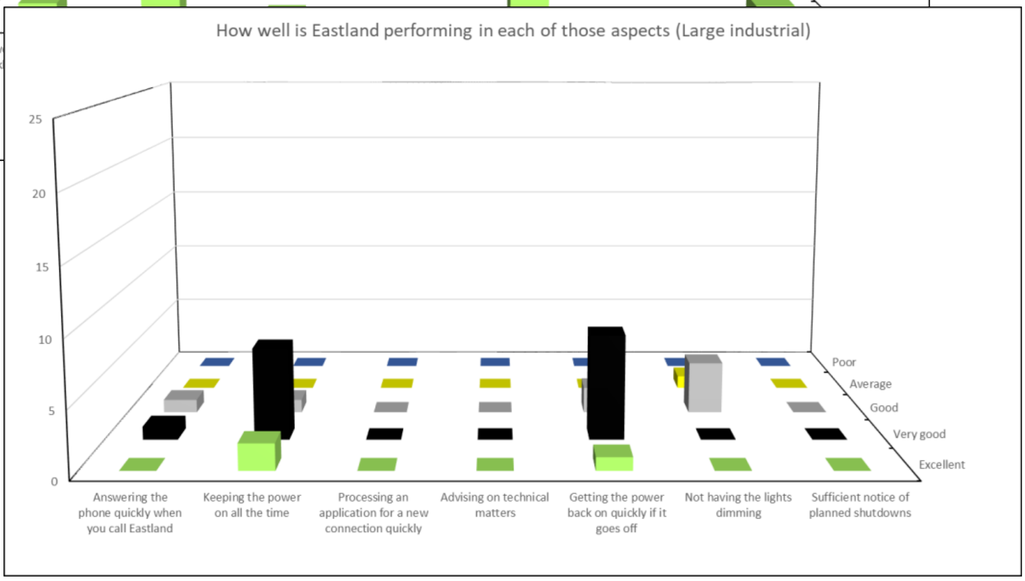
| Representative group | Interest |
|---|---|
| Activate Tairawhiti | Ensuring that economic development initiatives are supported by a reliable and reasonably priced electricity supply. |
| Gisborne Chamber of Commerce | Ensuring that the business sector's interests of reliability and reasonable prices are looked after. |
| Greypower | Ensuring that the elderly's (especially those on fixed incomes) interests of low prices are looked after. |
| Wairoa District Council | Ensuring that economic development initiatives are supported by a reliable and reasonably priced electricity supply. |
| Te Rununga O Turanganui A Kiwa | Ensuring that development initiatives are supported by a reliable and reasonably priced electricity supply. |
| Te Runanga O Ngati Porou | Ensuring that development initiatives are supported by a reliable and reasonably priced electricity supply. |
| Federated Farmers | Ensuring that the farming sector's interests of reliability and reasonable prices are looked after. |

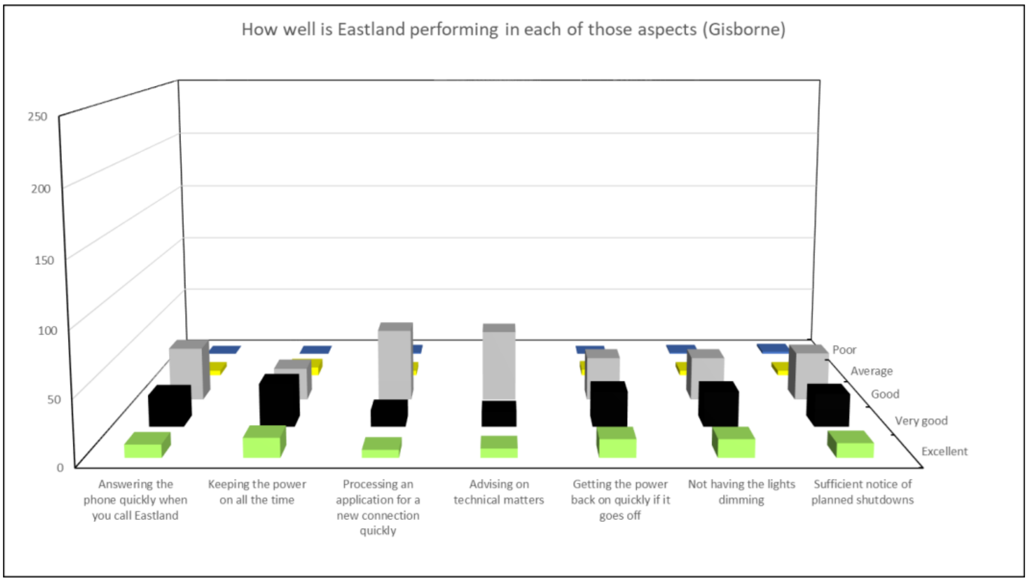
The following charts summarise the responses received from the consultation round.

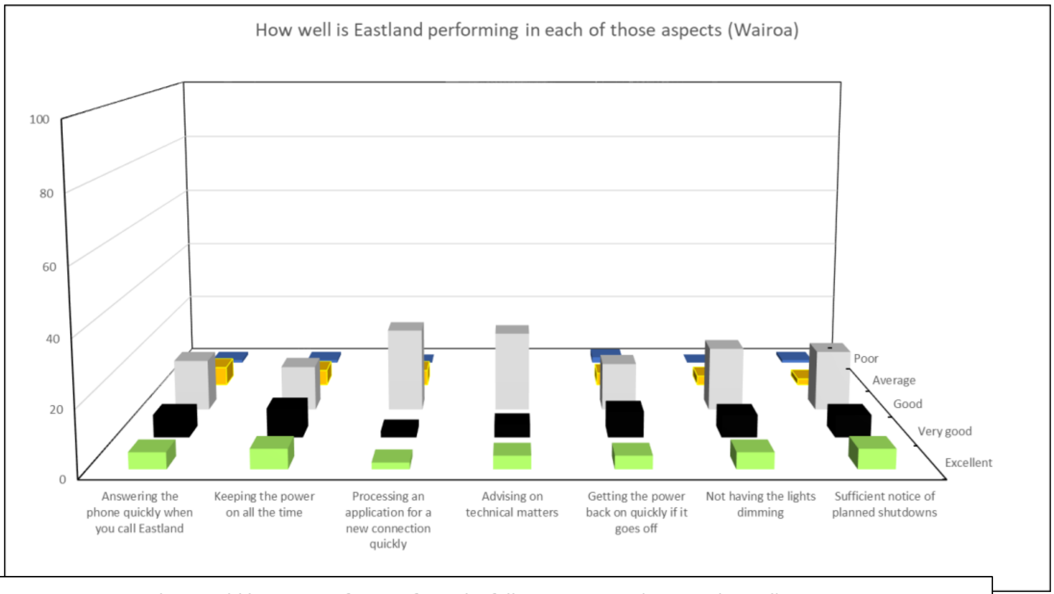

Which of the following aspects of electricity line services are first, second and third most important to you (Large industrial)
0
5
10
15
20
25
Third
Second
First
Answering the phone quickly when you call Eastland
Keeping the power on all the time
Processing an application for a new connection quickly
Advising on technical matters
Getting the power back on quickly if it goes off
Not having the lights dimming
Sufficient notice of planned shutdowns

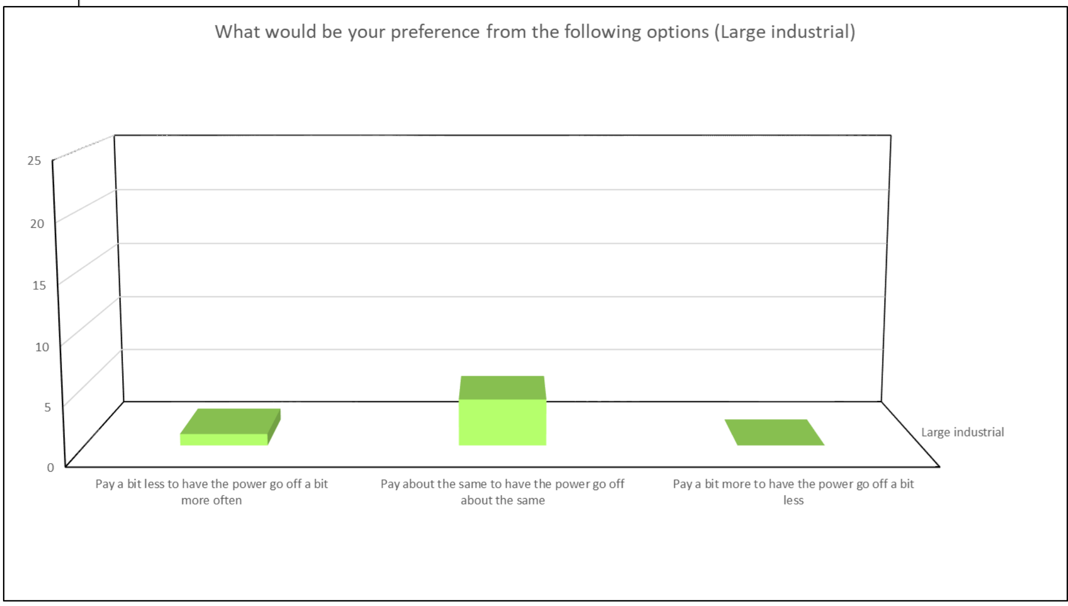

Which of the following aspects of electricity line services are first, second and third most important to you (Gisborne)
0
50
100
150
200
250
Third
Second
First
Answering the phone quickly when you call Eastland
Keeping the power on all the time
Processing an application for a new connection quickly
Advising on technical matters
Getting the power back on quickly if it goes off
Not having the lights dimming
Sufficient notice of planned shutdowns

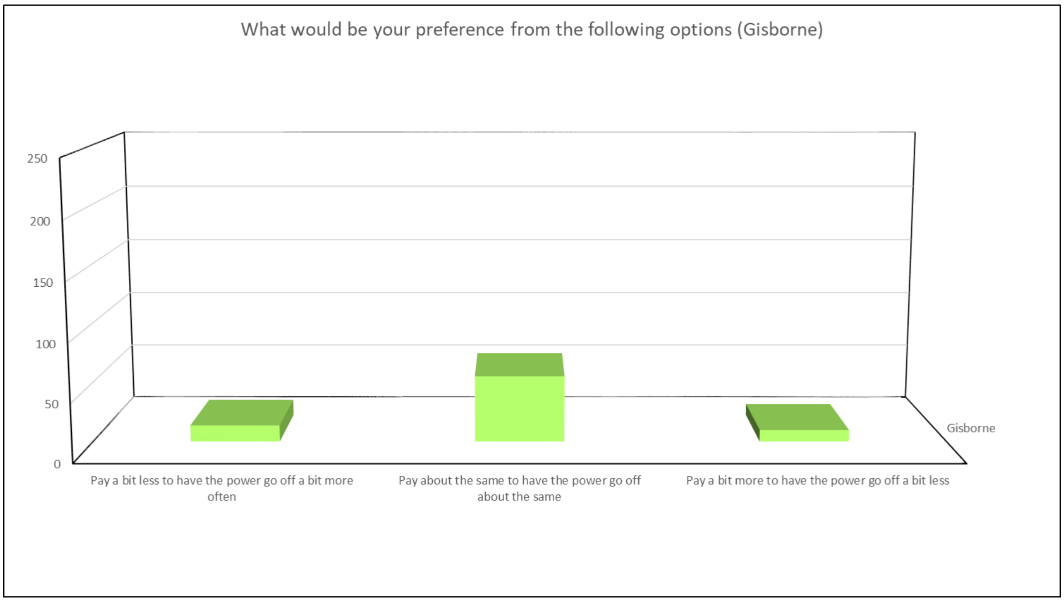

Which of the following aspects of electricity line services are first, second and third most important to you (Wairoa)
100
80
60
40
20
0
Third
Second

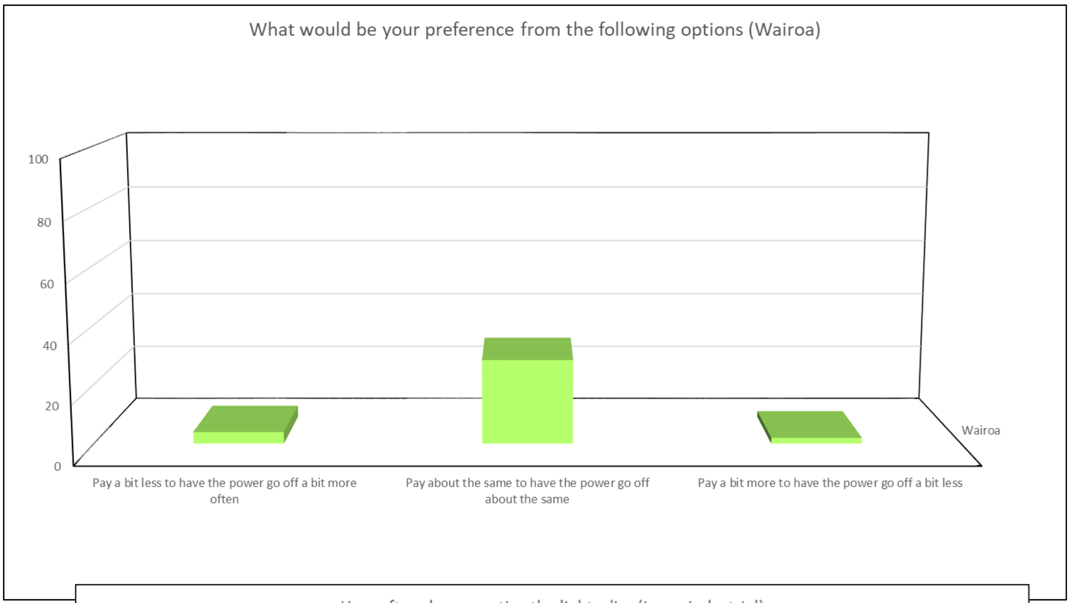

How well is Eastland performing in each of those aspects (Large industrial)
25
20
15
10
5
0
Poor
Average
Good
Very good
Excellent
Answering the phone quickly when you call Eastland
Keeping the power on all the time
Processing an application for a new connection quickly
Advising on technical matters
Getting the power back on quickly if it goes off
Not having the lights dimming
Sufficient notice of planned shutdowns

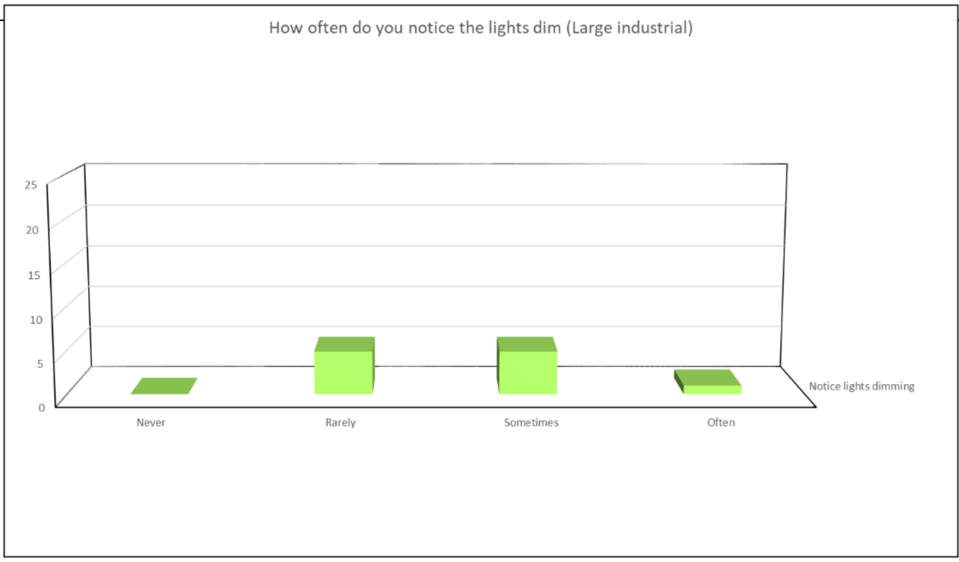

How well is Eastland performing in each of those aspects (Gisborne)
250
200
150
100
50
0
Poor
Average
Good
Very good
Excellent
Answering the phone quickly when you call Eastland
Keeping the power on all the time
Processing an application for a new connection quickly
Advising on technical matters
Getting the power back on quickly if it goes off
Not having the lights dimming
Sufficient notice of planned shutdowns

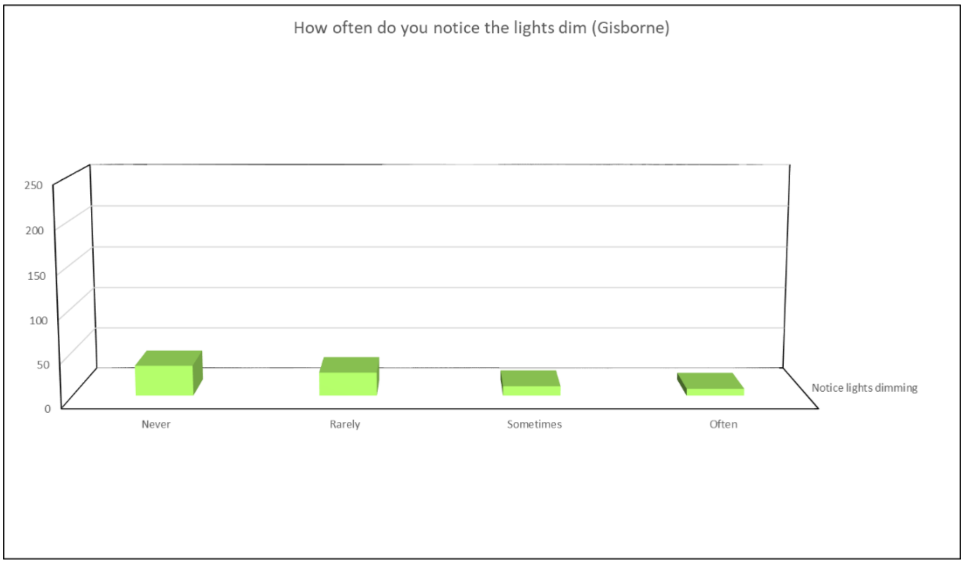

How well is Eastland performing in each of those aspects (Wairoa)
100
80
60
40
20
0
Poor
Average
Good
Very good
Excellent
Answering the phone quickly when you call Eastland
Keeping the power on all the time
Processing an application for a new connection quickly
Advising on technical matters
Getting the power back on quickly if it goes off
Not having the lights dimming
Sufficient notice of planned shutdowns

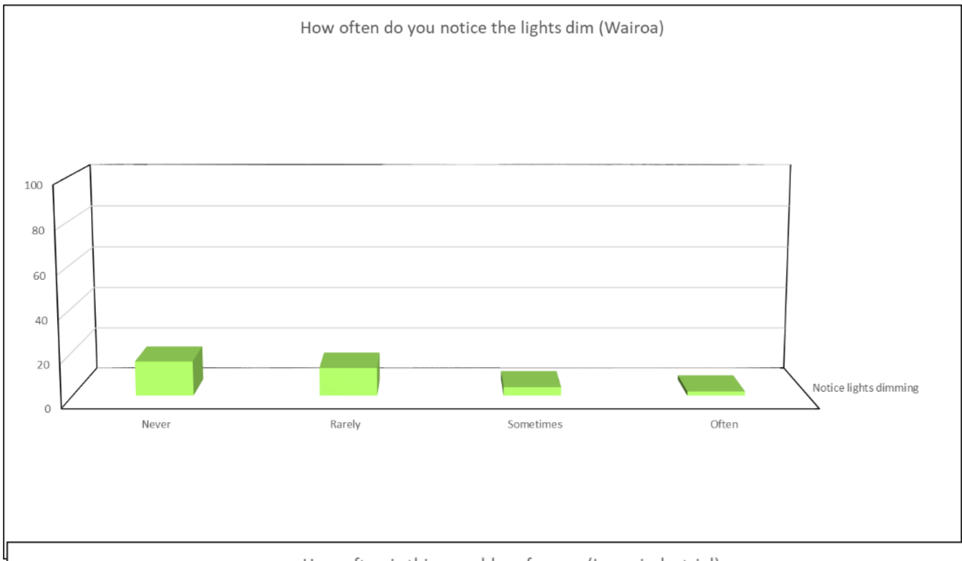

What would be your preference from the following options (Large industrial)
25
20
15
10
5
0
Large industrial
Pay a bit less to have the power go off a bit more often
Pay about the same to have the power go off about the same
Pay a bit more to have the power go off a bit less

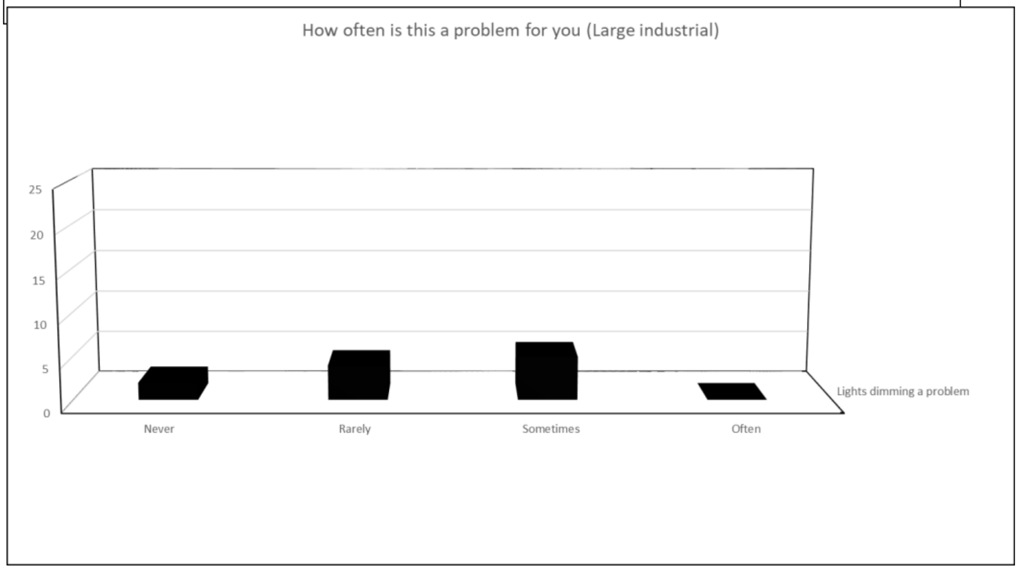

What would be your preference from the following options (Gisborne)
250
200
150
100
50
0
Gisborne
Pay a bit less to have the power go off a bit more often
Pay about the same to have the power go off about the same
Pay a bit more to have the power go off a bit less

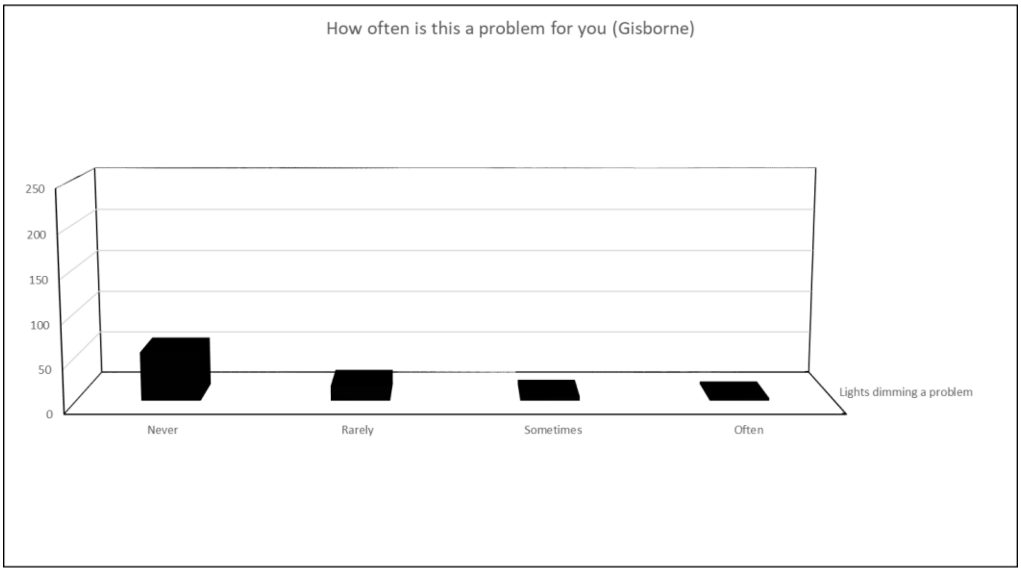

What would be your preference from the following options (Wairoa)
100
80
60
40
20
0
Pay a bit less to have the power go off a bit more often
Pay about the same to have the power go off about the same
Pay a bit more to have the power go off a bit less
Wairoa

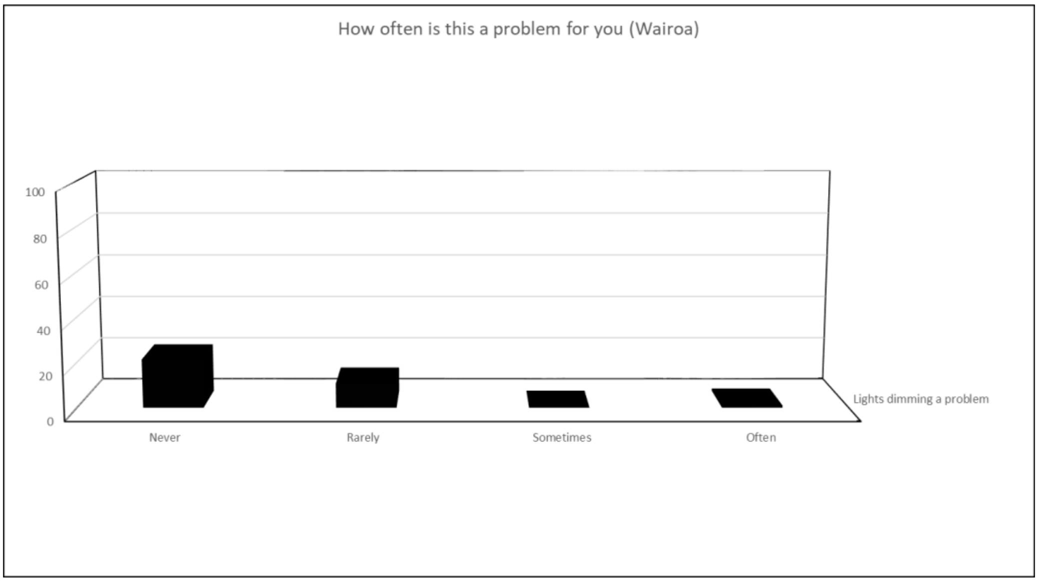

How often do you notice the lights dim (Large industrial)
25
20
15
10
5
0
Never
Rarely
Sometimes
Often
Notice lights dimming

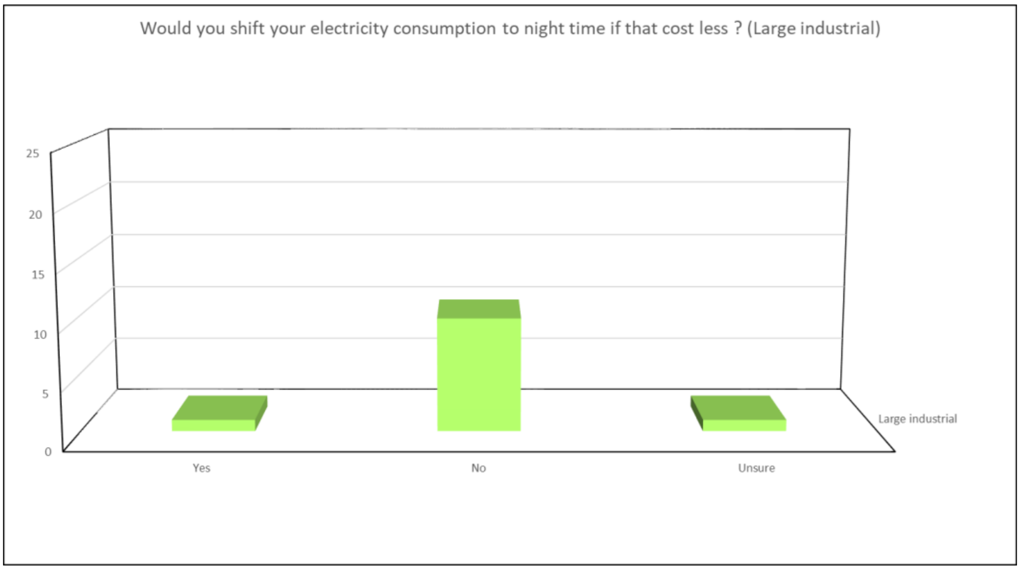

How often do you notice the lights dim (Gisborne)
250
200
150
100
50
0
Never
Rarely
Sometimes
Often
Notice lights dimming

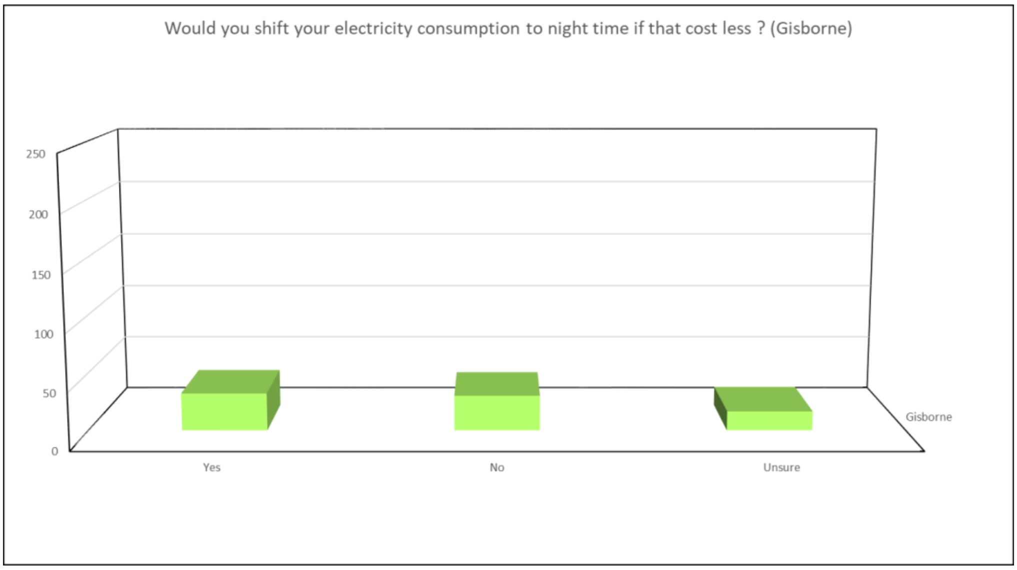

How often do you notice the lights dim (Wairoa)
100
80
60
40
20
0
Never
Rarely
Sometimes
Often
Notice lights dimming

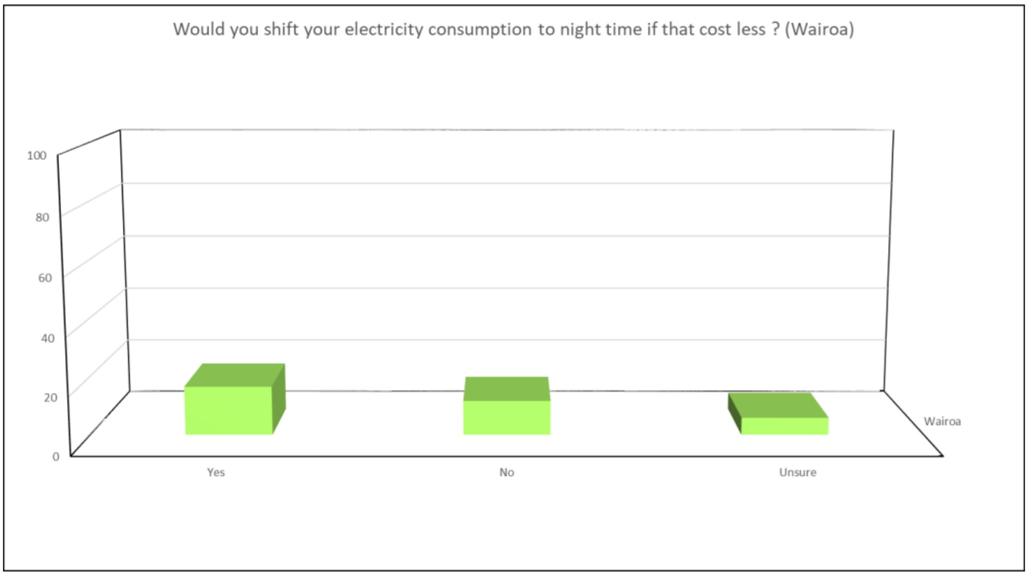

How often is this a problem for you (Large industrial)
25
20
15
10
5
0
Never
Rarely
Sometimes
Often
Lights dimming a problem

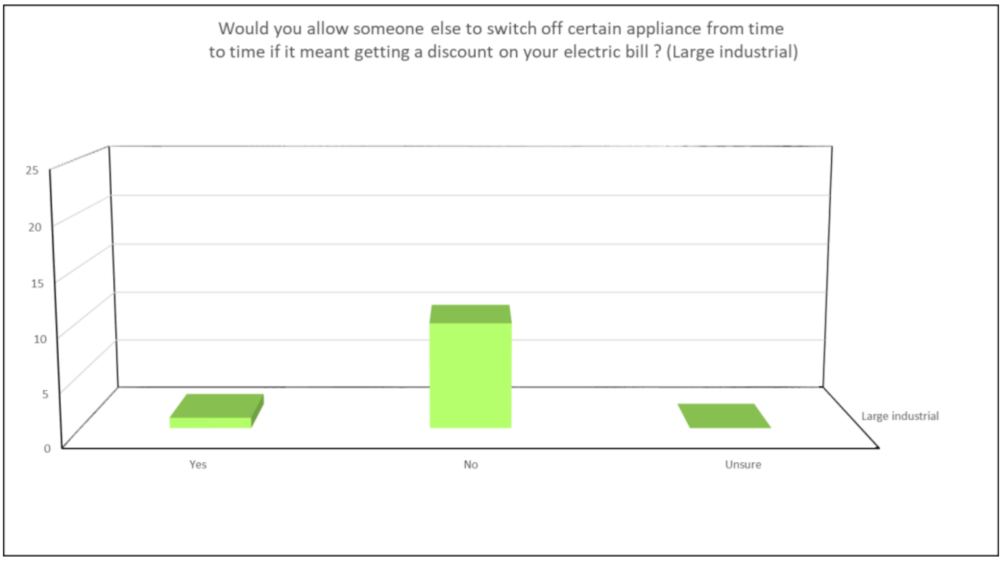

How often is this a problem for you (Gisborne)
250
200
150
100
50
0
Never
Rarely
Sometimes
Often
Lights dimming a problem

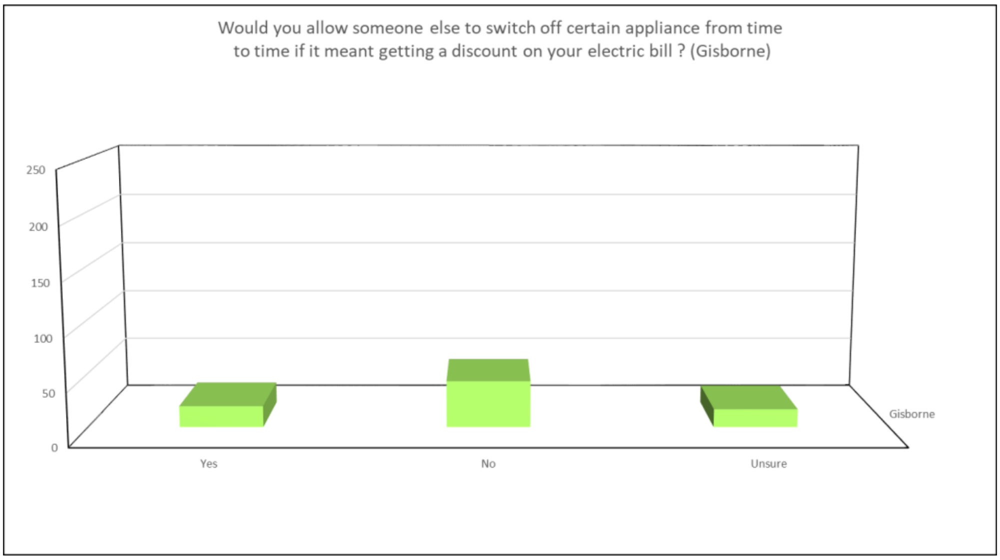

How often is this a problem for you (Wairoa)
100
80
60
40
20
0
Never
Rarely
Sometimes
Often
Lights dimming a problem

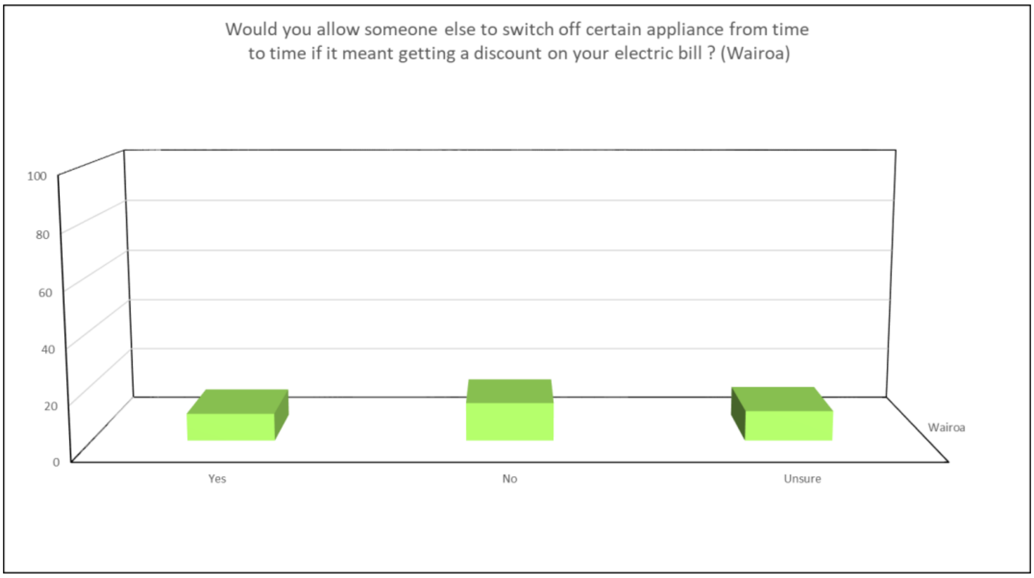

Would you shift your electricity consumption to night time if that cost less ? (Large industrial)
25
20
15
10
5
0
Yes
No
Unsure
Large industrial


Would you shift your electricity consumption to night time if that cost less ? (Gisborne)
250
200
150
100
50
0
Yes
No
Unsure
Gisborne


Would you shift your electricity consumption to night time if that cost less ? (Wairoa)
100
80
60
40
20
0
Yes
No
Unsure
Wairoa


Would you allow someone else to switch off certain appliance from time to time if it meant getting a discount on your electric bill ? (Large industrial)
25
20
15
10
5
0
Yes
No
Unsure
Large industrial


Would you allow someone else to switch off certain appliance from time to time if it meant getting a discount on your electric bill ? (Gisborne)
250
200
150
100
50
0
Yes
No
Unsure
Gisborne


Would you allow someone else to switch off certain appliance from time to time if it meant getting a discount on your electric bill ? (Wairoa)
100
80
60
40
20
0
Yes
No
Unsure
Wairoa

From the survey, Eastland Network has drawn the following conclusions:

| Aspect | Conclusions from survey | Recommendations |
|---|---|---|
| Importance of line service components. | • Continuity (keeping the power on) and restoration (getting the power back on if it goes off) continue to be the 1st and 2nd most important aspects of line services.<br>• No flicker (dimming) and sufficient notice of planned shutdowns are the 3rd most important aspects for large industrial customers. | • Continue focusing on supply continuity.<br>• Revise the planned shutdown notice process, in particular confirming that phone numbers are correct. |
| Performance in each of those line service components. | • Large industrial customers rate Eastland as very good in the 1st and 2nd most important aspects of continuity and restoration.<br>• Mass market customers seem evenly split between good and very good (with varying skews) in the 1st and 2nd most important aspects of continuity and restoration. | • Compile a time series of mass market responses to how well Eastland is performing in the 1st and 2nd most important aspects of continuity and restoration. |
| Preference for price and reliability. | • All market segments indicate a strong preference for paying about the same to have the power go off about the same. | • Continue to target the current SAIDI and costs. |
| Occurrence of flicker. | • Flicker is rarely or sometimes a problem for large industrial customers.<br>• Flicker is never or rarely a problem for mass market customers. | • Possibly show-case the success that AFFCO Wairoa seem to have had by replacing Sodium vapor lights with LED's. |
| Ability to alter consumption patterns. | • No willingness from large industrial customers to shift consumption to night time.<br>• Certainly some willingness from both Gisborne and Wairoa mass market customers to consider shifting consumption to night time. | • Consider developing a night tariff, possibly targeting heavily congested residential feeders. |

| | | |
|---|---|---|
| Preference for third-part control of appliances. | • Large customers and Gisborne mass-market customers unwilling to consider third-party control.<br>• Some willingness amongst Wairoa mass-market customers to consider third-party control. | • Any demand management program might be best targeted at the Wairoa mass-market. |

### 3.1.1 Primary customer service levels

Eastland Network Limited's customers have clearly signaled that continuity and restoration are the two operational performance attributes that they value the most and at a minimum Eastland Network Limited needs to maintain current levels of performance without increasing its line charges.

#### Operational Performance

To measure operational performance with respect to continuity and restoration, Eastland Network Limited in accordance with industry standard practice and the Information Disclosure and Electricity Distribution Threshold regimes, sets targets for the next five years against the following key indices;

SAIDI – system average interruption duration index. The measure of how many system minutes of supply are interrupted per year.

SAIFI – system average interruption frequency index. The measure of how many system interruptions occur per year.

In 2014 the Regulator completed a review of historical performance for the primary customer service levels and determined new targets for the next regulatory period 2015-2020.

The new targets have been linked to financial and future target incentives for distribution lines businesses that do not have exemptions.

The determination significantly amended the treatment of reliability performance measurement and reporting.

Three of the key changes resulting from the Default Price Path reset were:

The establishment of SAIDI and SAIFI daily boundary values derived from the past 10 years of network reliability data

The determination that outages that are planned will only count for half as much when calculating SAIDI and SAIFI totals

The introduction of cap, collar, and target SAIDI and SAIFI performance values linked to financial incentives

The incentive linked performance values were adjusted from the figures given in the determination to account for the outages of the Transmission assets being acquired; they are shown in the table below:

| Quality Measures | SAIDI | SAIFI |
|---|---|---|
| Boundary Value | 13.39 | 0.208 |
| Limit | 285.78 | 3.766 |
| Target | 252.45 | 3.277 |
| Collar | 219.13 | 2.787 |
| Cap | 285.78 | 3.766 |

As the targets have been determined based on historical performance they do not allow for changes in industry guidelines or work practices. E.g. changes in guidelines for reclosing circuits after faults may increase outage times when physical inspection of the entire line prior to re-livening is required.

With these results in mind Eastland Network Limited has forecast that the new quality targets may be exceeded and budgeted conservatively, allowing for the maximum penalty each year. This would result in an approximate $227,000 reduction in revenue each year that SAIDI and SAIFI reach their respective Cap values.

To meet the determined targets Eastland Network Limited has considered the following options:

Changes to existing design. To reduce unplanned events caused by failure of assets, the common failure modes and outage times shows that the best improvements for asset design include.

Increased levels of automation to provide fast back feed in meshed networks. Current levels of automation have been optimised to avoid over automation and additional unnecessary automation maintenance.

Replacement of rural overhead lines with underground. The investment to achieve this option is of the order of 3 or 4 times current network valve.

Development of radial networks into meshed networks. The investment to achieve this option is approximately 1.8 time the current network value.

Significant increased expenditure on tree control. The analysis of tree faults to date indicate little improvement will be made from a disproportional value investment unless tree regulations allow trees to be removed from falling distance of the lines.

Installation of standby generation on radial feeders/segments of the network. Eastland Network Limited is developing this strategy which is incorporated into plans.

Significant increases in Manpower including fault response and repair crews. Identified as an issue refer 1.5.6

Establishment of additional Depots, stock holdings and Plant to reduce repair delays. Potentially a step following option D above.

### Primary Service levels conflict

A potential conflict between the stakeholders linked to the primary service levels has emerged.

On one side of the conflict, regulated service level targets have been set to reward improvement of security standards for network designs, maintenance, response and restoration of supply.

On the other hand regulated incomes are in place which limit the rate at which improvement to the current security standards can be made. In addition results of surveys from consumers strongly indicate a preference to maintain current security levels rather than increase costs to achieve improved security levels.

Eastland Network Limited's' priority's for managing this conflict are identified in section 1.4.5.

Eastland Network Limited is committed to improvements to current and future security standards where this can be achieved within current financial criteria.

From analysis of the design standards, life cycle management, historical performance and current future strategies it is possible that Eastland Network Limited will be unable to achieve the regulated targets in each year of the next 5 year regulatory period.

In addition should Eastland Network Limited wish to increase maintenance and design changes requiring outages to implement, an insufficient margin exists within the set targets to achieve the work without exceeding the targets.

Key reliability and efficiency performance targets for the next 10 years are indicated:

| Performance Measure | Actual 2017-18 | Target 2018-19 | Target 2019-20 | Target 2020-21 | Target 2021-22 | Target 2022-23 | Target 2023-24 | Target 2024-25 | Target 2025-26 | Target 2026-27 | Target 2027-28 | Target 2028-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAIDI: B ENL Planned | 41.8 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 |
| SAIDI: C ENL Unplanned | 370.1 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 |
| SAIDI: Total (B + C) | 411.9 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 | 272.0 |
| SAIDI: ½B + C (ComCom Target) | 391.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 | 252.0 |
| SAIFI: B ENL Planned | 0.31 | 0.540 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 |
| SAIFI: C ENL Unplanned | 3.18 | 3.000 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| SAIFI: (B + C) | 3.49 | 3.540 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 | 3.54 |
| SAIFI: ½B + C (ComCom Target) | 3.34 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 | 3.27 |

If Eastland Network Limited were to set the targets to align with the forecast development program the targets set would be above the regulated targets hence the lower of the two assessments has been used.

The SAIDI and SAIFI targets are used to drive a steady state level of performance that considers network asset design, age, location, configuration, financial implications and customer expectations. Investment to improve service beyond steady state and regulated levels is seen as over investment and as such cannot be justified.

Given the relatively small asset base there is high degree of uncertainty in the validity of the forecast predictions.

Complimentary to key operational performance targets are targets for the restoration of faults which affect the supply to customers. Eastland Network Limited's targeted performance is to meet the targets as prescribed in current Use of System Agreements entered into with energy retailers. These minimum targets are;

### Fault Restoration

| | |
|---|---|
| Urban | 4 hours |
| Rural | 8 hours |

An exception to these targets can occur where private lines have failed or where hazards exist that prevent private lines from being restored, until the hazards have been corrected. This situation typically occurs where trees have encroached into the safety zone on private lines.

The control operations staff and/or faults service contractor record response times and the causes for the network outages defined by the disclosure rules, in the System Outage database which facilitates analysis and disclosure reporting. For outages that are excluded from the disclosure requirements information is recorded on the fault response documentation. An Engineering officer is responsible for reviewing the recorded figures and implementing improvements or corrective action when necessary. Comparisons of the response times are made with benchmark values to indicate trends. Outage duration and repair time components are incorporated into the performance indices for industry benchmarking.

### Line Function Services Charges

Customer consultation constantly determines that in general Eastland Network Limited's customers are satisfied with the current level of network operational performance and are unwilling to pay for improved performance. However, Eastland Network Limited is faced with three significant issues that fundamentally affect how the business will be operated and managed in the future to deliver even the minimum levels of service:

It has a network that has been identified as being relatively old, with a significant level of assets nearing the end of the lives;

Investment required to meet operational and service level challenges posed by new technologies (ie: SSDG and EVs);

On-going pressure, due to regulation with regards to maintaining businesses Return on Investment (ROI).

Eastland Network has identified a developing gap, for some asset categories, between required renewal rates to maintain asset age and current targeted rates, primarily limited by available funding. This is compounded by a distribution network that is spread over a large geographic area characterised by a low density of less than seven connections per kilometer of line.

Eastland Network Limited's service level with respect to lines charges is that lines charges need to be sufficient to provide for the correct level of investment and return on the network, which in turn allows changing customer service level requirements to be met.

Today there is an increased reliance on electricity both for the economy and the lifestyles we have become accustomed to. Consumers are changing how they use and consume electricity by embracing new technologies as costs reduce.

Historic pricing structures aare no longer relevant for the changing future of the industry. Consequently, Eastland Network is developing cost reflective/service-based pricing for introduction in 2020 which will more appropriately signal the costs that consumers place on the distribution network. It is believed that this step is critical to being able to maintain its relevance and tp ensure investment in the areas that will provide the most benefit to consumers in the future.

While it would be helpful to be able to introduce cost reflective pricing across all consumers, this will be hindered by the lack of advanced metering in the region and the reluctance of many energy retailers, (and their metering providers), to improve the current AM installation ratio of approximately 50%. Further where advanced metering is in place, Eastland Network is experiencing that reasonable access to data in a cost-effective manner is not easily achieved.

### 3.1.2 Secondary customer service levels

Secondary service levels are the attributes of service that Eastland Network Limited's consumers ranked below the attributes of supply continuity and restoration, and line function services charges. A key point to note is that most of these service levels are process driven which has two implications:

They tend to be cheaper than fixed asset solutions e.g. someone could work a few hours overtime to process a back log of new connection applications.

They are heterogeneous in nature i.e. they can be provided exclusively to consumers who are willing to pay more in contrast to fixed asset solutions which will equally benefit all consumers connected to an asset regardless of whether they pay.

The attributes of service which customers have ranked as secondary in importance and which Eastland Network Limited sets and monitors performance against targets are;

Shutdown notification and coordination.

To provide notification timing and shutdown advice in accordance with current Use of System Agreements, Eastland Network Limited has implemented the industry standard pro-forma email notification process. This process identifies affected ICPs and standardized information is emailed to relevant energy retailers. The energy retailers in turn advise their customers accordingly.

When organizing a shutdown, Eastland Network Limited directly contacts large and significant customers, (e.g. rest homes) to discuss and negotiate outage times which as much as possible are set to accommodate the preferences of those customers.

How quickly Eastland Network Limited processes Network Alteration applications for new connections, changes in required capacity or total disconnection.

How promptly and how well Eastland Network Limited provides technical advice to consumers on network asset related issues.

How promptly and how well Eastland Network Limited responds to quality of supply issues. The quality of supply is measured in terms of voltage flicker complaints, low voltage issues, harmonic content in supply, interference to telecommunication assets and radio interference.

The legislation and regulations that determine Eastland Network Limited supply quality requirements include The Electricity Act 1992, Electricity Regulations 1997 and The Commerce Act 1986.

Deviations from regulatory limits and poor supply quality levels are recorded in the network defects database as soon as they are identified. Corrective actions are carried out as soon as practicable. Issues requiring longer term supply quality improvement to the network asset are incorporated into the company design standards and management plans for the affected asset categories.

How prompt and effective Eastland Network Limited's Complaint and Dispute Resolution Process is.

Eastland Network Limited is an electricity company member of the complaints scheme administered by the Electricity & Gas Complaints Commission. Accordingly Eastland Network Limited is compliant with the

Commission's Code of Practice for Electricity Companies and its Complaint and Dispute Resolution Procedure. Eastland Network Limited performance targets are aligned with those of the Commission.

Eastland Network Limited secondary customer service level performance targets for the next 10 years are;

| Attribute | Measure | 2019-2029 |
|---|---|---|
| Notification of Planned Outages | Number of planned outages not notified to energy retailers at least 10 working days in advance. | 0 |
| | Number of individual ICP omissions or errors in outage notification to energy retailers. | 0 |
| | Number of large or significant customers not consulted directly during outage planning. | 0 |
| Processing of Network Alteration applications | Number of working days to process correctly completed applications for a new domestic or small commercial supply where infrastructure, capacity or resource consent issues do not exist. | 3 |
| | Number of working days to process correctly completed applications for load increases/decreases for existing domestic or small commercial ICPs where infrastructure, capacity or resource consent issues do not exist. | 5 |
| | Number of working days to process correctly completed applications for the installation of small scale (<10kW) distributed generation systems. | 10 |
| | Number of working days to process correctly completed FINAL applications for the installation of large scale (>10kW) distributed generation systems. | 45 |
| | | |
| Provision of technical advice | Number of working days to acknowledge inquiry. | 2 |
| | Number of working days to investigate and respond to a customer inquiry. | 20 |
| Supply Quality issues | Number of working days to acknowledge a customer reported supply quality issue and initiate an investigation. | 5 |
| Complaints Procedure | Number of working days Eastland Network Limited has to acknowledgement that a complaint has been received from a customer. | 2 |
| | Number of working days to when an unresolved dispute is deemed deadlocked. | 20 |
| | Number of working days to when an unresolved dispute is deemed deadlocked. (with Eastland Network Limited having advised that additional investigation time is required) | 40 |

### 3.1.3 Other Stakeholder service levels

In addition to the service levels that are of primary and secondary importance to consumers, Eastland Network Limited has safety and environmental management service levels that benefit stakeholders.

#### 3.1.3.1 Safety

Eastland Group is committed to providing and maintaining a safe and healthy environment for all of its employees, contractors, customers and the public.

Eastland Group's regulatory and corporate responsibilities for health & safety management across the businesses it manages are described in the Eastland Group Health & Safety Manual. This manual also determines for each business the health & safety management policies and procedures required to be implemented to meet those responsibilities. In addition a safety management system required under regulation exists to ensure specific processes are in place to ensure prevention of serious harm to the public and/or significant damage to property.

In all over 100 documents have been identified that contain compliance requirements associated with operation maintenance and reporting for the Network Assets.

The key regulations and industry codes of practice that Eastland Network Limited has a responsibility to comply with are;

Health & Safety in Employment Act 1992

Electricity (Hazards from Trees) Regulations

Maintaining safe clearances from live conductors (NZECP34:2001)

Power system earthing (NZECP35:1993)

Safety Manual –Electricity Industry

Electricity Act

Electricity (Safety) Regulations

Key elements of the Eastland Group Health & Safety Manual and Safety Management system which Eastland Network Limited implements are;

Workplace Hazard Management

Contractor Health & Safety Management

Public Safety – Asset Hazard Management

As drivers to achieve the Eastland Group safety policy standards of safety performance, Eastland Network Limited has set the following targets for every year of the planning period and beyond;

| Event / Incident Description | Target |
|---|---|
| Serious Harm Employees Contractors /Lost Time | 0 |
| Serious Harm Public | 0 |
| Serious Damage Company Property and Equipment | 0 |
| Serious Damage Public Property | 0 |
| Near Miss Harm Employees Contractors | NA |
| Near Miss Harm Public | NA |
| Near Miss Damage Company Property and Equipment | NA |
| Near Miss Damage Public Property and Equipment (HV Power faults) | NA |

Safety performance reporting to the Eastland Network Limited Board of Directors is undertaken at every monthly Board Meeting.

#### 3.1.3.2 Environmental management

In planning and undertaking activities which have implications for the environment, Eastland Group is committed to managing and operating its businesses in a manner which meets the community's environmental expectation. For Eastland Network Limited this requires a balance be met between the community's need for electricity and that of effective environmental management.

Eastland Network Limited has the environmental management performance target of full compliance with all laws, regulations, resource consent and local authority District Plan conditions.

## 3.2 Industry and Business performance targets

As a monopoly lines business Eastland Network Limited is required to disclose a range of internal performance and efficiency measures as required by the Electricity (Information Disclosure) Requirements. Eastland Network Limited aligns future performance targets against the Disclosure measures. The measures which are applied to target asset management performance are described below;

The peer/benchmark values for the industry are published annually by Price Waterhouse Coopers (refer www.pwc.co.nz)

### 3.2.1 Asset performance

Complimentary to the primary customer service levels for SAIDI, SAIFI, Section 3.1.1, Eastland Network Limited also forecasts and monitors network performance via the number of faults per 100km for both overhead and underground assets at per asset voltage category. This targeted performance for the next ten years is;

SERVICE PERFORMANCE TARGETS

| | 2018/19 | 2019/20 | 2021/22 | 2023/24 | 2025-2030 |
|---|---|---|---|---|---|
| Interruptions | | | | | |
| B Planned | 180 | 180 | 180 | 180 | 180 |
| C Unplanned | 180 | 180 | 180 | 180 | 180 |
| Faults/100km | | | | | |
| 110 kV | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| 50 kV | 3.64 | 3.64 | 3.64 | 3.64 | 3.64 |
| 33 kV | 5.81 | 5.81 | 5.81 | 5.81 | 5.81 |
| 11 kV | 12.2 | 12.2 | 12.2 | 12.2 | 12.2 |
| Total | 11.28 | 11.28 | 11.28 | 11.28 | 11.28 |
| Underground | | | | | |
| 110 kV | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 50 kV | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 33 kV | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 11 kV | 8.31 | 8.31 | 8.31 | 8.31 | 8.31 |
| Total | 8.22 | 8.22 | 8.22 | 8.22 | 8.22 |
| Overhead | | | | | |
| 110 kV | 3 | 3 | 3 | 3 | 3 |
| 50 kV | 3.66 | 3.66 | 3.66 | 3.66 | 3.66 |
| 33 kV | 14.57 | 5.82 | 14.57 | 5.82 | 14.57 |
| 11 kV | 9.95 | 12.46 | 9.95 | 12.46 | 9.95 |
| Total | 9.17 | 11.41 | 9.17 | 11.41 | 9.17 |

### 3.2.1 Financial efficiency measures

Eastland Network Limited's projected financial efficiency measures are shown below. These measures are:

Operational Expenditure per km of line

Operational Expenditure per ICP

Where operational expenditure is the expenditure incurred in the operation of the distribution business, and that is not Capital Expenditure and excludes depreciation, tax, expenditure on transmission and expenditure relating to financing the business.

| Financial Efficiency Measure | Actual 2017-18 | Target 2018-19 | Target 2019-20 | Target 2020-21 | Target 2021-22 | Target 2022-23 | Target 2023-24 | Target 2024-25 | Target 2025-26 | Target 2026-27 | Target 2027-28 | Target 2028-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Operational Expense ($/km) | $2,511 | $2,816 | $2,962 | $2,805 | $3,013 | $2,974 | $3,007 | $2,993 | $3,004 | $3,032 | $2,991 | $2,994 |
| Operational Expense ($/ICP) | $389 | $437 | $455 | $427 | $454 | $444 | $445 | $439 | $437 | $437 | $428 | $424 |

2017/18 Information Disclosure industry averages, Operational Expenditure per km = $3969, Operational Expenditure per ICP = $390/ICP.

While other measures are directly associated with performance of the network assets these targets are determined from both impacts relating to asset management activities and the impact of other strategic and business initiatives unrelated to asset management.

### 3.2.2 Energy delivery efficiency measures

Eastland Network Limited's projected energy efficiency measures are shown below. These measures are:

Load factor – [kWh entering the network during the year] / [[max demand for the year] x [hours in the year]].

Loss ratio – [kWh lost in the network during the year] / [kWh entering the network during the year].

Capacity utilisation – [max demand for the year] / [installed transformer capacity].

It should be noted that the energy delivery efficiency parameter values achieved are predominately determined by the network configuration and assets required to supply the demand profiles of customers. Over the planning period Eastland Network Limited expects to maintain a sustainable steady state position with respect to energy delivery efficiency delivery. Tactics to achieve this are described in Section 5.0.

| Energy Delivery Efficiency Measure | Actual 2017-18 | Target 2018-19 | Target 2019-20 | Target 2020-21 | Target 2021-22 | Target 2022-23 | Target 2023-24 | Target 2024-25 | Target 2025-26 | Target 2026-27 | Target 2027-28 | Target 2028-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Load Factor ENL | 60% | 58% | 55% | 54% | 54% | 54% | 54% | 54% | 54% | 54% | 54% | 54% |
| Loss Ratio ENL | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 9.5% | 109.5% |
| Capacity Utilisation ENL | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% | 23.0% |

2017/18 Information Disclosure industry averages, Load Factor = 59%; Loss Ratio = 5.6%; Capacity Utilization = 30.7%.

Loss limits are managed by regulation as upper and lower voltage limits. For the network design to supply voltage within regulated limits for the given load, the conductor size for each voltage determines transformer spacing and requiremanets for power factor correction. A network with low losses is a potential sign of over investlment while a network with high losses may have issues related to delivery within regulated limits. Note for each voltage step within the metering points used to determine losses a step in the network losses can be expected. The increase to 9.5% forecast from 2015 is due to inclusion of 110kV transmission losses following relocation of the Metering to Tuai GXP. For companies with no Transmission and Subtransmission assets the loss ratio is expected to be lower

The average load factor indicates that the load characteristic of the region is consistent with other areas.... The below average capacity utilisation reflects the low density connections using minimum size transformers that are larger than necessary. In general the results are in line with expected levels.

## 3.3 Justification of service levels

Historical trends for key service levels in Section 8 of this plan show the extent of variation between good and bad years can be in the order of 50%. While comparison of targets over a short time base may suggest little incentive is in place for improvement Eastland Network Limited has considered the entire asset life cycle and short term variance when setting the steady state targets. When the targets are aligned over a time frame equivalent to the asset life there is a significant incentive in place to improve designs and methods to improve service levels where possible.

Eastland Network Limited's service levels are justified through consideration of the following;

By what is achievable and sustainable within current revenue boundaries. This is the primary consideration affecting the ability to set and achieve marked improvement in future performance. In line with customer survey conclusions improvements to the availability and reliability of supply to customers with no increase in cost significantly limits options for improvement of the asset to a level that dramatically enhances service levels, hence performance improvement will be gradual and lower than the levels of annual variation.

By the physical characteristics and configuration of the assets which comprise the network and which are difficult and expensive to significantly alter (but which can be altered if a consumer or group of consumers agrees to pay for the alteration). As with other lines businesses Eastland Network Limited has legacy decisions which have established service levels that would require significant additional investment to alter. Examples include the use of second hand 50kV insulators in the 1960's that are now impacting on reliability and the construction of distribution lines across country as opposed to alongside accessible roads.

Through consideration of customer consultation results and the subsequent analysis to determine the customer's primary service level requirements and their agreement to pay.

Achieving compliance with all legislative and regulatory requirements that are applicable to the ownership and operation of the network. This includes when an external agency imposes a service level on Eastland Network Limited (or in some cases an unrelated condition or restriction that manifests as a service level such as requirement to place new lines underground)

When establishing performance levels Eastland Network Limited carried out a comparison against other lines businesses for the purpose of determining its desired position in the market.

Analysis and consideration of previous information disclosures published annually is undertaken to confirm Eastland Network Limited is aligned with its peers.

In general service levels have been set to maintain Eastland Network Limited in an average industry position.

# 4. Development plans

Eastland Network Limited's development plans are driven almost totally by demand but on occasions may be influenced by other drivers, primarily security of supply.

At the most fundamental level, demand is created by each individual consumer, using energy via their individual connection. The demand at each connection aggregates "up the network" to the distribution transformer, then to the distribution network, then to the Subtransmission/Zone substation, then via the sub-transmission network to the Transmission Substation/Lines to the Grid Exit Point and ultimately through the grid to a power station.

## 4.1 Planning approach and criteria

### 4.1.1 Planning unit

Eastland Network Limited has adopted the 11kV distribution feeder as its fundamental planning unit which typically represents one or perhaps two of the following combinations of consumer connections:

An aggregation of up to 1,000 urban domestic consumer connections.

An aggregation of up to 300 urban commercial consumer connections.

An aggregation of up to 20 or 30 urban light industrial consumer connections.

An aggregation of anywhere from 20 to 100 rural domestic or farm consumer connections.

A single large industrial consumer connection.

Injection of up to 5MW of generation (e.g. Waihi and the diesel generators).

Physically this planning unit will usually be based around the lines or cables emanating from an 11kV switchboard.

### 4.1.2 Planning approaches

Eastland Network Limited tends to plan development of its assets in three different ways (strategically, tactically and operationally) as shown below

:

Planning approaches

| Attribute | Strategic | Tactical | Operational |
|---|---|---|---|
| Asset description | Sub-transmission lines & cables.<br>Major substation assets.<br>Load control injection plant.<br>Central SCADA & telemetry.<br>Generation Connections<br>Distribution configurations e.g. Decision to link or divide feeders. | Minor substation assets<br>All individual distribution lines (11kV)<br>All distribution line hardware.<br>All on-network telemetry and SCADA components.<br>All distribution transformers and associated switches.<br>All HV consumer connections. | All 400V lines and cables.<br>All 400V consumer connections.<br>All consumer metering and load control assets. |
| Number of consumers supplied | Anywhere from 500 to about 7,500 | Anywhere from 1 to about 500. | Anywhere from 1 to about 50. |
| Impact on balance sheet and asset valuation | Individual impact is low.<br>Aggregate impact is moderate. | Individual impact is moderate.<br>Aggregate impact is significant. | Individual impact is low.<br>Aggregate impact is moderate. |
| Degree of specificity in plans | Likely to be included in very specific terms, probably accompanied by an extensive narrative. | Likely to be included in specific terms, and accompanied by a paragraph or two. | Likely to be included in broad terms, with maybe a sentence describing each inclusion. |
| Level of approval required | Approved in principal in annual business plan.<br>Individual approval by board and possibly shareholder. | Approved in principal in annual business plan.<br>Individual approval by Group Chief Executive. | Approved in principal in annual business plan.<br>Individual approval by GM Networks. |
| Characteristics of analysis | Tends to use one-off models and analyses involving a significant number of parameters and extensive sensitivity analysis. | Tend to use established models with some depth, a moderate range of parameters and possibly one or two sensitivity analyses. | Tends to use established models based on a few significant parameters that can often be embodied in a “rule of thumb”. |

To further guide its thinking Eastland Network Limited has developed the following "investment strategy matrix" shown in Figure 4.1.2(b) which broadly defines the nature and level of investment and the level of investment risk implicit in different circumstances of growth rates and location of growth.

***Figure 4.1.2(b) – Investment strategy matrix***

| Location of demand growth | Lo | Hi |
|---|---|---|
| Outside of existing network footprint | **Quadrant 3**<br>• CapEx will be dominated by new assets that require both connection to existing assets and possibly upstream reinforcement.<br>• Likely to absorb lots of cash – may need capital funding.<br>• Easily diverts attention away from legacy assets.<br>• Likely to result in low capacity utilisation unless modular construction can be adopted.<br>• May have high stranding risk. | **Quadrant 4**<br>• CapEx will be dominated by new assets that require both connection to existing assets and possibly upstream reinforcement.<br>• Likely to absorb lots of cash – may need capital funding.<br>• Easily diverts attention away from legacy assets.<br>• Need to confirm regulatory treatment of growth.<br>• May have a high commercial risk profile if a single customer is involved. |
| Within existing network footprint | **Quadrant 1**<br>• CapEx will be dominated by renewals (driven by condition).<br>• Easy to manage by advancing or deferring straightforward CapEx projects.<br>• Possibility of stranding if demand contracts. | **Quadrant 2**<br>• CapEx will be dominated by enhancement rather than renewal (assets become too small rather than worn out).<br>• Regulatory treatment of additional revenue arising from volume thru' put as well as additional connections may be difficult.<br>• Likely to involve tactical upgrades of many assets |

Prevailing load growth

Eastland Network Limited's current demand growth falls mainly in Quadrants 1 and 2 as follows:

### Quadrant 1

Areas such as Matawai, Raupunga, Waikaremoana and the semi-rural areas around Wairoa are quite clearly in this quadrant – there is little if any growth so investment tends to be dominated by Renewal i.e. assets "wear out" rather than get "too small". The potential for the population to decline particularly in the Wairoa District increases the risk of stranding assets.

### Quadrant 2

Areas such Makaraka, Matawhero, the Gisborne industrial estate, the Kaiti / Port area of Gisborne and the Mahia Peninsula are clearly in this quadrant – growth is high but it is largely within or very close to the existing network footprint. As Eastland Network Limited further examines in section 4.3.2 the impending forestry maturity cycle could drive very significant growth around Matawhero over the next 5 to 20 years if the logs are processed in the district instead of simply exported.

Investment in this quadrant tends to be dominated by Up-sizing rather than Renewal i.e. Assets get "too small" rather than "wear out".

## 4.1.3 Trigger points for planning new capacity

Because new capacity has ODV, balance sheet, depreciation and ROI implications, Eastland Network Limited will meet demand by other, less investment-intensive means. This discussion also links strongly to the discussion of asset life cycle in section 5.1.

The first step in meeting future demand is to determine if the projected demand will exceed any of the defined trigger points for asset location, capacity, reliability, security or voltage. These points are outlined for each asset class in Table 4.1.3(a).

If and only if a trigger point is exceeded does Eastland Network Limited then move to identify a range of options to bring the assets' operating parameters back to within the acceptable range of trigger points. These options are described in section 4.2 which also defines a preference for avoiding new investment unless a commercial return is certain.

*Table 4.1.3(a) – Summary of planning "trigger points"*

| Asset category | Location trigger | Capacity trigger | Reliability trigger | Security trigger | Voltage trigger |
|---|---|---|---|---|---|
| LV lines & cables | Existing LV lines and cables don't reach the required location. | Not applicable – tends to manifest as voltage constraint. | Operational performance/reliability outside industry stds. | Not applicable. | Voltage at consumers' premises consistently drops below 0.94pu. |
| Distribution substations | Substation is not efficiently located in relation to load. | Where fitted, MDI reading exceeds 80% of nameplate rating. | Operational performance/reliability outside industry stds. | Excursion beyond triggers specified in section 4.2.2 | Voltage at LV terminals consistently drops below 1.0pu. |
| Distribution lines & cables | Load cannot be reasonably supplied by LV configuration therefore requires new distribution lines or cables and sub. | Conductor current consistently exceeds 66% of thermal rating for more than 3,000 half-hours per year. Conductor current exceeds 100% of thermal rating for more than 10 consecutive half-hours per year. | Operational performance/reliability outside industry stds. | Excursion beyond triggers specified in section 4.2.2 | Voltage at HV terminals of transformer consistently drops below 10.5kV and cannot be compensated by local tap setting. |
| Zone substations | Substation is not efficiently located in relation to load. | Max demand consistently exceeds 100% of nameplate rating. | Operational performance/reliability outside industry stds. | Excursion beyond triggers specified in section 4.2.2 | Distribution voltage depression cannot be compensated for locally |
| Sub-transmission lines & cables | Load cannot be reasonably supplied by distribution configuration therefore requires new sub-trans lines or cables and zone sub. | Conductor current consistently exceeds 66% of thermal rating for more than 3,000 half-hours per year. Conductor current exceeds 100% of thermal rating for more than 10 consecutive half-hours per year. | Operational performance/reliability outside industry stds. | Excursion beyond triggers specified in section 4.2.2 | Voltage depression that cannot be compensated for at substations. |
| Transmission lines & cables | Load cannot be reasonably supplied by sub-transmission configuration therefore requires new | Conductor current consistently exceeds 66% of thermal rating for more than 3,000 half-hours per year. | Operational performance/reliability outside industry stds. | Excursion beyond triggers specified in section 4.2.2 | Voltage depression that cannot be compensated for at substations. |

| | | | | | |
|---|---|---|---|---|---|
| | transmission lines and Subtransmission sub. | Conductor current exceeds 100% of thermal rating for more than 10 consecutive half-hours per year. | | | |

## 4.2 Prioritisation methodology

Development projects are prioritised in the following order of precedence:

Projects to address a short fall in demand from existing connections.

Projects to re-establish security levels following increases in demand.

Projects to provide for new load at existing connections

Projects to provide for new connections.

Where development projects are linked with other work the order of precedence above is qualified by consideration of the Action Plan Priorities Ranked by Risk Reduction Outcomes assessment in section 6.2.3.

### 4.2.1 Development Options for meeting demand

Table 4.1.3(a) defines the trigger points at which the capacity of each class of assets needs to be increased. Exactly what is done to increase the capacity of individual assets within these classes can take the following forms (in a broad order of preference):

Defer while monitoring risk and simply accept that one or more parameters have exceeded a trigger point. This option would only be adopted if the benefit-cost ratio of all other reasonable options were unacceptably low and if assurance was provided to the chief executive that the option to defer did not represent an unacceptable increase in risk to Eastland Network Limited. An example of where this option might be adopted is where the voltage at the far end of a remote rural feeder is unacceptably low for a short period at the height of the holiday season – the benefits of correcting such a constraint are simply too low.

Operational activities, in particular switching on the distribution network to shift load from heavily-loaded to lightly-loaded feeders to avoid new investment or winding up a tap changer to mitigate a voltage problem. The downside to this approach is that it may increase line losses, reduce security of supply, or compromise protection settings.

Influence consumers to alter their consumption patterns so that assets perform at levels below the trigger points. Examples might be to shift demand to different time zones, negotiate interruptible tariffs with certain consumers so that overloaded assets can be relieved, or assist a consumer to adopt a substitute energy source to avoid new capacity. Currently the ability to implement Demand Side Management initiatives is somewhat hampered by lines companies not having direct relationships with end user customers.

Construct distributed generation so that adjacent assets performance is restored to a level below their trigger points. Distributed generation would be particularly useful where additional capacity could eventually be stranded or where primary energy is going to waste e.g. Waste steam from a process.

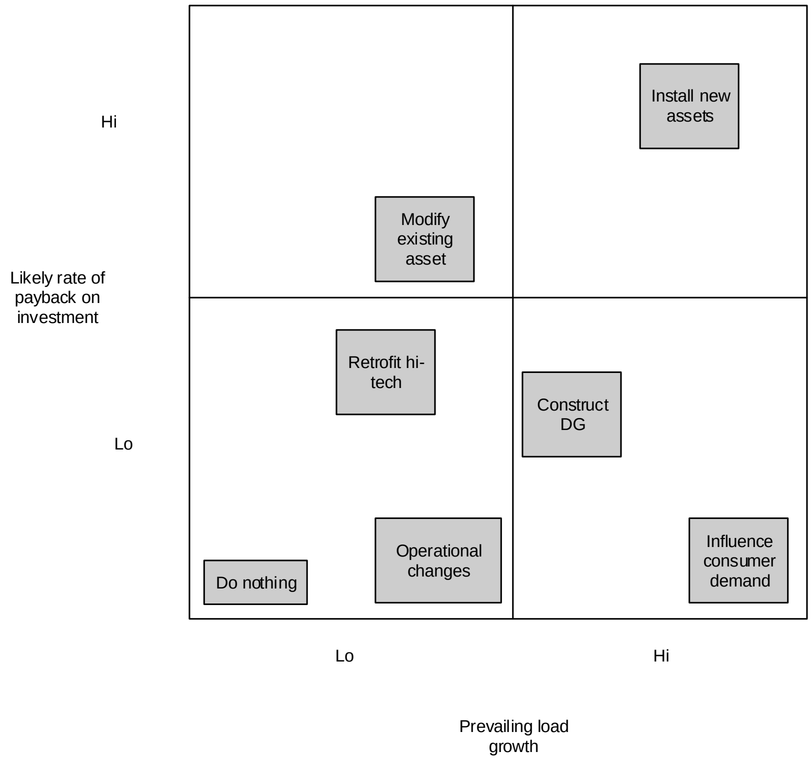
Modify an asset so that the assets trigger point will move to a level that is not exceeded e.g. by adding forced cooling. This is essentially a sub-set of the above approach, but will generally involve less expenditure. This approach is more suited to larger classes of assets such as 50/11kV transformers.

Retrofitting high-technology devices that can exploit the features of existing assets (including the generous design margins of a bygone era). Examples might be using remotely switched air-breaks to improve reliability, or using advanced software to thermally re-rate heavily-loaded lines.

Install new assets with a greater capacity that will increase the assets trigger point to a level at which it is not exceeded. An example would be to replace a 200kVA distribution transformer with a 300kVA so that the capacity is not exceeded.

In identifying solutions for meeting future demands for capacity, reliability, security and voltage Eastland Network Limited considers options that cover the above range of categories. The benefit-cost ratio of each option is considered (including estimates of the benefits of environmental compliance and public safety) and the option yielding the greatest benefit is adopted. Eastland Network Limited uses the model in figure 4.2.1(a) to broadly guide Eastland Network Limited's adoption of various approaches:

***Figure 4.2.1(a) – Options for increasing capacity***




### 4.2.2 Development options for meeting security requirements

A key component of security is the level of redundancy that enables supply to be restored independently of repairing or replacing a faulty component. Typical approaches to providing security to a zone substation include:

Provision of an alternative sub-transmission circuit into the substation, preferably separated from the principal supply by a bus-tie.

Provision to back-feed on the 11kV from adjacent substations where sufficient 11kV capacity and interconnection exists. This obviously requires those adjacent substations to be restricted to less than nominal rating.

Use of local generation.

The most pressing issue with security is that it involves a level of investment beyond what is obviously required to meet current demand. In general it is necessary to allow increases in demand to erode security levels beyond trigger levels thereby increasing risk, then invest in new asset to restore the security levels and allow for future growth. Hence demand growth and security essentially overlap throughout the development cycle.

#### 4.2.2.1 Prevailing security standards

The commonly adopted security standard in New Zealand is the EEA Guidelines which reflect the UK standard P2/5 that was developed by the Chief Engineer's Council in the late 1970's. P2/5 is a strictly deterministic standard i.e. It states that "this amount and nature of load will have this level of security".

Deterministic standards have largely given way to probabilistic standards in which and the failure rate of supply components is estimated to determine the impact on performance targets providing comparative investment levels between multiple projects, to avoid interruption. The disadvantage of this approach is that, in terms of investment cost to performance improvement, investment in remote groups of connections rather than a single large industrial connection is favored. This is balanced by weighting the decisions based on the importance of the load to the wider community e.g. Pumps, Hospitals and Schools and the contribution/income provided by the large single customer loads. The risk matrix approach shown in section 6.3 is used to assess or balance the decisions relating to security standards.

#### 4.2.2.2 Issues with deterministic standards

A key characteristic of deterministic standards such as P2/5 and the EEA Guidelines is that rigid adherence generally results in at least some degree of over investment.

#### 4.2.2.3 Contribution of local generation to security

To be of any use from a security perspective, local generation would need to have 100% availability which is unlikely from a reliability perspective and even less likely from a primary energy perspective such as run-of-the-river hydro, wind or solar. For this reason the emerging UK standard P2/6 provides for minimal contribution of such generation to security.

#### 4.2.2.4 Eastland Network Limited's security standards

Eastland Network Limited's security standards below provide the base security criteria applied to all network design.

| Class | Range of group peak demand (GPD) MVA | No. of customers effected | Security Level | Contingent Capacity | Time to restore after 1st event | Time to restore after 2nd event |
|---|---|---|---|---|---|---|
| D | More than 25MVA i.e. transmission, or sub-transmission rings. | 15,000 or more | n-1 | 100% | Maintain 100% GPD less 12MVA. Remaining 12MVA restored within 3 hours. | Repair time. |
| C | Between 12 and 25 MVA i.e. small GXP, primary CBD & urban substations | 7,000 to 15,000 | n-1 | 100% | Maintain 100% of GPD. | Restore 90% of GPD within 3 hours and remaining 10% in time to repair. |
| B1 | Between 6 and 12 MVA i.e. Primary urban or industrial substations. | 3,500 to 7,000 | n | 100% | Restore 75% of GPD within 15 min, restore 90% within 3 hours, and remaining 10% in time to repair. | Within 3 hrs. restore 90%, repair time 100% |
| B2 | Between 3 and 6 MVA i.e. single transf subs and urban meshed feeders | 1,750 to 3,500 | n | 80% | Restore 75% of GPD within 30 minutes, 90% within 3 hours and remaining 10% in time to repair. | Restore 100% in time to repair. |
| B3 | Between 1 and 3 MVA i.e. rural zone substation, meshed feeders. | 500 to 1,750 | n | 67% | Restore 50% of GPD within 1 hour, 90% within | Restore 100% in time to repair. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | 3 hours, and remaining 10% in time to repair. | |
| A | Less than 1MVA i.e. rural feeders, urban spurs, distribution transformers | Less than 500 | n | Note 1 | Restore 100% in time to repair. | Restore 100% in time to repair. |

Note 1 - refer to Eastland Network Limited's Customer Service Standards for LV Network backup, dual distribution transformer capacity or temporary supply criteria. Temporary options include construction of prefabricated OH lines, HV or LV flexible surface jumpers or 300kVA generator supplies.

The following table confirms that Eastland Network Limited's target security levels are being met at Major substation level, for the forecast loads over the planning period:

| Sub. | Applicable security level | Projected 2021/22 load | Additional provision for security |
|---|---|---|---|
| Gisborne Transmission Substation | D | Load is projected to exceed the 110kV line around 2018 in shoulder periods. Transformer capacity is not forecast to be exceeded until 2023 | Further detailed investigation is planned in respect of the actual level of security and capacity provided by the 110kV lines. |
| Carnarvon Substation | C | Load well within 11kV back-feeding capacity from Parkinson & Port. | None required |
| JNL Substation | B1 | Load within 11kV support capacity from adjacent Matawhero and Parkinson Substations. | None required |
| Kaiti Substation | C | Load within 11kV support capacity from adjacent Port Substation. | Possibility that in the long term not all Kaiti load could be back-fed on the 11kV from Port. Single transformer is a recognised point of weakness. |
| Makaraka Substation | B1 | Expected load not expected to exceed transformer capacity | In Medium term opportunities to provide additional support capacity from Matawhero/JNL are a consideration. |
| Matawhero Substation | C | Expected load well within capacity | None required |
| Ngatapa Substation | B3 | Expected load well within capacity | None required |
| Parkinson Substation | C | Expected load well within capacity | None required |
| Patutahi Substation | B1 | Expected load well within capacity of either transformer. | None required. |
| Pehiri Substation | B3 | Expected load well within capacity | None required. |
| Port Substation | C | Expected load well within capacity | None required. |
| Puha Substation | B2 | Expected load within capacity but only 1 transformer | Security provisions will be required potentially from Ngatapa |

| | | | |
|---|---|---|---|
| Ruatoria Substation | B3 | Expected load well within capacity of diesel generator and 11kV back-feeding capability. | None required. |
| Te Araroa Substation | B3 | Expected load can be totally supplied by diesel generator. | None required. |
| Tokomaru Substation | B3 | Expected load well within capacity of diesel generator and 11kV back-feeding capability. | None required. |
| Tolaga Substation | B3 | Expected load well within capacity of diesel generator and 11kV back-feeding capability. | None required. |
| Blacks Pad Substation | B3 | New substation planned | Sub-transmission development. |
| Wairoa Substation | C | Load is project to exceed transformer firm capacity by 1MW in 2015 under an n-1 scenario | The current load can be managed operationally via load control and generation. The Wairoa assets are approaching end-of-life and are being scheduled for replacement and additional capacity will be provided at this time. |
| Kiwi Substation | B2 | Expected load will require reconfiguration | Upgrade feeder assets. |
| Tahaenui Substation | B3 | Expected load well within capacity | None required. |
| Waihi Substation | B2 | Expected load within capacity | None required. |
| Tuai Substation | A | Expected load will never merit any alternative supply other than the possibility of re-locating a diesel generator if an outage looked prolonged. | None required. |

#### 4.2.2.5 Guiding Eastland Network Limited's security policy

The following philosophies are fundamental to meeting Eastland Network Limited's security standards in the design of any network component:

Eastland Network Limited's network is a low density, lightly loaded, distribution network. In a network of this character the provision of security via full redundancy can rarely be justified, is not cost efficient, and does not offer the best fault tolerance.

Having said that, the preferred method of providing contingency supply will be via excess capacity in adjacent network components.

Transformer loading for both zone and distribution transformers shall comply with IEC 354 which permits short duration overloads beyond nominal ratings under specified ambient and cyclical conditions.

Alternative supply options will be built at the lowest voltage practical due to better inherent fault tolerance and flexibility with respect to interconnection.

Cables will not be loaded into duty cycle levels of loading. Legacy jointing practices and installation design do not provide for this mode of operation.

Preference will be given to ring design for an alternative route instead of double spur circuits.

In rural spur networks the density of isolation points will be used to localize the effects of faults, to achieve customer service standards.

#### 4.2.2.6 Specific security provisions

Transmission and Sub-transmission

(n-1) circuit security will be provided for all lines, cables, and equipment where loading exceeds 12MVA.

Breakers' will be rated at 2x expected max demand to enable carrying of adjacent feeder loads.

33kV and 50kV CB's shall only be fitted with bypassing arrangements when supplying a spur line. This is to allow maintenance or repairs with the substation(s) on-line.

Transmission/Subtransmission Substations

Transformer loading is to comply with IEC354. This permits overloading beyond nominal ratings under specified ambient and cyclical conditions. Thus the duration of restoration following a first interruption will result in no ageing beyond design provisions. Overloading of transformers such that ageing occurs will only be permitted for a second contingent event of up to 1 hour.

Loading shall never exceed 120% of the transformers design rating or the lesser of limits imposed by cabling.

All connections and auxiliary equipment shall be rated for continuous operation at maximum load levels.

Transformers will be rated to support a minimum of half the loading of neighboring zones.

Installation of forced or assisted cooling will be used in preference to dual transformer installations or capacity upgrades where overload is required beyond IEC354 for contingent events.

Substations carrying normal load in excess of 12MVA will be of dual transformer designs if it is unlikely that neighboring substations or feeder circuits will be able to support that substation after allowing for 10 years growth.

11kV switch panels will have a split bus arrangement where maximum demand is likely to exceed 6MVA. In single transformer substations the incomer and the tie line to the adjacent substation shall be connected on opposite sides of the bus-tie. This ensures that at least one side of the 11kV bus can be energised.

Urban 11kV feeder CB's shall not be normally loaded beyond 4MVA to allow sufficient capacity to pick up 2MVA from an adjacent feeder. The tie feeder between Carnarvon St and the Port area requires an 8MVA rating.

Feeder cables from CB's must be rated to match CB excess capacity requirements which will typically be 6MVA in the urban, CBD or industrial area. In rural areas feeder cables shall be rated to 3MVA.

All feeder circuits must have a tie switch external to the substation to another circuit from the opposite side of the bus or ties to a feeder from an adjacent substation.

Distribution

11kV circuits provide security via excess capacity, interconnection and isolation ability i.e. the focus is on restoration speed and contingency provision as opposed to un-interruptible supply. Generally excess capacity and provision of mobile generation provide LV circuit security. In key commercial and industrial areas LV interconnection may be appropriate. Generally the installation of remote or automatically operated equipment shall be governed by the response times determined in section 4.2.2.4.

11kV pad mounted switchgear provisions:

No more than 3 transformers supplied from 1 switchboard without bus section.

Not more than 1MVA fed from switchgear supplied from a single cable circuit (excluding industrial situations).

No more than 1MVA of installed transformers and associated switchgear cascaded with no back feed.

Not more than 1 cable circuit connected directly to the bus of a switchboard arrangement.

In rural areas an air break switch will be installed to provide an isolation point every 50 customers or 25km of downstream circuit.

Cables will be designed with 33% excess capacity to enable sharing of half the load of the connecting circuit where there are two alternative supply routes.

Where overhead lines have back-feed capability they will be permitted to operate to 120% capacity in emergencies. Therefore they will be designed for sag and clearances appropriate to the maximum conductor operating temperature rather than 50$^{o}$C provided this does not exceed 75$^{o}$C.

Lines will not be permitted to have more than 2% losses at installation.

Spur assets (lines, cables, transformers) that cannot be supported via the LV network will have provisions for backup generator connection if normal loading exceeds 200kVA.

Distribution transformers (less than 1,000kVA) will be permitted to overload to the ratings of IEC354.

In commercial and industrial areas:

General distribution transformers will normally be 200-300kVA units. All cables will be rated to allow loading of the transformer to 120%. This would provide overload capacity for 6 hours in winter peak areas at 20$^{o}$C (10 hours at 10$^{o}$C) and for 3 hours in summer peak areas at 30$^{o}$C given an initial loading at 80%. Actual load profiles for a given transformer where initial loading is less than 80% will enable extension to the period of overload.

LV interconnection where viable will be sized to allow for an out of service condition of an intermediate transformer. Where LV-interconnected, transformers should not exceed (other than for short duration's of less than 1 hour) 80% of their rating under normal operating conditions.

LV runs from transformer to an open tie point should not exceed 200m (400m from transformer to transformer).

Loads in industrial areas greater than 50kVA should have a dedicated LV feed.

In urban domestic supply areas including small commercial areas located predominantly within an urban area:

Transformer size should be standardised to 200kVA in winter peak areas with cables rated to allow loading of the transformer to 133% and to 300kVA in summer peak areas with cables rated to allow loading of the transformer to 100%.

Each LV feeder should not be supporting more than 25 domestic supplies assuming an ADMD of 3kVA.

LV interconnection would normally only be provided where a small commercial shopping center is located within a predominately urban area. 300kVA transformers may be required.

Provision of quick mobile substation connections to the LV is preferred to the provision of LV interconnection.

Transformers must be able to be isolated from LV bus bars via incomer links where LV interconnection to another transformer is provided.

#### 4.2.3 Development Funding

There are a number of options available to ensure Eastland Network Limited is able to fund and resource development projects. Typically new load and network extension projects are funded by the requesting company or developer who has the option of selecting local or national resources to establish the required assets. This arrangement usually applies to projects in categories 3 and 4 above and in some cases to category 2 hence the likelihood that Eastland Network Limited will be faced with insufficient funding or resources to achieve projects in category 1 is very low. Should the rate of development ever increase beyond Eastland Network Limited's capabilities then deferral of new load is a final option.

### 4.2.4 Choosing the option

The level of analysis is guided by the bottom row of Table 4.1.2(a). In particular, the underlying principles will be reused for sufficiently similar circumstances, whilst for new situations previous principles with suitable modifications are applied.

Broadly the cheapest option that meets minimum consumer needs, safety and environmental standards and revenue constraints will be chosen and modified to suit particular circumstances such as likely future load growth. The asset management risk assessment tool (refer 6.2.3) is used to determine the relative priority of both development options and renewal plans in terms of activity category and identified projects.

## 4.3 Demand forecast

### 4.3.1 Current demand

Eastland Network Limited's current after diversity maximum demand (ADMD) for the 2017/2018 financial year was 58.659MW. This demand is disaggregated to the Gisborne and Wairoa Region demands below.

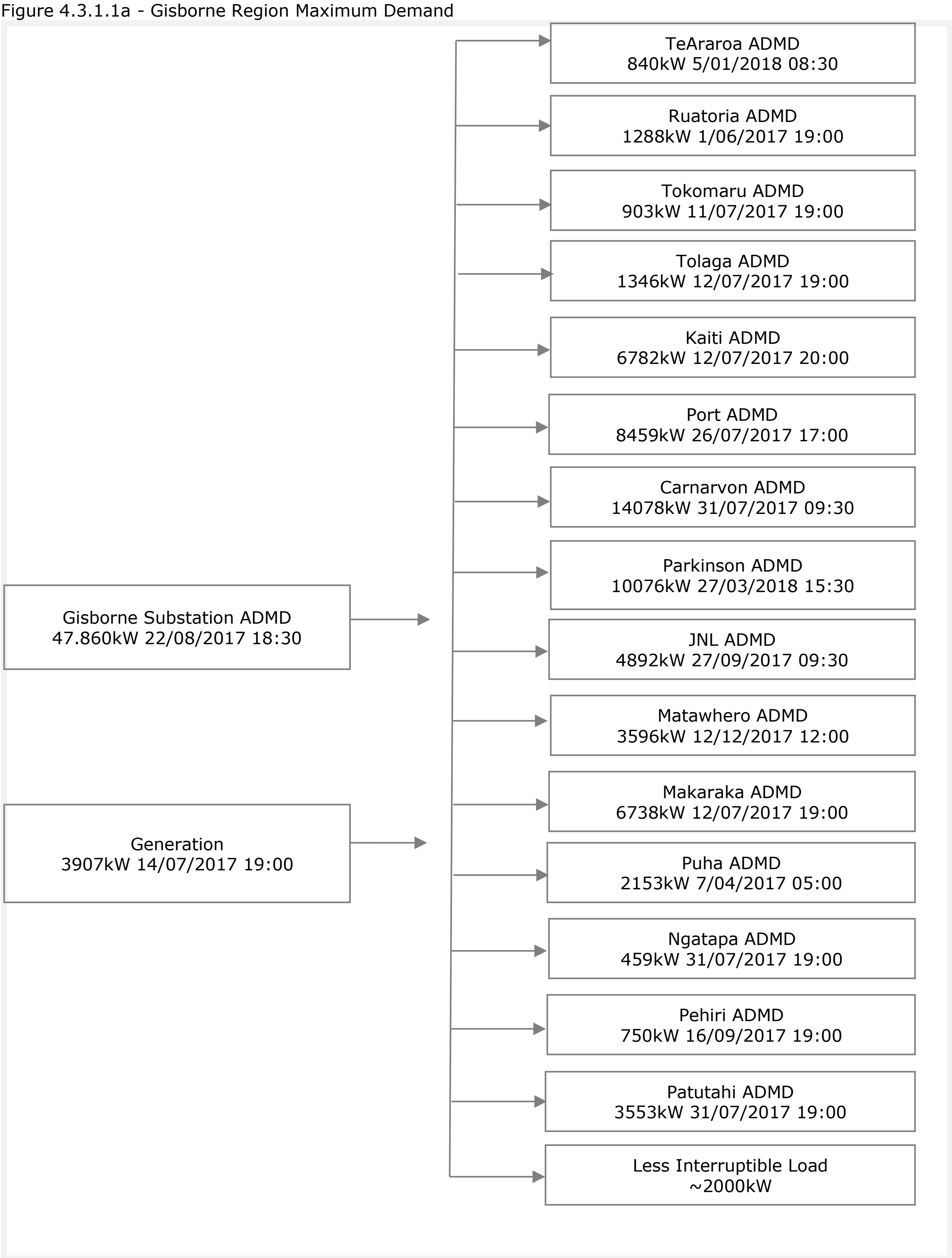
The system demand figures including embedded generation are-

| | |
|---|---|
| Gisborne Region | 49.772 MW 22/8/2017 18:30 |
| Wairoa Region | 9.987MW 1/8/2017 09:00 |
| System Total | 58.659MW 13/7/2017 18:00 |

#### 4.3.1.1 Gisborne Region

The current after diversity maximum demand (ADMD) in the Gisborne Region for the 2017/2018 financial year was 49.772 MW. This demand is disaggregated in Figure 4.3.1.1(a).

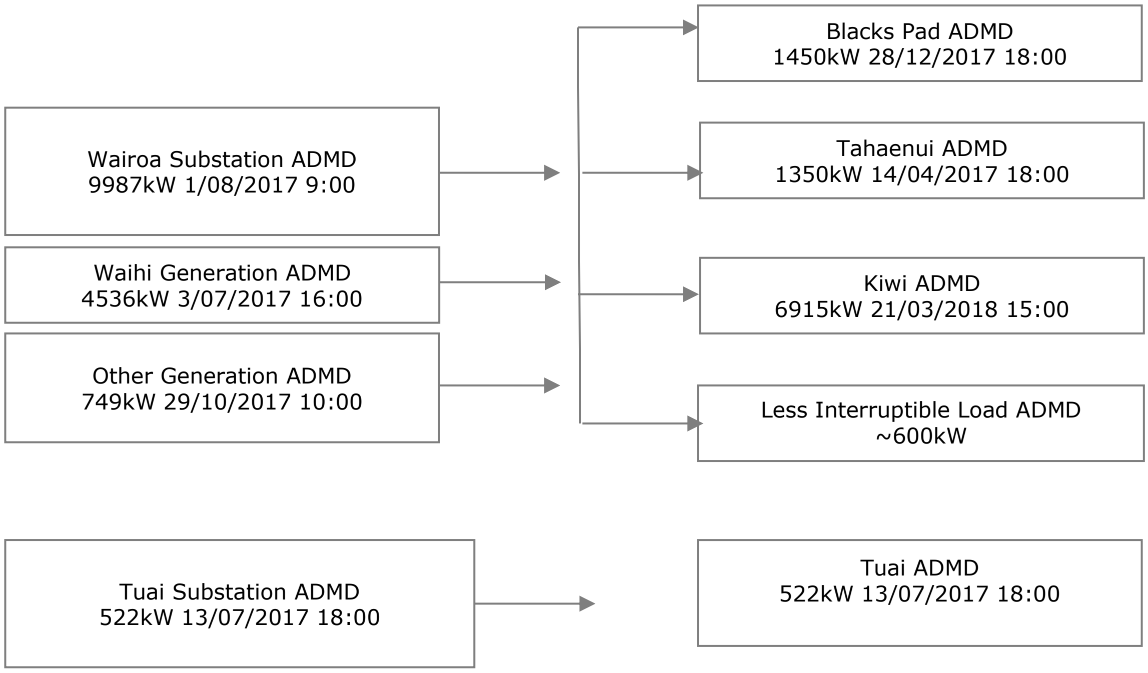
Figure 4.3.1.1a - Gisborne Region Maximum Demand




### 4.3.1.2 Wairoa Region

Eastland Network Limited's current after diversity maximum demand (ADMD) for the Wairoa Region 2017/2018 financial year was 9.987MW, which is disaggregated in Figure 4.3.1.2(a).

Figure 4.3.2.1a – Wairoa Maximum Demand




#### 4.3.1.3 Demand Management Initiatives

The main initiatives that have had a measurable impact on the Gisborne and Wairoa Substations is the use of embedded generation.

Use of embedded distributed generation has reduced the GXP peak demand by 10MW at the GXP. Given the installed capacity of generation totals 13MW this indicates less than 65% of the generation potential was able to be realised.

Use of load control to manage demand is likely to have contributed less than 2MW of reduction to the total peak demand. As metering equipment is not setup to measure the demand that wasn't supplied the measurement of load control demand effectiveness can only be determined by extrapolation of the daily demand profile curves (refer section 4.7.1.3) over the flat area for times where load control was active.

Demand management initiatives that do not have a measurable impact are generally undertaken by customers with external Energy consultants providing the technical expertise. As Eastland Network Limited wishes to encourage any initiatives no notification barriers are imposed on the activities. Hence Eastland Network Limited is often not advised of activities been undertaken. Examples of three initiatives Eastland Network Limited is aware of are:

Replacement of the compressor drives with variable speed drives on Eastland Groups cool store. This initiative produced only a slight demand reduction but the reduction in energy usage was of the order of 20%.

Solar hot water cylinder upgrades at TePuia Springs. This project involved the installation of a solar hot water system with traditional element backup. While there was a resulting reduction in energy usage there was an increase in demand as the original hot water cylinders with 1kW elements were replaced with cylinders containing 3kW backup elements. As the backup elements are typically needed at times coincident with the maximum demand the expectation of reduced demand was not realised.

The Mahia Sewage scheme was installed in 2013. The scheme uses small pumps on each installation to take advantage of diversity and avoid peak loading often seen when large pumps are used.

As the following forecasts provided in this section rely heavily on historical trends and involve a high degree of aggregation, minimum and maximum demand forecasts are provided which take into account any demand reduction initiatives that may occur.

As discussed in the development section 4.7.1.4 there is a limit to the extent that demand initiatives can be effective which occurs when the demand profile flattens.

Future demand initiatives targeting a shift in consumption from day to the period between 12:00am and 4:00am at night will have the biggest impact on demand. Currently no initiatives to achieve this have been identified.

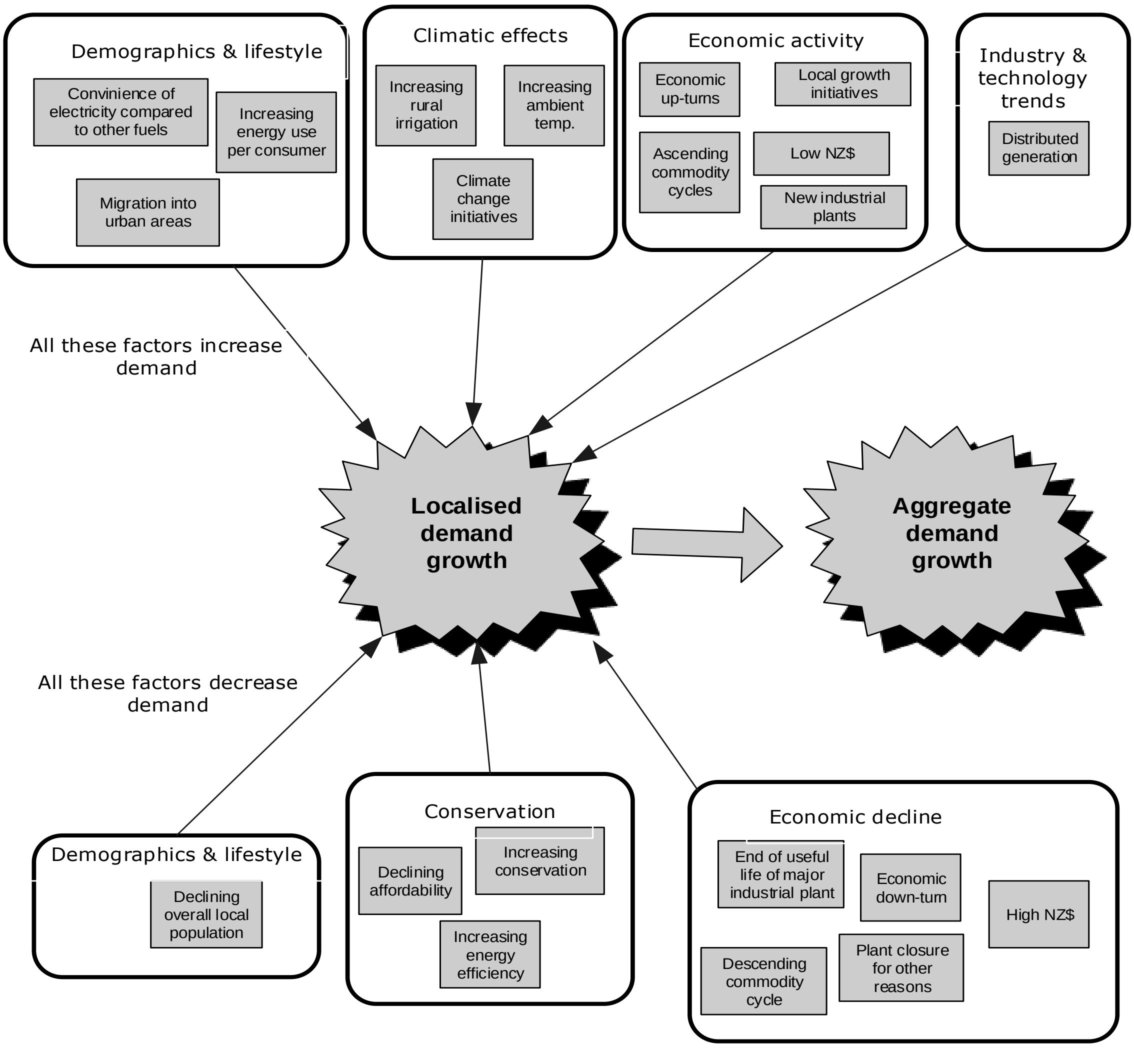
#### 4.3.1.4 Demand Management Impact on Forecasts

As described in 4.3.1.3 above measurable Impacts on demand initiatives to date equate to approximately 10% of the regional peak demands. As the natural variation due to environmental conditions is of this order no impact on demand forecasts has occurred.

### 4.3.2 Drivers of future demand

Key drivers of demand growth (and contraction) are depicted in Figure 4.3.2(a) below.

***Figure 4.3.2(a) – Drivers of demand***




At a localised level (11kV feeder) one or two of these issues will generally predominate, will be predictable and manageable, and can be aggregated into a reasonably reliable feeder demand forecast. The estimates of future demand are described in section 4.3.3 below.

The following section examines in detail what Eastland Network Limited believes will be the most significant drivers of its network capacity and configuration over the next 15 to 20 years:

#### 4.3.2.1 Maturing forestry

##### Expected processing volumes

The predominant economic growth for the region is expected to be linked to forest harvesting. The Ministry of Agriculture and Forestry's forecasts of the total recoverable volume of logs through to 2040 indicate current log volumes are expected to triple to around 2.5 million $m^3$ within 5 years, and increase still further to around 3.5 million $m^3$ approximately 10 years after that. Capacity to accommodate growth is established at JNL and Matawhero.. The regional benefits and anticipated increases in load will continue to be limited if most logs are exported unprocessed.

#### 4.3.2.2 Electric Vehicles

The current proportions of Energy consumed in the region are forecast to change. The transportation of Diesel and Petrol fuel is forecast to reduce by up to 40% as the use of electric vehicles increases. This reduction will have a corresponding increase in electricity being transported through the region to charge the vehicles. It is possible that some capacity/demand growth will be needed depending on the mix of rapid verses slow charge technologies. The short term demand requirement for a single charging station ranges from 100-300kW this is equivalent to the typical maximum demand of a small rural zone substation e.g. Ngatapa Substation. Planning consideration of the location of rapid charging facilities involves a balance between user convenience and location of sufficient capacity without the need for capacity upgrade. For rapid charging stations with a disproportionate low energy volume tarrifs recognising the demand component may be necessary to achieve the economics for the assets required.

#### 4.3.2.3 Battery storage technology

The use of battery technologies provides a mechanism to reduce peak demand and increase asset utilisation. Ie batteries can be charged at times of low load typically 11pm to 6 am. The stored energy can then be used to reduce morning and evening peaks avoiding capacity upgrades. As an example to avoid investment in capacity upgrades discussed in 4.3.2.2 above a 300kW charging station with battery storage could be charged over night and the batteries then used to charge the electric vehicles without overloading the power supply. In order for this technology to be viable the differential cost between charging and discharging energy units needs to be greater than current daytime/nighttime energy prices. Currently the differential between the export price of a domestic solar installation and the domestic energy import cost is sufficient to fund domestic battery installations where solar systems have also been installed.

The optimum capacity of battery storage for the regions current usage profile is around 8MW peak In addition the storage needs to deliver this demand for up to 4 hours i.e. 32MWhr.

Distributed installations have an advantage over bulk installation as they improve asset utilisation at multiple voltage levels.

#### 4.3.2.4 Regional natural gas reserves

Undeveloped gas resources existing in the region could be a source of relatively cheap electricity generation in the Gisborne and Wairoa regions and radically alter net power flows. New gas-fired generation could also significantly reduce net power imports at Gisborne Substation. Given the high costs of augmenting the double circuit 110kV line supplying Gisborne Substation, the Vector high-pressure gas main from Opotiki, local gas supplying local generation could provide cheap and stably-priced electricity. The ability to use gas-fired generation as a contingency for rare events affecting both 110kV lines is an advantage.

The current issue associated with the development of gas-fired generation is the difficulties associated in securing prices for long term gas supply. Analysis of gas generation opportunities was reviewed in 2016.

#### 4.3.2.4 Changes in Technology

As identified above changes in generation technology e.g. wind and solar that replace the need for network capacity to some degree are being realised. The need for investment in network assets with an economic 40 year life (but a practical life of about 70 years) is therefore clearly subject to challenge. This is particularly true of capacity investment in the remote rural network, where small scale distributed generation or off grid generation is potentially more economic.

Transmission and distribution lines exist for the sole purpose of transporting electricity from where it is generated to where loads are located. Logically, if generation could be moved closer to loads, then there would be less need for transmission and distribution. In this sense, new generation "competes" with electricity lines businesses/investments. This is particularly true of distributed generation (and direct substitutes such as direct solar water heating). Larger embedded generation plants are less of a threat for distribution networks, but pose a significant risk of bypass for transmission networks. These technologies can also be used as substitutes for network upgrades and as contingency measures.

Potential new generation around Gisborne investigated to date, includes biomass generation to accompany additional forestry mills, larger biomass plant(s) that would produce more power than required by the mills, gas generation plant to take advantage of surplus capacity in the Vector pipeline or new gas discoveries, small gas turbines and hydro that could be operated as peaking plant to reduce peak demand, and other renewables such as the high wind and solar resources in the region.

Eastland Network Limited may have the opportunity to use embedded and distributed generation to reduce the need for transmission and distribution upgrades, and can also re-engineer its network during the current upgrade program so that it is more suitable for a distributed generation environment. These issues are the subjects of a development strategy in preparation to minimise investment risk and lower electricity supply costs primarily from improved asset utilisation.

Conversely where the scale of any distributed generation is greater than the local load the generation surplus at any location may require line upgrades and/or distribution or transmission solutions in addition to the existing lines. While this would not result in a reduction in the local region long term benefits remain at the transmission or national level.

Introduction of smart metering systems by some Energy Retailers active in the region is progressing. The impact of this technology is currently too small to identify the effects on energy and demand measurements.

While smart meters are a tool that can assist end users to reduce energy and demand, any benefit will require end users to change their behaviour patterns before any change will occur. This is particularly true for the domestic market.

Battery, solar and transport technology rollout is happening faster than initially expected. An accelerated shift to electricity for transport requires Eastland Network to increase its understanding and involvement with the end users. in order to gain a real understanding Eastland Network has implemented a distributed solar trial which will follow a number of typical installations and capture data in real time that can be extrapolated to determine future impact on the electricity assets. Eastland Network is participating in a regional energy centre to promote interactive communication with end users to ensure future development and needs are understood prior to investment. A goal of the energy centre is to assist end users with the decision making processes associated with selecting the best technology to meet their needs.

### 4.3.3 Estimated Distribution Feeder demands

As outlined in detail in the remainder of section 4, Eastland Network Limited expects its future demand to vary from the current demand as follows:

Some growth within the existing network footprint in the Kaiti / Port area, the Gisborne industrial estate and the Mahia Peninsula.

A low rate of growth within or very close to the existing network footprint at Matawhero if the impending forest harvest is processed locally.

Possible contraction of demand along the east coast north of Gisborne.

Possible contraction of demand in the rural parts of the Wairoa District other than Mahia.

Eastland Network Limited's collective experience strongly indicates that it would be rare to ever get more than a few months confirmation (sufficient to justify significant investment) of definite changes in an existing or new major consumers demand. This is because most of these consumers operate in fast-moving consumer markets and often make capital investment decisions quickly themselves, and they generally keep such decisions confidential until the latest possible moment. Probably the best that Eastland Network Limited can do is to identify in advance where the network has sufficient surplus capacity to supply a large chunk of load, but as experience shows industrial location decisions rarely if ever consider the location of energy supply – they tend to be driven more by land-use restrictions, raw material supply and transport infrastructure.

This section examines each of Eastland Network Limited's Subtransmission substations at a feeder level in regard to the issues identified above and provides a 10 year projection of demand, determined using Eastland Network Limited's collective experience, for each sub and what provision for growth if any is required.

#### 4.3.3.1 Gisborne Region

Carnarvon St Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Aberdeen | Typical domestic commercial mix Medium | None required |
| Anzac | Typical domestic commercial mix Medium | None required |
| Awapuni | Typical domestic commercial mix Medium | None required |
| Childers | Typical domestic commercial mix Medium | None required other than for security |
| City | Swings in growth due to cyclic prosperity in CBD | None required other than for security |
| Gladstone | Typical domestic commercial mix Medium | None required other than for security |
| Kahutia | Swings in growth due to cyclic prosperity in CBD | None required |
| Palmerston | Typical domestic commercial mix Medium | None required other than for security |
| Watties | Commercial subject to lumpy change | None required |
| Sub | High, less lumpy than industrial subs but still dependent on retail cycles. Likely to exhibit load shifts between feeders. | None required – projected 10 year load is expected to be only 65% of capacity. |

JNL Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| JNL | Large step changes Moderate | Non required |
| Matawhero Tie | Provides for security only | Non required |
| Sub | Moderate | Non required |

### Kaiti Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Dalton | Domestic Medium | Non required |
| Delatour | Domestic load increases rather than new load | Non required |
| Hershell | Domestic Medium | Non required |
| Tamarau | Domestic Medium | Non required |
| Wainui | Domestic Medium | Non required |
| Whangara | Domestic Rural Low to Medium | Growth constrained intermediate zone sub considered |
| Sub | Moderate, reasonably diverse and predictable as this is largely domestic. | Projected 10 year load is expected to be about 95% of capacity, Expect to off-load 3MW or 4MW to Port. If large growth in Wainui possibly establish Whangara substn (2.5MVA), 2013 -15. |

### Makaraka Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Bushmere | Lifestyle Rural medium | None required |
| Campion | Lifestyle domestic High | None required |
| Haisman | Lifestyle domestic High | None required |
| Nelson | Lifestyle domestic High | None required |
| Sub | High | Projected 10 year load just exceeds 100% of capacity. Off-loading 2MW or 3MW to Patutahi is an option. If high subdivision growth in Linton West/Nelson Rd possibly establish Mangapapa substn (12.5MVA) 2017 -2020. |

### Matawhero Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Bell | Industrial Rural medium | None required |
| Dunstan | Industrial Rural medium | None required |
| JNL A | Security Tie | None planned |
| Manutuke | Industrial load new load forecast | None required |
| Waipaoa | Industrial load new load forecast | None required |
| Sub | Very high | Projected 10 year load is expected to be 85% of capacity. Offset by and secures JNL sub. |

### Ngatapa Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Ngatapa | Rural minimal | None required |
| Tahora | Rural minimal | None required |
| Totangi | Rural minimal | None required |

| | | |
|---|---|---|
| Sub | Low, vulnerable to single large load being a high percent of existing surplus capacity. | Security Provision planned – projected 10 year load is expected to be only 60% of capacity under existing normal conditions |

Parkinson Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Cedenco | Industrial Low | None required |
| Chalmers | Domestic Low | None required |
| Elgin | Domestic Low | None required |
| Innes | Industrial Steady but Lumpy increases | None required |
| Lytton | Domestic Low | None required |
| Solander | Domestic Low | None required |
| Willows | Security Tie Low | None required |
| Sub | Low, potentially lumpy and uncertain due to medium sized industrial loads. | None required – projected 10 year load is expected to only be 65% of capacity. |

Patutahi Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Lavenham | Rural Mix Low | None required |
| Muriwai | Rural Mix Low | None required |
| Te Arai | Rural Mix Low with large load | No needs identified |
| Waimata | Rural Mix Low | None required |
| Sub | Low. | None required – projected 10 year load is expected to be only 33% of capacity. Could take about 3MW of load from Makaraka and Matawhero if necessary. |

Pehiri Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Parikanapa | Rural Mix Low | None required |
| Tahunga | Rural minimal Rural Mix Low | None required |
| Tiniroto | Rural Mix Low | None required |
| Warenga | Rural minimal | None required |
| Sub | Low. | None required – projected 10 year load is expected to be only 30% of capacity. |

Port Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Crawford | Domestic Low | None required |
| Esplanade | Commercial load new load forecast | None required |
| Harris | Domestic Low | None required |
| Port | Industrial load Low | None required |

| | | |
|---|---|---|
| Sub | Low. | None required – projected 10 year load is expected to be only 15% of capacity, so there is scope to shift about 9MW on to Port from Kaiti or Carnarvon. |

Puha Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Kanakanaia | Rural growth generally low. Small increases significant in terms of total load one significant load at end of line. | None Required |
| Matawai | Stable Township no growth | None Required |
| Te Karaka | Stable township possible decrease offset by outlying lifestyle blocks | None Required |
| Whatatutu | Rural growth generally low. Small increases significant in terms of total load | None Required |
| Sub | Low. Large step increase in load experienced in 2009 due to addition of distributed generation with var requirement. | None required – projected 10 year load is expected to be only 45% of capacity. |

Ruatoria Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Makarika | Rural growth generally low. Small increases significant in terms of total load | None Required However security support limited. |
| Ruatoria | Stable Township. Growing slowly | None Required |
| Tikitiki | Rural growth generally low. Small increases significant in terms of total load | None Required |
| Sub | Low. | None required – projected 10 year load is expected to be only 33% of capacity. |

Te Araroa Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Awatere | Rural growth generally low. Small increases significant in terms of total load | None Required |
| Hicks | Rural growth generally low. Small increases significant in terms of total load | None Required |
| Te Araroa | Stable Township | None Required |
| Sub | Low, vulnerable to single large load being a high percent of existing surplus capacity. | None required – projected 10 year load is expected to be only 35% of capacity. |

Tokomaru Bay Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Inland | Rural growth generally low. Small increases significant in terms of total load | None Required however security support necessary. |

| | | |
|---|---|---|
| Mata | Rural growth generally low. Small increases significant in terms of total load | None Required however security support necessary. |
| Seaside | Rural growth generally low. Small increases significant in terms of total load | None Required |
| Sub | Low, vulnerable to single large load being a high percent of existing surplus capacity. | None required – projected 10 year load is expected to be only 45% of capacity. |

Tolaga Bay Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Rototahi | Rural growth generally low. Small increases significant in terms of total load | None Required |
| Tauwhare | Rural growth generally low. Small increases significant in terms of total load | None Required |
| Toko Tie | Rural growth generally low. Small increases significant in terms of total load | None Required however security support necessary. |
| Town | | |
| Sub | Low | None required – projected 10 year load is expected to be only 37% of capacity. |

#### 4.3.3.2 Wairoa Region

Blacks Pad Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Mahia feeder | High, spread amongst life-style blocks, holiday homes and dairy conversions. Holiday homes add a peaky aspect to the load which makes recovery of investment awkward. | Already using one 1MWe diesel generator to support both load and voltage. Plans to provide additional network capacity by moving Blacks Pad closer to the Mahia load and install a larger 33/11kV transformer in place. |
| Sub | High, spread amongst life-style blocks, holiday homes and dairy conversions. Holiday homes add a peaky aspect to the load which makes recovery of investment awkward. | Already using one 1MWe diesel generator to support both load and voltage. Plans to provide additional network capacity by moving Blacks Pad closer to the Mahia load and install a larger 33/11kV transformer in place. |

Wairoa Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Kiwi A | Low Growth Region | At capacity 33kV upgrade necessary |
| Kiwi B | Low Growth Region | At capacity 33kV upgrade necessary |
| Kiwi C | Low Growth Region | At capacity 33kV upgrade necessary |
| Sub supply to Mahia | Low Growth Mahia | None required |
| Raupunga | Little if any | Voltage constrained at far end, so any remote growth would require either re-conducting or adopting of 22kV. Generator Support in Place for security |

| | | |
|---|---|---|
| Frasertown | Little if any | Voltage constrained at far end, so any remote growth would require either re-conducting or adopting of 22kV, or Generator Support for security |
| Sub | Low Growth Region | |

Kiwi Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| AFFCO | Unpredictable | At limit |
| Borough 1 | Low Growth Township | Approaching secure limit |
| Borough 2 | Low Growth Township with industry | Approaching secure limit |
| Brickworks | Little if any | None Required |
| Nuhaka | Little if any | None Required |
| Waihi | Generator - no increase expected | None Required |
| Sub | Non Required Supplies Waihi Substation | None Required |

Tahaenui Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Morere feeder | Minimal if any growth. Load can peak if used to back feed Blacks Pad or the Nuhaka feeder. | None required |
| Sub | Minimal if any | Non required. |

Tuai Substation

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Lake | Little if any | None required |
| Ruatikuri | Little if any | Distance main issue Voltage regulator or capacitors beyond current planning period |
| Sub | Minimal if any. | Non required. |

Waihi

| Feeder | Rate and nature of growth | Provision for growth |
|---|---|---|
| Waihi Sub | Nil – takes injected generation from Waihi hydro. | None required. |

### 4.3.4 Estimated demand aggregated to Transmission and Subtransmission Substation level

#### 4.3.4.1 Gisborne Region

| Sub. | Rate and nature of growth | Provision for growth |
|---|---|---|
| Gisborne 110kV/50kV | Low | Load is projected to exceed the 110kV line supplying the Gisborne 110kV during shoulder periods. Transformer capacity is not forecast to be exceeded until 2023. Development options identified in Development Program. Need |

| | | |
|---|---|---|
| | | another 110kV circuit from Tuai to Gisborne to provide (n-1) security at current demand, and will require a second additional 110kV circuit to meet demand growth. Would be useful to build a new Subtransmission Substation near Matawhero or Makaraka instead of terminating any new lines at Gisborne Substation. |
| Carnarvon | Low, less lumpy than industrial subs but still dependent on retail cycles. Likely to exhibit load shifts between feeders. | None required – projected 10 year load is expected to be only 65% of capacity. |
| JNL | | |
| Kaiti | Low, reasonably diverse and predictable as this is largely domestic. | Projected 10 year load is expected to be about 95% of capacity, so expect to off-load 3MW or 4MW to Port. |
| Makaraka | Low | Projected 10 year load just exceeds 100% of capacity. Off-loading 3MW or 4MW to Patutahi would be a key option. |
| Matawhero | Low | Projected 10 year load is expected to be 85% of capacity. JNL new sub |
| Ngatapa | Low, vulnerable to single large load being a high percent of existing surplus capacity. | None required – projected 10 year load is expected to be only 60% of capacity. |
| Parkinson | Low, potentially lumpy and uncertain due to medium sized industrial loads. | None required – projected 10 year load is expected to only be 65% of capacity. |
| Patutahi | Low | None required – projected 10 year load is expected to be only 33% of capacity. Could take about 6MW of load from Makaraka and Matawhero if necessary. |
| Pehiri | Low | None required – projected 10 year load is expected to be only 30% of capacity. |
| Port | Low | None required – projected 10 year load is expected to be only 15% of capacity, so there is scope to shift about 9MW on to Port from Kaiti or Carnarvon. |
| Puha | Low | None required – projected 10 year load is expected to be only 45% of capacity. |
| Ruatoria | Low | None required – projected 10 year load is expected to be only 33% of capacity. |
| Te Araroa | Low, vulnerable to single large load being a high percent of existing surplus capacity. | None required – projected 10 year load is expected to be only 35% of capacity. |
| Tokomaru | Low, vulnerable to single large load being a high percent of existing surplus capacity. | None required – projected 10 year load is expected to be only 45% of capacity. |
| Tolaga | Low | None required – projected 10 year load is expected to be only 37% of capacity. |

### 4.3.4.2 Wairoa Region

| Sub. | Rate and nature of growth | Provision for growth |
|---|---|---|
| Wairoa 110kV Substation | Low | Load can exceed transformer firm capacity under an n-1 scenario. The current load can be managed operationally via load control and generation. The Wairoa assets are approaching end-of-life and are being scheduled for replacement and additional capacity will be provided at this time. Replacement with110/33kV Transformers likely. |
| Wairoa Substation | Linked to Area Growth | Non Required<br>Additional growth complication is that the Frasertown and Raupunga feeders are very long (and hence voltage constrained) so any significant load growth on either of these feeders would require 11kV reinforcement as well as augmenting Wairoa Substation |
| Blacks Pad Substation | Low at limit, spread amongst life-style blocks, holiday homes and dairy conversions. Holiday homes add a peaky aspect to the load which makes recovery of investment awkward. | Already using one 1MWe diesel generator to support both load and voltage. First step to provide additional network capacity has been to move Blacks Pad closer to the Mahia load, next step will be install a larger 33/11kV transformer. |
| Kiwi Substation | Likely growth is almost totally big industrial and therefore lumpy and difficult to forecast. | None required Generation Infeed |
| Tahaenui Substation | Minimal if any growth. Load can peak if used to back-feed Blacks Pad or the Nuhaka feeder. | None required. |
| Waihi Substation | Nil – takes injected generation from Waihi hydro. | None required. |
| Tuai Substation | Minimal if any. | No provision for growth is required and no constraints on growth exist. |

### 4.3.4.2 Subtransmission Substation Growth

Transmission and Subtransmission substation capacities and present loads are shown in the following table. The loads shown are half hour maximum demands with normal load control policy in effect. Reductions at some sites compared with previous years are caused by imbedded generation reducing the burden on the substation Transformer assets. As the expected life of the generation assets is shorter than that of the Transformer assets and the reliability/availability is lower the capacity of the transformers is set to provide for peak demands should the generators be unavailable.

Forecast peak power demands for the installed transformer capacity by the end of the planning period are also indicated.

Growth forecasts have been averaged on a 10-year prediction to smooth out step increments introduced by new loads.

A year by year forecast has not been provided as the exact timing and nature of future loads in is not known hence the information would be inaccurate and misrepresent the general predictions provided.

| Substation | Transformer Capacity (MVA) | Maximum 2017/18 | % of Installed Capacity | Growth | Load 2027/28 | % of Installed Capacity |
|---|---|---|---|---|---|---|
| | | (MW) | | (%) | (MW) | |
| TE ARAROA | 1 x 2.5 | 0.84 | 34% | 0% | 0.95 | 38% |
| RUATORIA | 1 x 5.0/7.5 | 1.288 | 26% | 0% | 1.39 | 28% |
| TOKOMARU | 1 x 2.5 | 0.903 | 36% | 0% | 0.95 | 38% |
| TOLAGA | 1 x 1phase 5.0 | 1.346 | 27% | 0% | 1.27 | 25% |
| KAITI | 1 x 12.5 | 6.782 | 54% | 0% | 10.56 | 84% |
| PORT | 1 x 12.5 | 8.459 | 68% | 0% | 8.34 | 67% |
| GISBORNE | 2 x 60 (110kV/50kV) | 47.86 | 40% | 2% | 53.67 | 45% |
| CARNARVON | 1 x 12.5, 1 x 12.75 | 14.078 | 56% | 0% | 15.35 | 61% |
| PARKINSON | 2 x 12.5 | 10.07 | 40% | 0% | 9.89 | 40% |
| MAKARAKA | 1 x 12.75 | 6.738 | 53% | 1% | 8.22 | 64% |
| PATUTAHI | 2 x 1phase 5.0 | 3.553 | 36% | 0% | 2.48 | 25% |
| PEHIRI | 1 x 2.5 | 0.75 | 30% | 0% | 1.50 | 60% |
| NGATAPA | 1 x 2.5 | 0.459 | 18% | 0% | 0.46 | 19% |
| PUHA | 1 x 1phase 5.0 | 2.153 | 43% | 0% | 2.34 | 47% |
| JNL | 1 x 12.75 | 4.892 | 38% | 0% | 3.88 | 30% |
| MATAWHERO | 2 x 5.0/7.5 | 3.596 | 24% | 1% | 3.43 | 23% |
| TUAI | 1 x 1 phase 6 (110/11) | 0.552 | 9% | 0% | 0.71 | 12% |
| WAIROA | 2 x 1 phase 10 (110/11) | 4.8 | 74% | 2% | 4.80 | 74% |
| WAIROA MAHIA | 1 x 12.5 (11/33) | 9.29 | 46% | 0% | 10.23 | 51% |
| KIWI | 1 x 6.5 (11/50) | 1.75 | 14% | 0% | 1.80 | 14% |
| BLACKS PAD | 1 x 1.5 (33/11) | 1.45 | 97% | 1% | 1.51 | 101% |
| TAHAENUI | 1 x 1.5 (33/11) | 1.35 | 90% | 0% | 0.50 | 33% |
| WAIHI | 1 x 6.5 (50/11) | 4.8 | 74% | 0% | 4.8 | 74% |

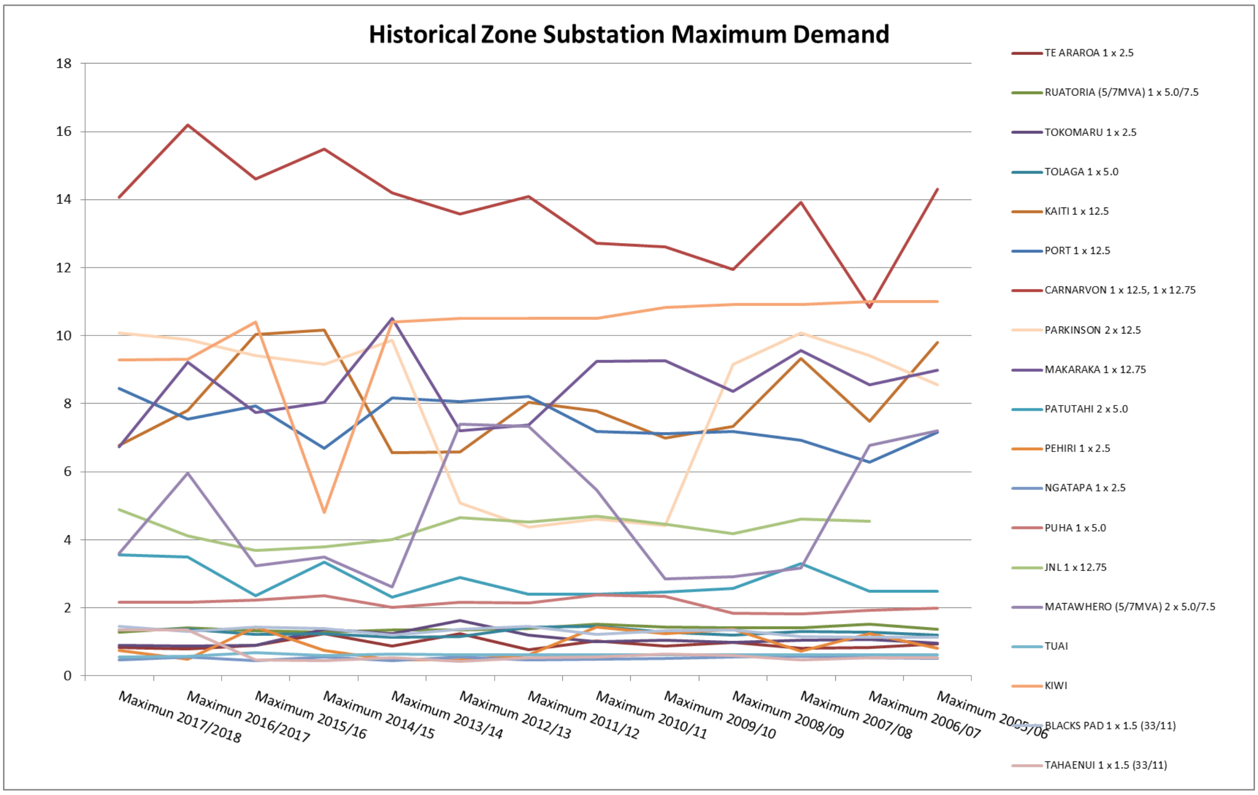
Notes

- Gisborne is a Transmission Substation

- Kiwi and Waihi are a Generation Infeed

- Wairoa Mahia is an outfeed to Blacks pad and Tahaenui

The graph below indicates the historical maximum demand for each major substation. The variation from year to year for a number of substations represents contingent events where the reserve capacity has been utilised to supply adjacent substations during maintenance activities.




Disclosure Requirement

The Electricity Disclosure Determination 2012 Report on Capacity Forecast, (Schedule 12b.) is provided in an appendix of this plan. Due to rounding requirements the figures provided round to the nearest 1MVA which does not accurately reflect demand at small substations with peak demands below 800kW. The detail figures can be seen in the table above.

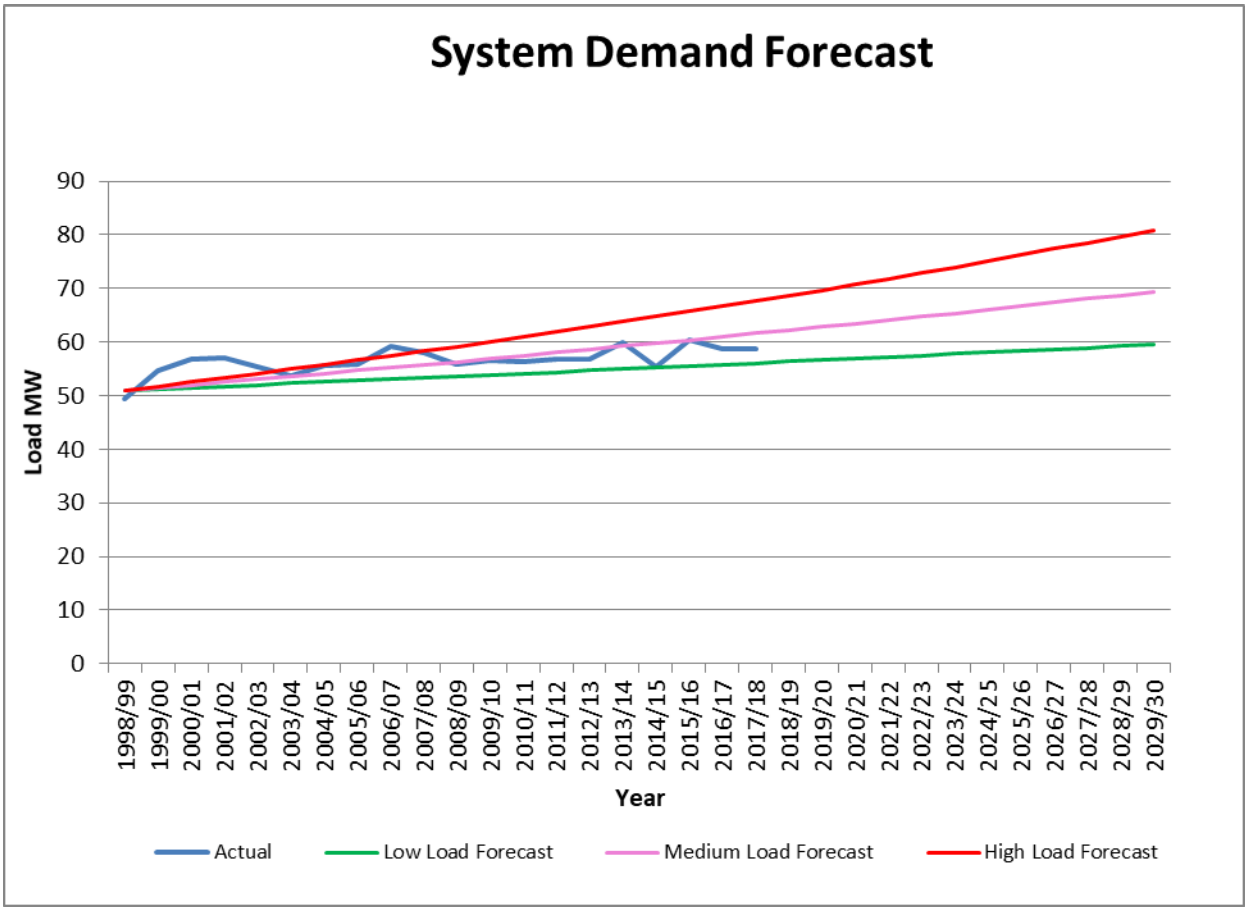
In the disclosed report the definition of firm capacity does not recognise the existence of the transformer in a single transformer zone substation. Details of the transformers are shown in the asset description section of this plan and in the table above.

### 4.3.5 Overall System Growth – Demand Aggregated to GXP

By projecting growth trends forward, coincident system peak demand has been forecast to grow from 60 MW in 2017/18 to a worst case of 80 MW in 2028. This gives an overall growth rate of approximately 1.5% p.a.

Alternatively the conservative scenario indicates minimal if any growth to 60 MW in 2028 which equates to a rate of 0% p.a.

When making development decisions related to capacity requirements for long life assets, Eastland Network Limited considers the high load forecast and a prudent planning margin, to ensure investment covers the worst case scenario. To avoid over investment, the investment in capacity is deferred as long as possible. For other decisions the low or medium forecasts are used as appropriate.

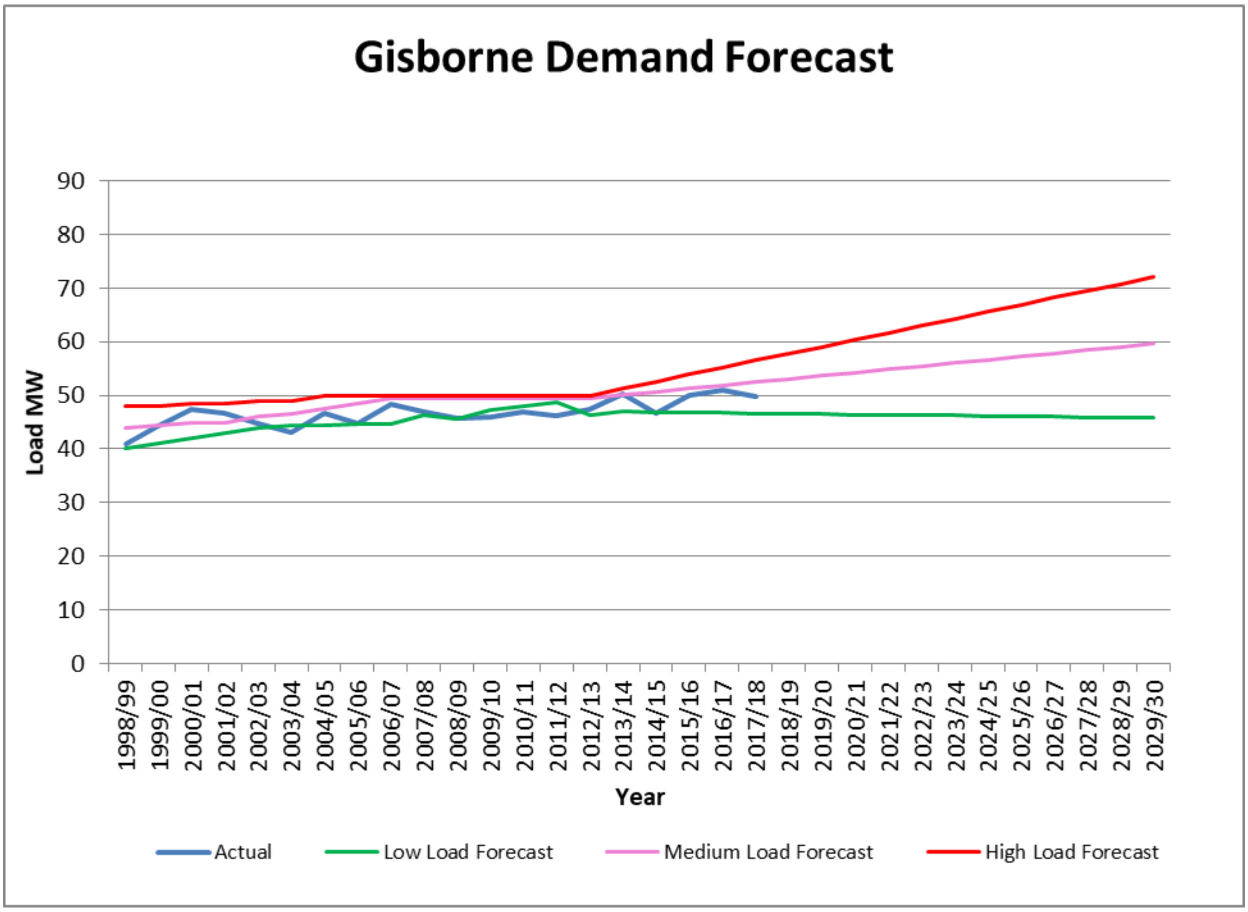



### Gisborne Transmission Substation – Prudent Planning Margin

When considering the firm capacity at Gisborne Substation a 6 MW 'prudent planning margin' has been included in the assessment of the adequacy of future capacity. This assessment is in addition to other planning assessments outlined in this AMP.

The margin is considered appropriate for regional planning purposes to ensure that Eastland Network Limited is capable of supply a step-change increase in industrial load. The planning margin is necessary given the very long lead-time to increase supply capacity in respect of 110kV Substations and 110kV transmission lines. Having headroom in the capacity is considered to be of particular importance in the Gisborne region given the unpredictability in growth associated with wood harvesting and related industrial activity.

The results of this assessment indicate that Gisborne Substation and the distributed generation provide suitable firm capacity to 2028.



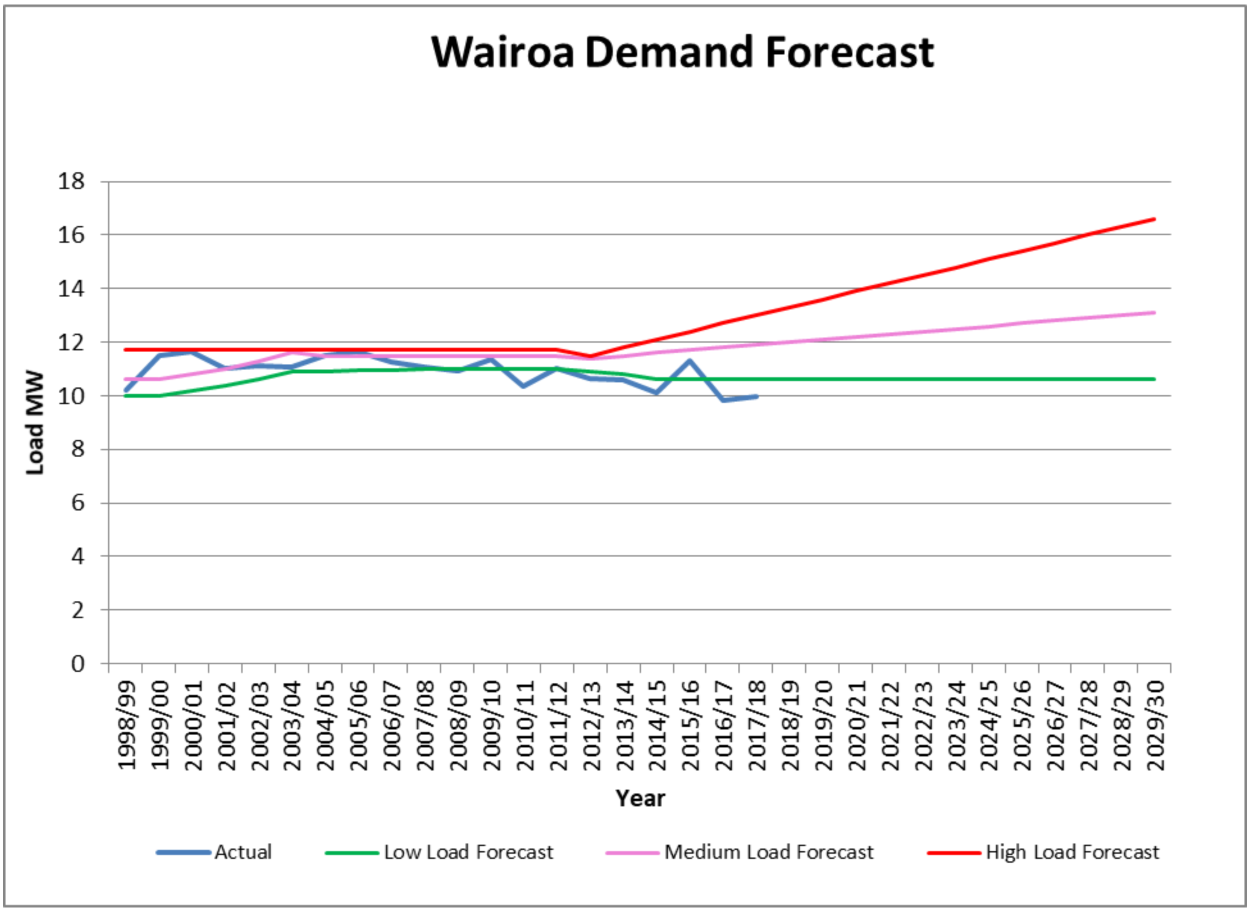

### Wairoa Transmission Substation – Prudent Planning Margin

When considering the firm capacity at Wairoa Substation a 2 MW 'prudent planning margin' has been included in the assessment of the adequacy of future capacity. This assessment is in addition to other planning assessments outlined in this AMP.

The margin is considered appropriate for regional planning purposes to ensure that Eastland Network Limited is capable of supplying a step-change increase in industrial load. The planning margin is necessary given the very long lead-time to increase supply capacity in respect of 110kV Substations and 110kV transmission lines.

The planning margin has been estimated at 2 MW and represents a new small to medium industrial site, or the expansion of an existing industrial site.

The results of this assessment indicate that Wairoa Substation and the distributed generation provide suitable firm capacity beyond the end of current planning horizon.




The forecast demand growth trends are -1% to +2% p.a. the historical trend shows an annual variation of up to 3% largely due to changing factors such as load control strategies, energy saving drives arising out of national energy shortages and weather patterns.

Disclosure Requirement

The Electricity Disclosure Determination 2012 Report on Forecast Demand, (Schedule 12c) is provided in an appendix of this plan. To determine the system growth in terms of GXP demand, an extrapolation of the high Load forecast for the Wairoa and Gisborne regions was modified slightly by the diversity to provide an approximate coincident value. The expected contribution of known embedded generation at 11kV was then separated out to provide a total GXP figure.

In 12c(i) of the report the embedded generation figures reflect the expectation of additions as per the required definitions. The predictions are based on current trend of 20 x 2kW solar installations p.a., a progressing distributed hydro generator approx. 100kW and the possibility of additional diesel generation discussed in the development options of this plan.

### 4.3.6 Forecast Accuracy and Variations

Eastland Network Limited has used a Load Forecasting Model to help predict the impact of accumulated load growth on its capacity requirements and security standards. The model allows scenario planning for investigating the impact of large loads associated with new processing plants and other industrial loads when applied at specific locations in the network. Forward projections of growth rates are obtained from historical trends at feeder level, or sub feeder level where data is available. There is significant dependence on the experience of the personnel establishing the correct growth rates and their understanding of the patterns in the region.

The model achieved this via the following method:

Profile Builder: Feeder load data is obtained from the SCADA system. Load profiles are created for domestic, non-domestic, and specific industrial consumers and reconciled so that they sum to known feeder level data.

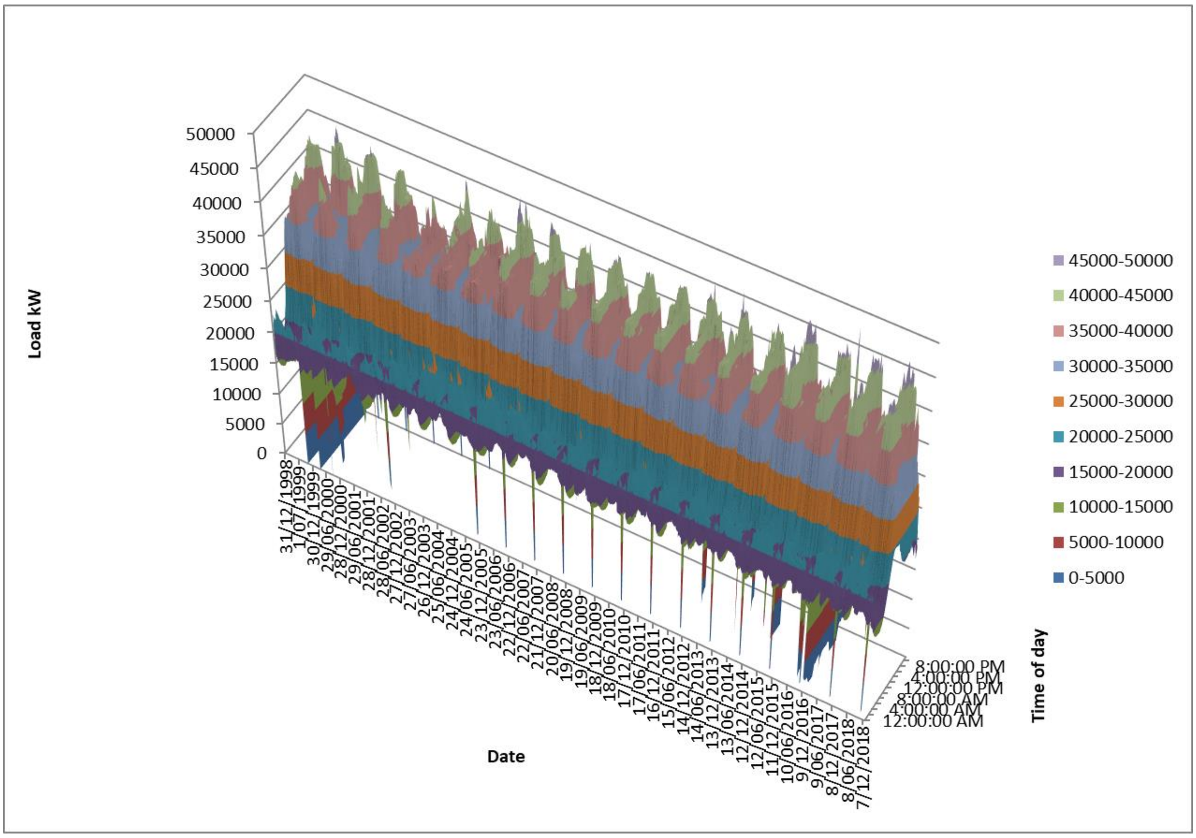
Zone/Subtransmission substation, sub transmission line, Transmission Substation and GXP profiles can then be built up which take into account diversity.

Load Forecasting: The number of connections and an assumed annual growth rate can vary each profile for each class of consumer.

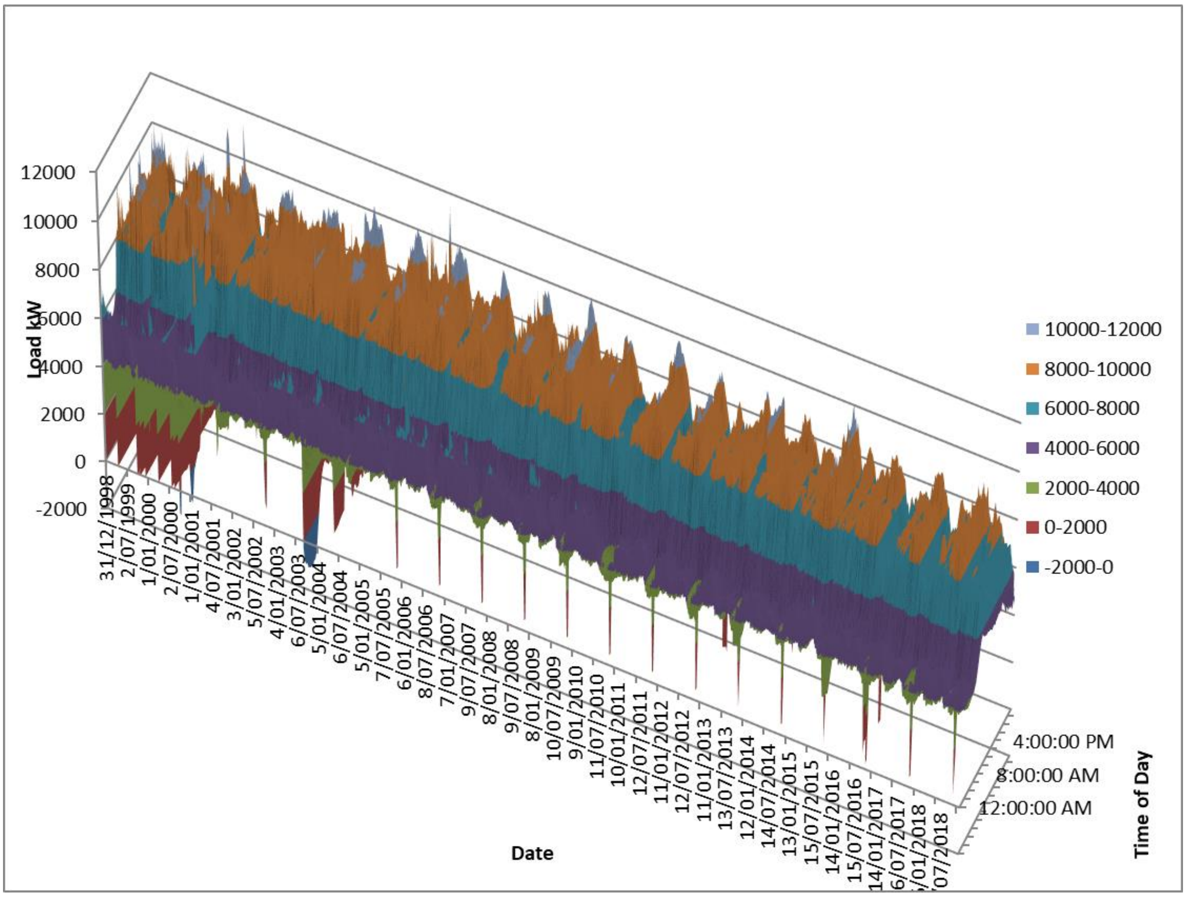
Scenario planner: Large loads and generation can be inserted at any sub-transmission node. i.e. Zone/Subtransmission Substation. Resulting loads and their profiles can be applied to load flow analysis software to determine voltage, loss and security issues.

Eastland Network Limited has also considered historical and national trends and has found that they provide the most effective method for load forecasting. Consideration is made of regional developments via use of the Load model however past experience has shown that load forecasts provided by end users do not take diversity into account. Only a small proportion of the developments eventuate and in general the forecasts have proven to be inaccurate. To compensate for inaccuracy in load forecasting the security standards in place provide a buffer to accommodate load growth and allow appropriate time frames to compensate and re-establish the appropriate security.

*Gisborne System Historical Load 1999 to 2018*




*Wairoa System Historical Load 2001 to 2018*




Shown by the charts above all demand forecasts are subject to variation as a result of externalities such as weather and economic growth. Annual variations in these factors will create demand variations in the short term, whilst sustained trends are likely to cause more persistent departures from the forecast. The Gisborne trend above shows a sudden change in the demand profile from 2002 periods. This change was due to a change in load control strategies from 2002 and the national campaign to save energy due to water storage levels in 2003.

Varying the timing of planned work can accommodate forecast variances. Lower than expected load growth can be accommodated by deferral and faster than expected load growth by acceleration. Adequate notice is generally available for the type of work involved to undertake such acceleration, although major items of equipment can have long lead times and constrain the extent to which work can be performed 'just in time'. Eastland Network Limited's basis for network planning and operations is sufficiently rigorous and conservative to avoid serious capacity shortages and un-served demand.

### 4.3.7 Issues arising from estimated demand

No issues from the estimated demand have been identified.

## 4.4 Capacity constraints

### 4.4.1 Transmission constraints

Gisborne Transmission Substation

The Gisborne Substation transformer upgrade completed in March 2007 addressed immediate issues related to capacity constraint, meeting future load growth and Eastland Network Limited's security standards.

The worst case forecast is that the 60MVA firm capacity at Gisborne Substation, (at Class D security of supply), is sufficient to meet increasing maximum demands until approximately 2022. Whilst the 110kV lines from Tuai to Gisborne meet current demand their firm capacity, (at the required Class D security), is insufficient to meet forecast demand, (including the prudent planning margin). Eastland is presently utilising 4MW of firm distributed generation capacity to provide the necessary capacity to meet forecast demand, (including the prudent planning margin).

#### Wairoa Substation

There are currently no constraint issues at the Wairoa Substation. The contingency rating of the 110kV lines from Tuai is 57MW. The normal/contingency rating of the 2x 10MVA 110/11kV transformers is 20/12 MVA. The maximum coincidental demand of the Wairoa network is 11MW. After the application of load control, Waihi generation and Mahia generation the maximum demand at Wairoa Substation is 8.0MW.

Wairoa issues and development proposals relate to sub-transmission assets to Mahia and distribution assets only.

The 10MVA fixed capacity at Wairoa Substation, (at Class C security standard), is insufficient to meet forecast demand, (including the prudent planning margin). Eastland Network is presently utilising 3.5MW of firm distributed generation capacity to provide the necessary capacity to meet forecast demand, (including the prudent planning margin). The Waihi Hydro and Diesel generation utalised is owned by Eastland Generation Limited and its use for network support is secured through ACOD payments from Eastland Network. It is proposed that the current 110/11kV transformers due to age/condition considerations will be replaced with 110/33kV units prior to 2025. Development plans for the Wairoa sub-transmission network are being progressed to coordinate this upgrade.

#### Eastland Network Limited Tuai Substation

There are no current or forecast capacity constraint issues arising at the Tuai Substation. If any significant growth were to occur over time additional security measures will be required. Development of standby generation options to meet the necessary security levels is the most viable option at this time. To improve connection economics an option exists to extend the 11kV distribution from Tuai to the Frasertown feeder and supply 2 to 3MW of the Wairoa Substation load from the Tuai Substation. This option would defer the timing of the Wairoa Substation development to around 2027 given the worst case growth scenario.

#### Tuai GXP Transmission Supply

Operationally at Tuai the 110kV lines to the Gisborne, Wairoa and Tuai Substations are connected to a ring bus. Previous security constraints relating to the ring bus circuit breaker were eliminated when was equipped with bus protection in 2011.

### 4.4.2 Transmission /Sub-transmission constraints

The failure of a double circuit 110kV tower on either the Gisborne or Wairoa Lines will interrupt the entire supply to the respective Region. Previously Transpower managed this risk in line with their National standards.

These circuits are now managed by Eastland Network Limited.

Addition of a third line from Tuai to Gisborne on separate towers would address this constraint for Gisborne.

Sufficient embedded generation capacity to allow independent operation from the grid in the Gisborne and Wairoa Networks would improve the security levels.

The Mahia 33kV line which is currently limited to 1.5MW, by the Transformer Capacity at Blacks Pad. Following the 33kV extension project the limit will be 2.5MW.

### 4.4.3 Distribution constraints

In Eastland Network Limited's overhead network the constraint is generally driven by voltage drop. A nominal design standard of 3.0% is applied to new lines or connections to the existing lines. Voltage drop is permitted to reach 5% before reinforcement is considered or application for new load is declined. Other factors such as the need for contingent capacity to meet security needs are also considered.

Cable network tends to be more constrained by thermal ratings. Therefore underground systems are less tolerant of constraints.

Eastland Network Limited has identified the following distribution constraints:

Tikitiki Feeder Ruatoria – Limited transfer capacity between substations

Inland Feeder Tokomaru Bay– Limited transfer capacity between substations

Mata road feeder Tokomaru Bay – Very long feeder

Tauwharepare Feeder Tolaga Bay - Very long feeder

Dalton Feeder Kaiti Anarua Bay feeder is voltage constrained over holiday periods. Hence only isolated new loads could be supplied.

Nelson Road Feeder Makaraka

TeArai Feeder Patutahi - Very long feeder

Tiniroto Feeder Pehiri - Very long feeder

Tahora Feeder Ngatapa - Very long feeder

Whatatutu Feeder Puha- Very long feeder

Matawai Feeder Puha Additional load would require a voltage regulator and ultimately a 50/11kV zone substation.

Muriwai feeder Patutahi can only supply around an additional 200kVA of load, up to halfway along the feeder otherwise the voltage would be unacceptably low.

Frasertown and Raupunga feeder's remote connections are currently limited by voltage. This will preclude all new load other than isolated single dwellings.

Mahia Feeder Blacks Pad – High point loads at ends of feeder

Ruatakuri Feeder Tuai - Very long feeder

Hicks Bay Feeder TeAraroa - Very long feeder

Kiwi A and B feeders from Wairoa Substation to Kiwi Substation at Limit

Borough1 and Borough2 Feeders in Wairoa near security limit.

Relief of all of these constraints typically requires significant customer contribution as the required investment is unlikely to be covered by the allowable revenue. Eastland Network Limited is developing the option of installing Diesel Generation to support voltage at peak loading to relieve the constraints. Note the generation would not provide for significant growth if 24 hour generation was required. The generation solution when used during planned and unplanned shutdowns will contribute to improvement of key performance indicators for the feeders identified above.

### 4.4.4 Significant consumer constraints

In general significant consumers have supplies tailored to their requirements. Consumers requiring increases in capacity are effectively constrained by the minimum investment they initially undertook.

# 4.5 Use of non-asset solutions

Covered in section 4.2.1 Eastland Network Limited considers a range of non-asset solutions including smart technologies, third party generation and network reconfiguration. Eastland Network Limited's preference is for solutions that avoid or defer new investment.

### 4.5.1 Distributed Generation

Eastland Network Limited believes that in part a solution to improve security and defer investment to overcome constraint is the development of additional embedded generation throughout its distribution network. The following generation possibilities in the Gisborne and Wairoa Region have been identified;

- Medium scale, (80MW) hydro generation
- Small scale, (70-2000KW) hydro generation
- Bio-mass fueled combined heat & power plants
- Gas-fired cogeneration plants.
- Wind Generation
- Gas engines

Eastland Groups' Business Plans contain initiatives to investigate the feasibility of potential generation, both inside and outside the region, and develop those projects as appropriate.

In September 2008, Government passed the Electricity Industry Reform Amendment Bill under urgency in the House. This was the culmination of review of the EIRA designed to relax the rules regarding ownership and operation off generation by Lines Companies.

A key part of these changes were changes to the restrictions on renewable energy sources. Renewable energy sources are defined as:

*solar, wind, hydro, geothermal, biomass, tidal, wave, ocean current sources, or any other energy source that occurs naturally and the use of which will not permanently deplete New Zealand's energy sources of that kind, because those sources are generally expected to be replenished by natural processes within 50 years or less of being used.*

While clearly this has relaxed the rules regarding the amount of generation a lines company can own, in particular renewable generation and generation outside its geographic area, arm's length rules still apply to a lines company with generation and retail functions as shown in the table below:

| | | Electricity Lines Company | |
| --- | --- | --- | --- |
| | | Generation Division | Retail Division |
| Renewable Generation | In region | Unlimited | Information separation<br>>10MW:<br>Separate Co.<br>Separate Board<br>>30MW<br>Separate Company<br>Separate Board<br>Separate Mgmt. |
| | Outside region | Unlimited | |
| Non-renewable Generation | In Region | 50MW or 20% of max demand | |
| | Outside Region | Unlimited | |

The remaining restrictions, specifically those regarding the arms-length rules, could be a significant impediment to the development of generation/retailing opportunities.

Ultimately, each Generation Opportunity must be assessed against the criteria of creation of Shareholder value and regional prosperity before the decision to proceed is made. While this is can be subjective in terms of regional prosperity, all projects will be assessed on a Discounted Cash Flow basis, that incorporates all project costs and revenues, and only those projects which are expected to have a positive Net Present Value against a hurdle rate that is deemed acceptable for the project will proceed.

However, based on Eastland Network's previous experience, a key factor to the success of these projects is the ability to retail. As discussed above, the changes to the EIRA still present significant challenges and restrictions on the ability to retail. This may significantly undermine the value of many generation opportunities.

Eastland Network Limited recognises that emerging technologies such as Photovolaics/Solar, Electric vehicles, smart technologies, have the potential to significantly alter the way networks perform, are operated, also influence future network investments and criteria.

This asset management plan does not specifically address possible future issues relating to emerging technologies as a number of work streams are being undertaken by Eastland Network in association with the Eastland Group Business Development unit in the 2016/17. These issues will not be fully indentified and analysis completed until the end of the 2016/17 financial year, as such they will be discussed in the 2017/18 asset management plan.

## 4.6 Policies for distributed generation

Eastland Network Limited clearly recognises the value of distributed generation in the following ways:

- Reduction of peak demand at the Transpower GXP.

- Reducing the effect of existing network constraints.

- Avoiding investment in additional network capacity.

- Making at least a small contribution to supply security.

- Making better use of local primary energy resources thereby avoiding line losses.

- Avoiding the environmental impact associated with large scale power generation.

As many of these benefits are only realised if the generation can reliably and consistently perform when needed, wind, solar and run of river hydro generation are generally not able to make any significant contribution. Where there is no guarantee that the generation can offset transmission costs Eastland Network Limited is usually unable to contribute to the benefits until savings have been identified.

Eastland Network Limited also recognises that distributed generation can have the following undesirable effects:

- Increased fault levels, requiring protection and switchgear upgrades.

- Increased line losses if surplus energy is exported through a network constraint.

- Stranding of assets, or at least of part of an assets capacity.

- Reduction in asset utilization without the ability to remove the asset

- Instability of the network during faults and interaction with existing generation

- Deviation of voltage beyond allowable limits and voltage stability issues.

- Increased loading on assets to accommodate power factor requirements of induction generators

- Harmonic interference

- Automatic reclosing creating synchronising issues

Despite the potential for some undesirable effects, Eastland Network Limited actively encourages the development of distributed generation that will benefit both the generator and Eastland Network Limited. As per the Electricity Industry Participation Code 2010 Part 6 (Connection of Distributed Generation), details on the processes necessary and information required to enable connection of DG to Eastland Network Limited's assets are available in the Eastland Network section of the Eastland Group website, (www.eastland.co.nz).

The priority's for fault restoration and repair work are determined on the basis of the nature and number of customers affected, the available resources, locations, environmental conditions and estimated repair times. In general generation only connections are expected to have a lower priority assigned than load using customers with greater dependence on their electricity supply. Hence outage/repair times for generation may be greater than disclosed averages for outages and service levels may be lower.

The key requirements for those wishing to connect distributed generation to the network broadly fall under the following headings.

### 4.6.1 Connection terms & conditions (commercial)

Connection of distributed generation to an existing connection will not incur any additional line charges if the capacity of the connection does not alter. Connection of distributed generation requiring capacity greater than the existing connection may incur additional costs to reflect network reinforcement.

Distributed generation that requires a new connection to the network will be charged a standard connection fee, and may also be charged a fee to reflect reinforcement of the network back to the next transformation point.

Variable and fixed line charges will be payable by the connecting party to Eastland Network Limited.

Installation of suitable metering (refer to technical standards below) shall be at the expense of the distributed generator and its associated energy retailer.

Eastland Network Limited recognises and shares the benefits of distributed generation that arise from reducing Eastland Network Limited's costs (such as transmission investment costs, or deferred investment in the network) provided the distributed generation is of sufficient size to provide real benefits. Separate contracts for recognition of benefits will generally be fixed term and renewable if the benefits still exist. Penalties will apply to contracts if the benefits are not realised.

Those wishing to connect distributed generation must satisfy Eastland Network Limited that a contractual arrangement with a suitable party is in place to consume all injected energy.

### 4.6.2 Safety standards

A party connecting distributed generation must comply with any and all safety requirements promulgated by Eastland Network Limited.

Eastland Network Limited reserves the right to physically disconnect any distributed generation that does not comply with such requirements.

### 4.6.3 Technical standards

Prior to connection of an installation Eastland Network Limited will require evidence that all matters relating to regulatory compliance have been met. This may include but is not limited to

Easements

Resource consents

Building consents

Asset Capability Statement and approval from the System Operator

Safety Management Systems

Electrical compliance certificates

Metering capable of recording both imported and exported energy must be installed. If the owner of the distributed generation wishes to share in any benefits accruing to Eastland Network Limited, such metering may need to be half-hourly.

Eastland Network Limited may require a distributed generator of greater than 10kW to demonstrate that operation of the distributed generation will not interfere with operational aspects of the network, particularly such aspects as protection and control.

All connection assets must be designed and constructed to technical standards not dissimilar to Eastland Network Limited's own prevailing asset management standards.

While specific analysis is required on a case by case basis, the maximum injection into the network before voltage limits are exceeded is indicated in the following table.

| Location | Nominal Maximum export |
|---|---|
| Urban 50kV sub-transmission | 8 - 20 MW |
| Rural 50kV sub-transmission | 2 - 8 MW |
| Urban 11kV distribution | 3 - 6 MW |
| Rural 11kV distribution | 50% of the typical feeder load 50 - 500kW |
| Rural 11kV distribution near Major Substations | 1 - 2 MW |
| Urban 400V Reticulation | 100 - 200kW |
| Rural 400V Reticulation | 8 to 50kW |

In accordance with the Electricity Industry Participation Code 2010 Part 6 (Connection of Distributed Generation), details of the processes necessary and information required to enable connection of distributed generation to Eastland Network Limited assets is available from the Eastland Network Limited section of the Eastland Group web site.

# 4.7 Development program

## 4.7.1 Options considered for major initiatives

As identified in section 1.6 the Wisdom and Understanding inherent in Eastland Network Limited's processes and systems continually filters numerous ideas and options for development initiatives. While many options can be quickly considered and discounted the following options for major initiatives have developed as a result of the process. A ranking of success outcomes and risk factors for the following development initiatives in this section provided in section 6.2.3.

### 4.7.1.1 Transmission Development

The acquisition of transmission spur assets from Transpower in 2014 provided the following benefits.

Enhanced operation of the 110kV supply to the Gisborne and Wairoa regions through Eastland Network Limited gaining full indication and control of all the substation equipment

Material reduction in the cost of managing and operating the spur assets and operational efficiencies through coordination with other Eastland Network Limited activities in the region;

Optimisation of capital expenditure across, transmission, Subtransmission, distribution and local generation, which will achieve the necessary supply security at a lower cost than if the assets were separately managed;

Reduced regional coincident peak demand, resulting in reduced transmission interconnection charges.

Associated with the acquisition of theTranspower Transmission Assets, (and ctransfer of operational control to ENL), the following Transfer Projects, (total value $770k), were required to be undertaken;

Transfer of telemetry and control from Transpower SCADA system to Eastland Network Limited's SCADA system and establishing new communication links between Eastland Network Limited's control room to Tuai, Wairoa and Gisborne 110kV substations;

The purchase of 110kV line and station spares; and,

The purchase of temporary tower equipment (non-network assets).

### Gisborne Substation

Options available to incrementally increase the transmission capacity to Gisborne to accommodate growth are;

#### a. 110kV Line Thermal Upgrade

Worst case load forecasts for the Gisborne Substation predict that the 110kV lines summer contingent capacity becomes a constraint in 2020.

A study in 2010 indicated that a thermal upgrading of the line to 75 degrees C would increase the thermal capacity from 59MW to 77MW (winter rating). It is important to note that the voltage constraint would become the limiting constraint and additional capacitors on the 50kV bus at Gisborne would be required. The study indicated that installing 4 x 6MVAr capacitor banks would be necessary to achieve 67MW on the line. The cost of this option is likely to range from $2-10+ million.

A detailed investigation into the scope and of work required to achieve the thermal upgrade is required to validate this option.

It should be noted that the deferral of demand growth may be achieved through development of a significant amount of network connected generation if it occurs first.

#### b. Full re-conductoring and partial re-conductoring

The 2010 study investigated both partial and full re-conductoring. Re-conductoring overcomes both the capacity and voltage constraints on the line. Line capacity ratings of between 65 and 70MW can be achieved with these options.

A detailed investigation into the scope and of work required to Reconductor the line is required to validate this option. As the two circuits share the same towers on some sections of the line there is likely to be material safety issues to contend with. The cost of this option is likely to range from $2-10+ million.

#### c. Third transmission Line

As a potential solution to the eventual 60MW constraint, the possibility of reconductoring the Tuai – Gisborne 110kV line and installing additional transformer capacity, (a 3rd 60MVA transformer) at the Gisborne Substation. Estimated costs of the re-conductor work and additional transformer capacity are $30 - $50mill.

It is expected that this solution will not be optimum as the Eastland Network Limited sub-transmission network supplied from the Gisborne Substation will have become constrained. Being installed in predominantly urban areas means that these constraints will not easily be resolved through enhancement of, or additions to the existing sub-transmission lines also consenting issues will be significant.

The construction of a third transmission line from Tuai is therefore proposed. This 40MW line would terminate at Patutahi where a Transmission Substation would be established at the existing Eastland Network Limited subtransmission substation site. Potentially the Gisborne Substation would be transferred to this location and the existing 110kv lines from Patutahi to the Gisborne Substation would be converted to 50kV. The Patutahi location facilitates the "easy" construction of new sub-transmission lines to the Matawhero industrial area where the majority of demand increase is expected to occur. The estimated cost of the new line is $60mill and the new GXP $20mill.

Eastland Network Limited has previously identified a line route from Tuai to Patutahi which can share an existing 11kV line route. The 11kV would be overbuilt with 110kV on concrete poles. A preliminary concept report has been completed in 2008 and a process relating to the obtaining of necessary easements is the next stage.

The three 110kV line scenario will provide a transmission contingent capacity to the Gisborne region of 100MW.

Scheduled for post 2016 - dependent on growth triggers

#### Wairoa Substation

Previously it was proposed that the Eastland Network Limited security for Wairoa Substation be reduced to from a C to a B1 classification. This would require only an “n” level of security with 100% contingency capacity such that 75% of the load could be restored within 15 minutes, 90% within 3 hours and 100% restoration dependent upon repair time. Optimisation of the Wairoa Substation to this security level would have halved the quantity and value of assets required and saved approximately $40,000 pa in connection charges. It was proposed that the use of 1.5Mw of load control and 6MW of embedded generation, (5MW Waihi Hydro + 1MW Mahia Diesel) would compensate for the reduced service levels.

This proposal has now been discounted as it would result in an unacceptable divergence from Eastland Network Limited’s security standards. Waihi Hydro only has 3 days storage capacity and cannot be relied upon to deliver 5MW on call. This was demonstrated in March/April 2002 when due to lack of rainfall Waihi was unavailable for evening peak reduction. Under the proposal an event coinciding with Waihi unavailability would result in a capacity which could only be covered via supply rationing. The reduction of Wairoa Substation asset also would restrict the availability of capacity for growth.

Transpower has identified the age/conditioned based replacement of the 110/11kV transformers is due in 2016. Since acquiring these assets, results from its own detailed condition surveys of the 110/11kV transformers and the purchase of 2 spare units has allowed ENL to defer the replacement of these assets until 2023. As the detailed design of this project progresses replacement with 110/33kV transformers is a consideration.

### 4.7.1.2 Transmission/Sub-transmission Development

#### Transmission

The 110kV lines from Tuai to Gisborne and Wairoa are predominantly a double circuit tower construction. Failure of a single tower is likely to interrupt both circuits (n – 2 electrical). While the likely hood or frequency of this risk is low given the maintenance, inspection and robust design of the lines the consequence is very high.

The only option currently identified to eliminate this risk is construction of a new110kV line from Gisborne to Wairoa which provides both a contingent route and complements growth options in 4.7.1.1. To date the risk has not been considered significant and the levels are aligned with risk levels acceptable to other NZ lines businesses. Options considered for growth incorporate plans to eliminate this risk in the long term.

#### Gisborne Sub-transmission

Within the urban Gisborne sub-transmission network previously identified demand growth triggers have been reached and associated investments have been made to accommodate the expected minimum load growth projections. With the concentration of loads restricted to blocks of less than 12MW, n-1 security is provided without the requirement of dual transformers or large transformers in neighboring substations being needed to cover contingent events. Sufficient flexibility exists in key parts of the distribution system such as Matawhero, to accommodate forecast industrial load growth. Further development of the 11kV network is on-going but is only undertaken in response to meet firm load growth requirements.

In the long term the ability to upgrade the urban sub-transmission system to address security or capacity constraints is limited and will coincide with transmission constraint requiring a 3rd transmission line and new Transmission Substation.

Rural loadings are lower than the installed capacities of the sub transmission system. The daily load profile is reasonably flat, and there are few commercial and industrial loads. As the rural loads are relatively low growth is extremely sensitive to even small subdivisions or commercial developments. The ability to accommodate growth too far out from rural substations is also limited.

From an economic viewpoint, high levels of sub transmission investment made in the rural area cannot be justified, but long distances require high voltage and bulk supply has to be concentrated. Security provision would therefore normally require large, redundant assets. Eastland Network Limited has adopted a design approach where security is provided by standby generation support. This approach has the potential to deliver better service, reduce Transmission/Subtransmission substation asset investment, and avoid 11kV network reinforcement cost. Actions undertaken as a result of the installed generation in 2003 have included removal of high maintenance 2nd transformer banks and replacement of outdoor switchyards with indoor 11kV switchboards providing room for generators on existing sites.

Should the rate of growth exceed the expectations the following provisional projects have been identified that are considered sufficient to accommodate medium growth expectations.

- Provisional Whangara Substation 2.5MW. Situated between Kaiti and Tolaga bay substations this substation may be necessary to meet load growth and support requirements in the Wainui Beach area. While medium scale generation prospects in the area may negate the need to establish this substation large scale generation options will potentially require a substation with up to 10MW export capacity in this area. Provisionally scheduled for 2024 - 2026.

-Provisional 50kV/11kV 12.5MW Transformer situated at the Gisborne substation. An option has been identified to extend the Gisborne Substation 50kV Bus creating 2 additional Bays. The 50kV line to Kaiti and the Coast can then be separated utilising 1 of the additional Bays and a short 50kV line to a new substation can be established to reduce load and increase support for the Makaraka, Carnarvon and Kaiti Substations. Provisionally scheduled for 2022 – 2024.

-Provisional Patutahi Zone Substation capacity increase 12.5MW. Situated close to the Matawhero area an option has been identified to upgrade the capacity at this site should a short fall develop in the Matawhero area. The need for this is unlikely however provision is scheduled post 2026.

### Matawai Supply

The Matawai area supplied from the Puha Substation is exposed in terms of Eastland Network Limited's security standard by the single 11kV line from Puha to Otoko hill run over rugged inaccessible terrain. Currently Puha Substation is linked to Patutahi via the 11kV network and supported by a 1MW generator to enable regular maintenance on the ageing transformers.

To accommodate growth and/or improve security in the Matawai Area installation the following options have been identified:

50/11kV Substation Matawai. A Zone substation at Matawai combined with conversion of the 50kV line from Otoko to Matawai, currently operating at 11kV, back to 50kV has been considered. Two possible locations for the substation have been considered, Site 1 is at Matawai Township on Eastland Network Limited owned land, and Site 2 is near Olivers Road approximately halfway between Puha and Matawai and coincides with an 11kV embedded generation connection to the line that would be used at 50kV currently operated at 11kV.

Generator Relocation: Relocation of the Generator at Puha Substation to A site at Otoko past the single 11kV line bottleneck to the Matawai Area would overcome the security constraint but would not provide for benefits the other options would provide.

New 11kV Line Section: The Ngatapa substation has been identified as a key site in terms of location to provide security and support to the Matawai area currently supplied from Puha substation. Construction of a section of 11kV line from the end of the Ngatapa feeder to Otoko Hill under the existing 50kV line route. while being close to the value of a new substation at Matawai will not only provide for the security requirements of Matawai but will provide the additional benefit of capacity support for both the Ngatapa and Puha substations.

The Ngatapa/Otoko 11kV feeder project is scheduled in the distribution development section of this plan.

### Wairoa Sub-transmission

Wairoa sub-transmission development considers the Capacity constraint at Mahia, Capacity availability for the forecast Wairoa CBD growth, Rationalisation of Wairoa and Kiwi Substations and Tuai Substation Supply.

### Mahia

Mahia is currently supplied at 11kV from a 33/11KV 1.5MVA transformer at Blacks Pad. This transformer is not fitted with on load tap changing capability. This coupled with the length of the 11KV line and current conductor size results in voltage stability issues occurring when demand exceeds approximately 800KVA.

Demand requirements at Mahia have increased due to the growth of dairy farming at Mahunga, beach property subdivisions and installation of sewage treatment schemes in the area. The current rate of growth is forecast to continue due primarily to continuing subdivision activity. To date demand requirements exceed the capacity of the Mahia transformer and are very seasonal in nature. It is expected that over time this seasonality will not be as evident as more people take up permanent residence at Mahia.

Increasing demand requirements also result in increased voltage stability issues.

Since 2002 a generator has been installed and operated at Mahia during high demand holiday seasons to overcome capacity and voltage issues. However with the level of demand growth forecast to increase at Mahia and the expected change in demographics it is expected that the generator solution is a medium term solution.

Investigation has shown the upgrading of the 11kV Mahia network will not be sufficient to resolve current issues and accommodate increasing demand requirements. The optimum solution is to relocate the Mahia transformer closer to the load source and increase its capacity. This involves extending the 33kV line approximately 6.5km to Opoutama and establishing a small zone substation. The substation would comprise of a 2.5MVA transformer fitted with an on load tap changer.

The cost of this option is estimated at $1.5 mill. As this expenditure will result in little additional returns to Eastland Network Limited and additional financial contribution is being sourced from the developers in the form of contributions linked to the capacity being developed and their specific requirements.

Implementation of the Mahia development project has been delayed due to continuing challenges with the project including obtaining a suitable substation site and achieving easements over private property for the 33kV line extension. Also since 2007, (coinciding with the GFC?), a notable reduction and deferral of development at Mahia has occurred.

### AFFCO & Wairoa CBD

AFFCO's current approximate maximum demand of 4MW is 35% of the total maximum demand (11.6MW) of the Wairoa network. Load increases at AFFCO have a significant influence on the Wairoa 11kV network as a whole. AFFCO is currently supplied at 11kV from Kiwi substation. The maximum capacity limit of this supply is 5MW, after this limit is exceeded the supply to AFFCO will be required to be at 33kV.

AFFCO have previously advised that expansion of their plant may result in a maximum demand increase to 6.5MW the timing of this expansion is unknown. In 2008 new load associated with sawmilling in Wairoa was introduced however this venture is no longer operating.  Any future growth will take up the remaining contingent capacity of the 11kV network supplied from Kiwi substation.

The following options have been identified:

Embedded Generation Affco. Eastland Group/Eastland Network Limited continue to investigate embedded generation opportunities.

33kV Supply to Affco. In the medium term AFFCO could be supplied at 33KV by converting the Waihi 50KV line to 33kV and connecting to the 33kV Transformer at Wairoa instead of Kiwi. This will improve contingent 11kV capacity to Kiwi and be available to supply other Wairoa growth including sawmilling.

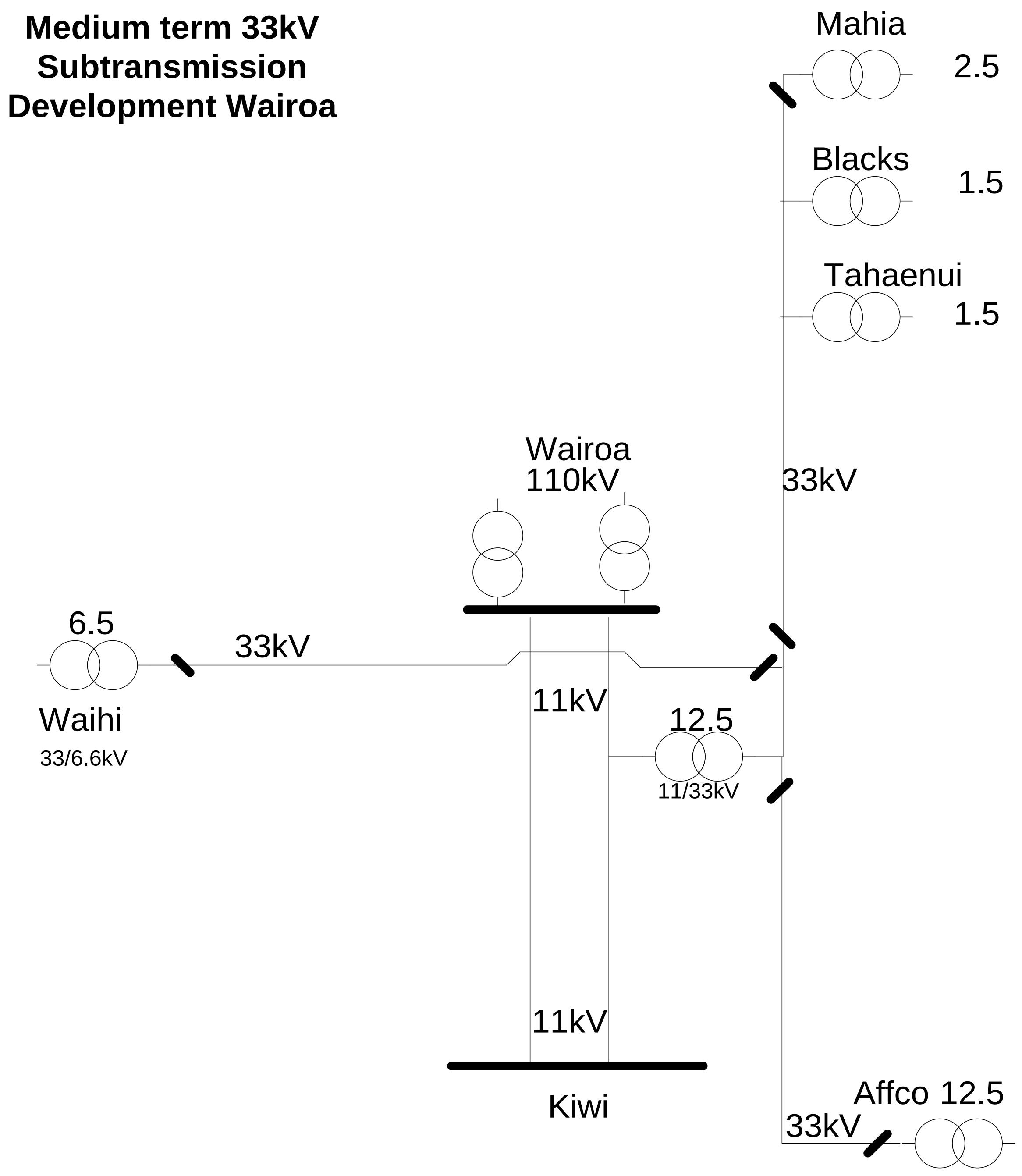
The long term option for the sub-transmission development of Wairoa is that the current 110/11KV transformers be replaced with 110/33KV transformers. This option provides for splitting of the Borough1 and Borough2 feeder load/connections to maintain contingent capacity on these two feeders crossing the Wairoa River.

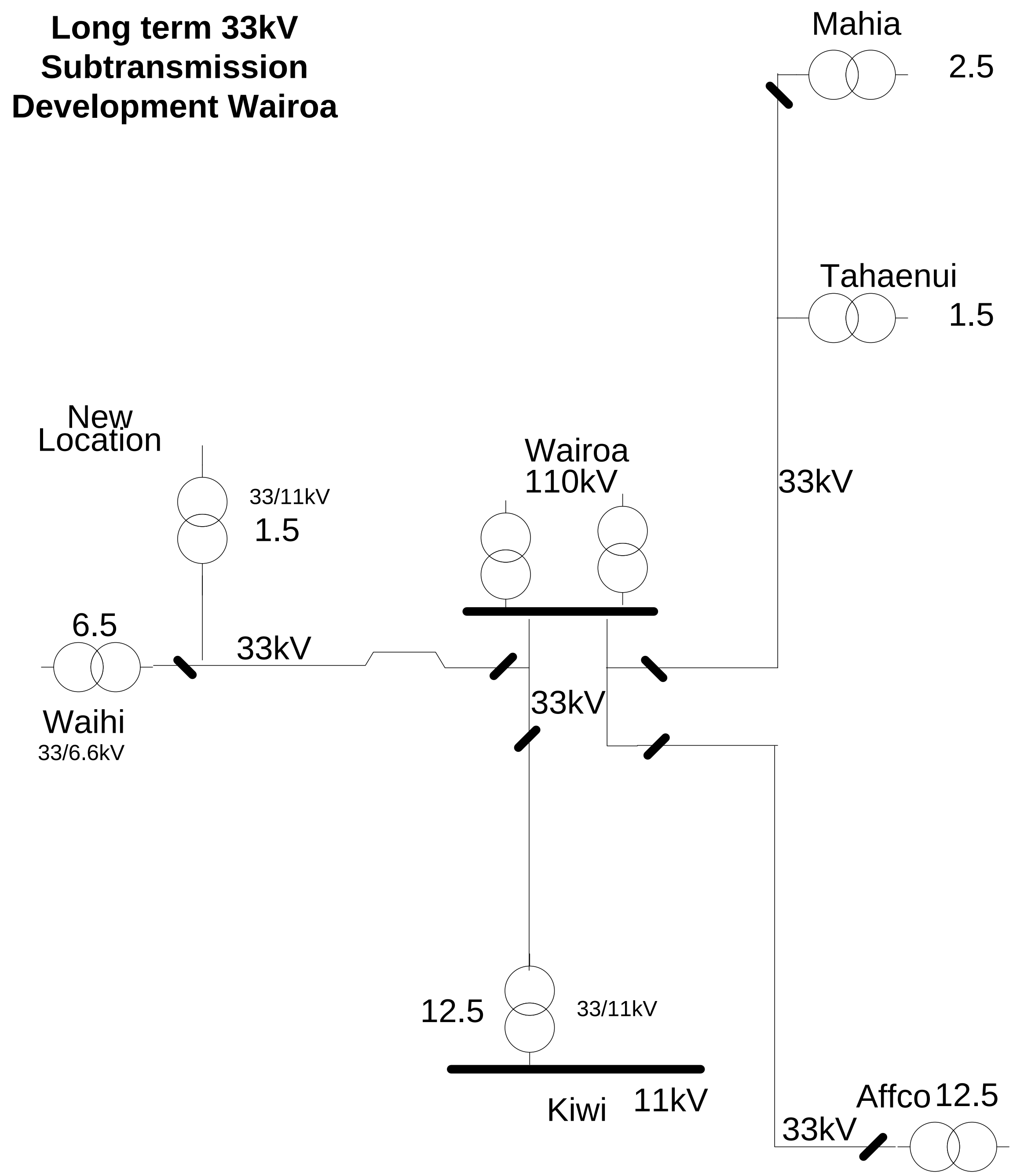
The medium and long term options for sub-transmission development in Wairoa are shown on the following schematics. While the first stage of development is underway it should be noted that the final stage will be deferred until necessary.

### Tuai Substation

A new 110/11kV 3phase Transformer was purchased for Tuai in 2017/2018 to replace the existing 1 phase transformer bank. A project is programmed to install the new transformer at a different location in the Tuai Substation and reconfigure the 11kV and metering in conjunction with the install.

Due for completion mid 2019


Medium term 33kV
Subtransmission
Development Wairoa
Mahia
2.5
Blacks
1.5
Tahaenui
1.5
Wairoa
110kV
33kV
6.5
33kV
11kV
12.5
11/33kV
Waihi
33/6.6kV
11kV
Kiwi
Affco 12.5
33kV




### Tuai Substation

The maximum demand Tuai is not forecast to exceed 0.65MW during the planning period.

The age/conditioned based replacement of the 110kV transformer is now due.

The potential to supply Waikaremoana load from alternative sources to avoid replacement of the 110kV transformer and allowing it removal has been investigated.

The alternative supply options allowing removal of the Tuai Transformer include.

Tuai/Wairoa 11kV Link. Building a line to Waikaremoana from the end of the existing Wairoa 11kV network which comes within about 1km of Waikaremoana. Because of the 11kV reinforcement/upgrade required all the way from Wairoa. It is also considered that consent and/or easement issues associated with this option would be considerable. The additional load and line length on the Frasertown feeder would incur a corresponding decline in primary performance figures.

A variation to this option could include converting the 50kV Waihi line to 33kV and provide a 6.6/11/33kV transformer at Waihi. This option will be further investigated when the Wairoa development plan is implemented.

Taking an 11kV supply straight from the generation bus at Tuai. This option was discounted due to loss of supply issues associated with planned and unplanned generation bus outages. The generator at the site has been approached but has declined proposals on both technical and operational grounds. Liability relating to obligation to supply and for damage to customers equipment were also identified as issues, preventing successful implementation, by the generator.

Standby Generation Development: The installation of standby generation, refer 4.7.1.5 offers a solution to the issue of contingency capacity while addressing distribution performance enhancement at the same time. This option does not provide for removal of the transformers but allows for replacement of the existing transformer with a single 3 Phase unit at lower cost than 2 units or a single phase bank with spare unit.

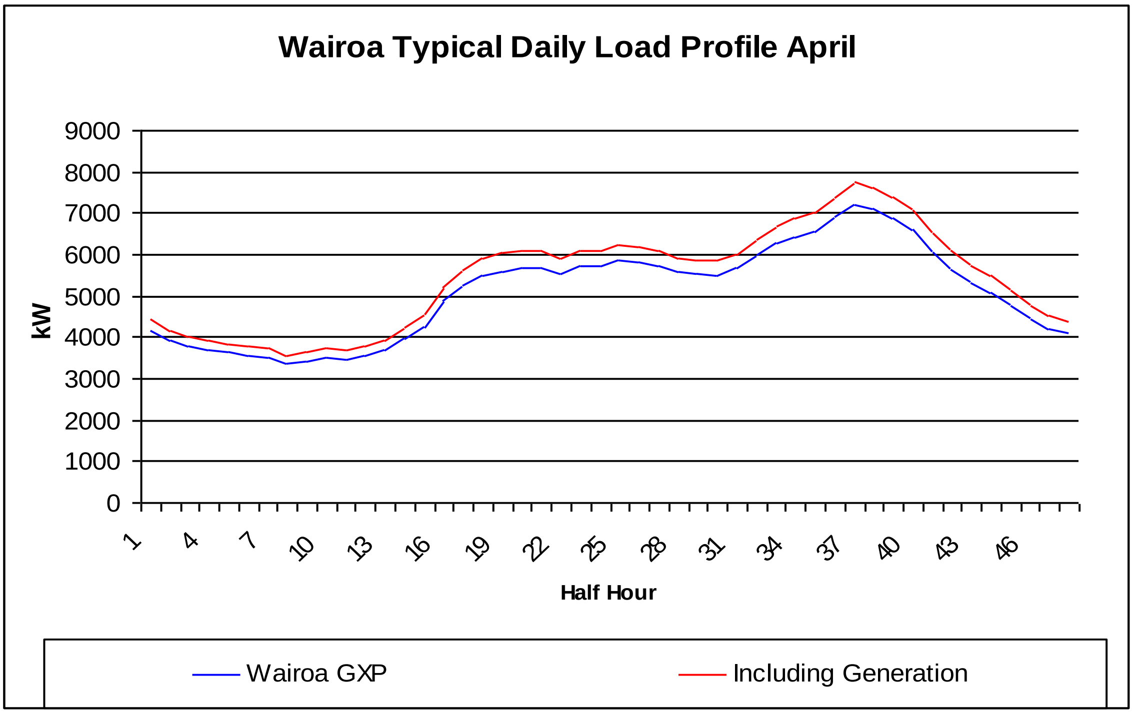
Eastland Network Limited has investigated the above options however, options A to C are not economically or commercially viable, and hence a supply from the Tuai GXP to a Substation at or near this site will be required for the foreseeable future.

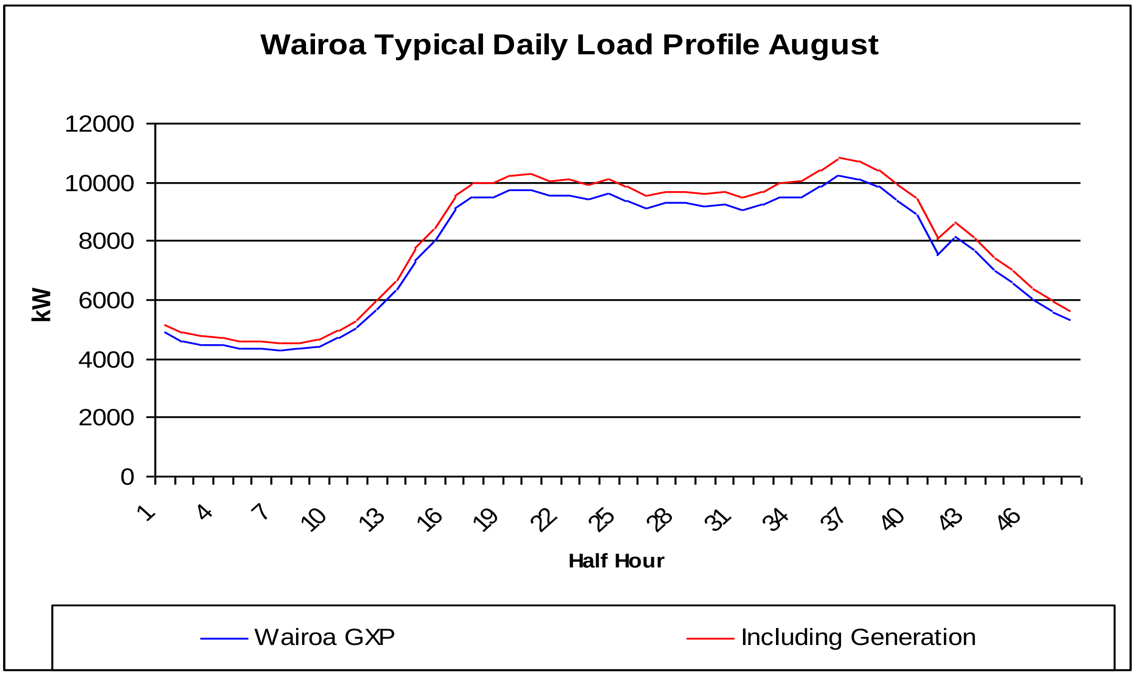
#### 4.7.1.3 Generation Development

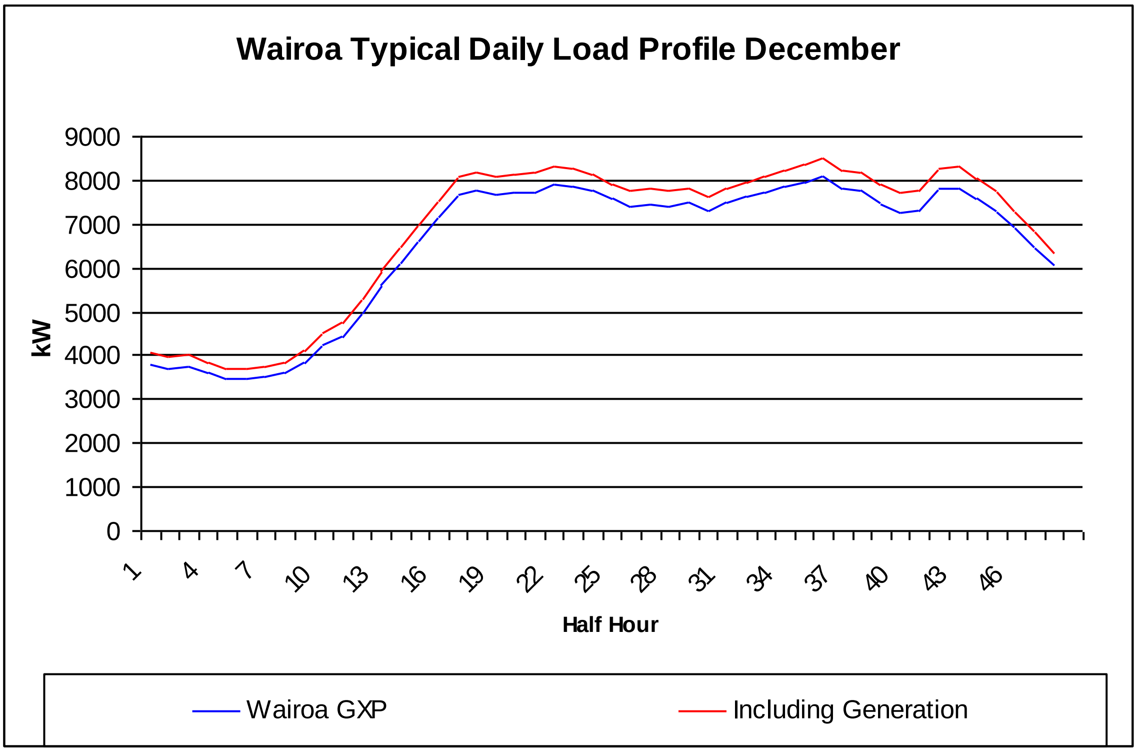
Investment in generation by Eastland Generation Limited presents a business diversity option as well as being a least cost substitute for expensive transmission and/or sub-transmission investment.

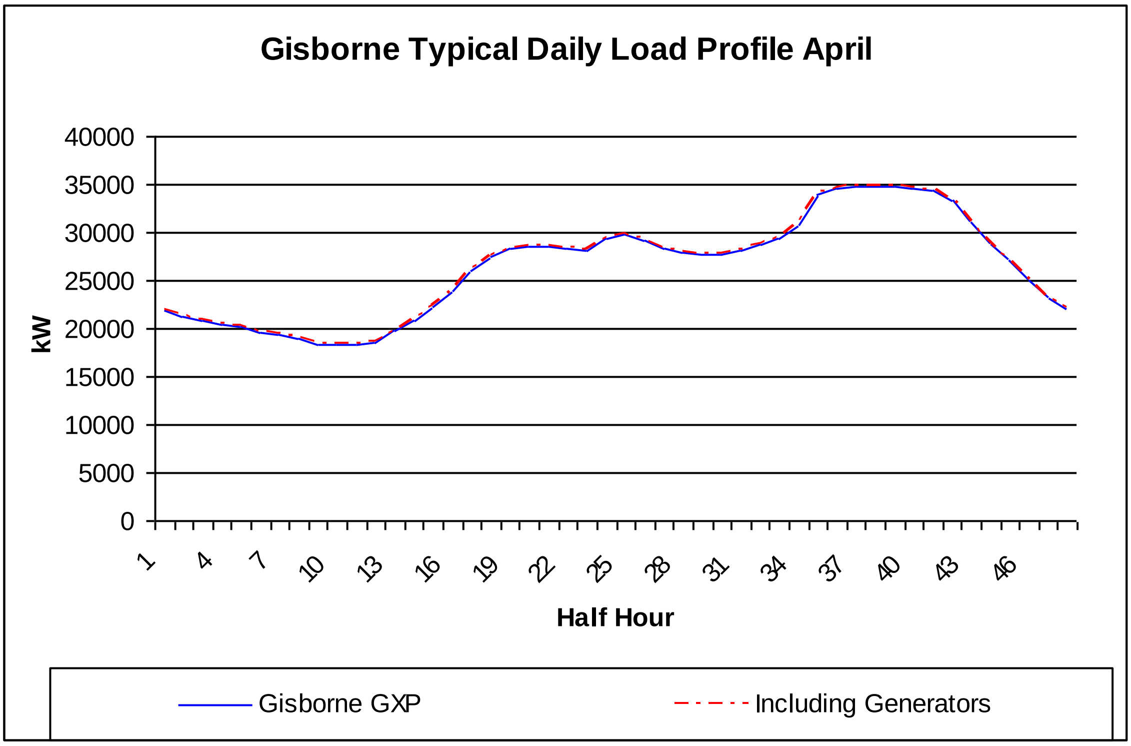
For each development need identified which involves an asset solution, Eastland Network Limited considers alternative solutions including distributed generation. Working with Eastland Generation Limited and other partnerships non-asset solutions are incorporated into development actions where appropriate. The work undertaken in conjunction with Generation partners includes: Water monitoring, Wind Monitoring and Engineering analysis activities. As the activities of Eastland Generation Limited include development opportunities outside the Eastland Network Limited region the internal processes used to develop these alternatives are outside the scope of this plan.

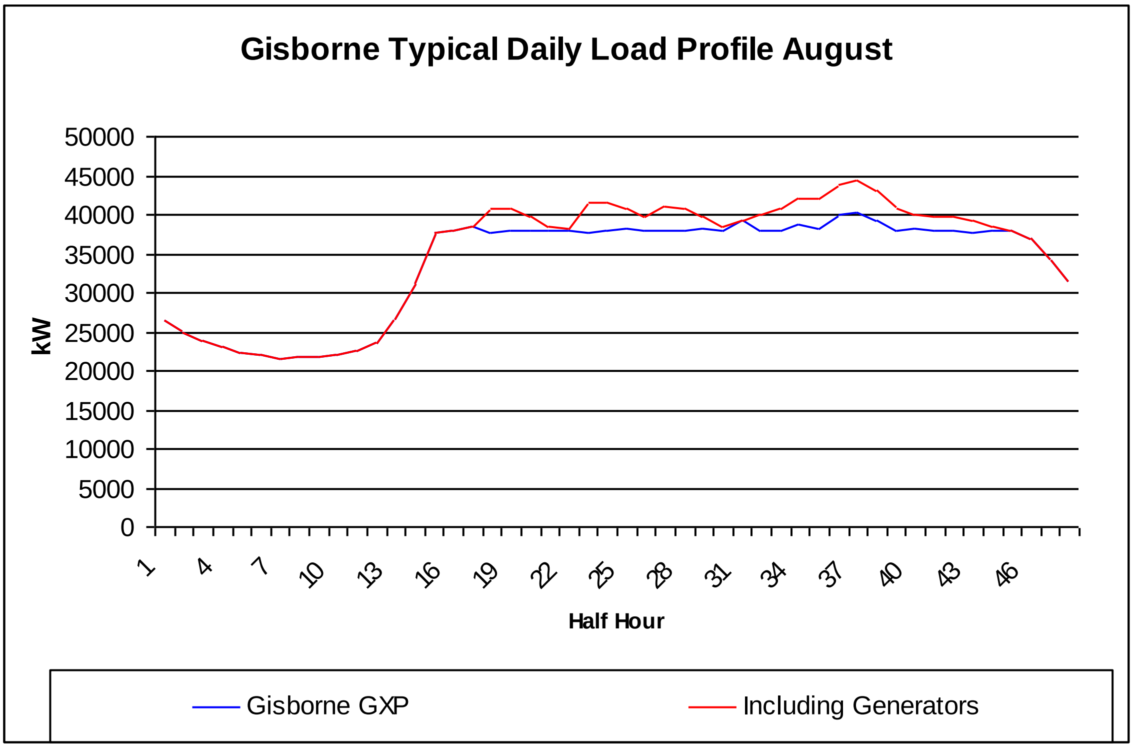
The following daily load profiles show how the use of Eastland Network Limited’s existing embedded generation when operated in conjunction with load control can effectively manage peak load periods creating a flat daily profile. These profiles indicate that there is little scope for additional peaking generation benefiting the overall demand side management of the assets. The contribution of base load generation opportunities is the preferred method to minimise further transmission and sub-transmission investment.

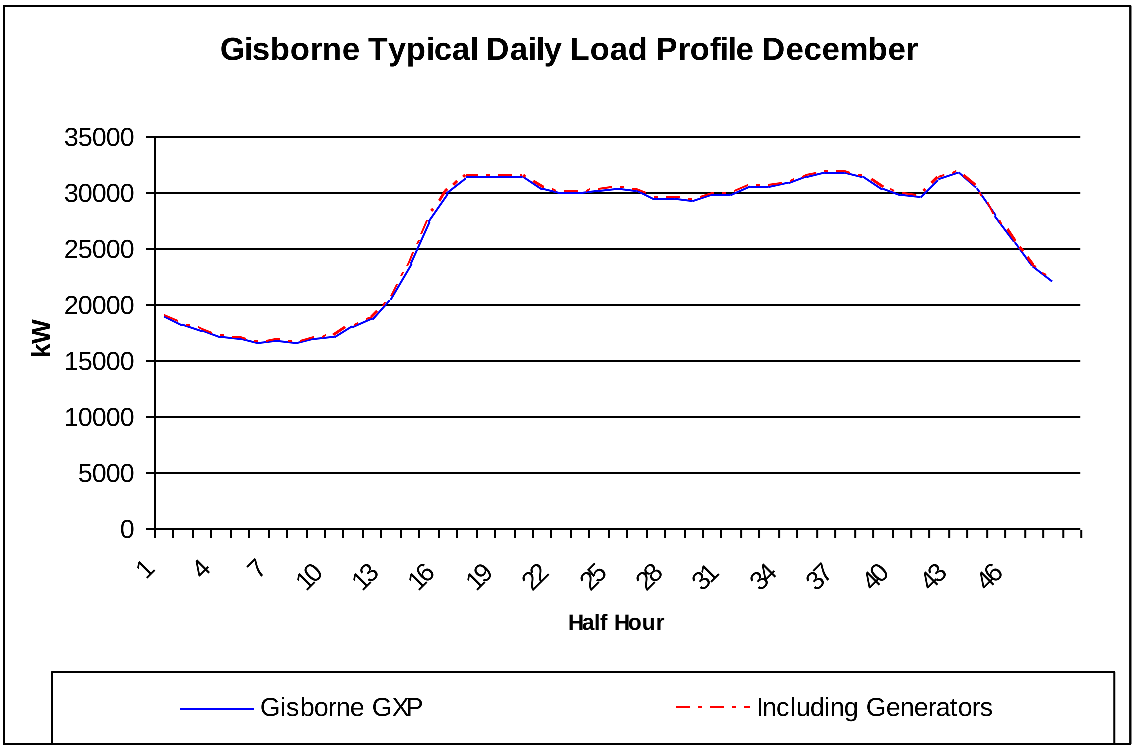

Wairoa Typical Daily Load Profile April
kW
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
Half Hour
Wairoa GXP
Including Generation


Wairoa Typical Daily Load Profile August
kW
12000
10000
8000
6000
4000
2000
0
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
Half Hour
Wairoa GXP
Including Generation


Wairoa Typical Daily Load Profile December
kW
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
Half Hour
Wairoa GXP
Including Generation


Gisborne Typical Daily Load Profile April
kW
40000
35000
30000
25000
20000
15000
10000
5000
0
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
Half Hour
Gisborne GXP
Including Generators




Regular review of alternative generation schemes previously investigated on the East Coast is undertaken. The various schemes investigated included Hydro, Wind, Biomass and Co-generation (utilising natural gas). The reviews are carried out in order to assess the viability of previously investigated generation options with regard to the increasing cost of energy and identify those worthy of implementation.

## Wind

Monitoring is currently being undertaken at Mokairau, Makarori and Whakapunaki. These sites were thought to show potential; however lack of wind and proximity to the existing distribution network is the primary constraint affecting economic viability. Large scale options have the additional logistical issues associated with road access from Gisborne. Another issue is that should significant development of wind generation occur, further base load generation would have to be introduced. This is to ensure network stability and provide contingent capacity support.

A Provisional allocation to establish wind generation has been identified in Eastland Generation Limited's development program should any option become viable.

## Biomass Generation

A number of proposals to install a biomass plant using waste from forestry and timber industries have been investigated. A site in the Matawhero area would supply the developing large scale industry with both electricity and process steam. Options of this plant are yet to be determined by Eastland Generation Limited and will be based around the requirements of the mill operators.

Studies into residue volumes and delivered price at Matawhero have been completed. The studies identify an economic line within which residue could be delivered to a bio-mass generation facility. The studies indicate some level of forest residue collection is viable. It is likely that this opportunity will be taken up by a third party in conjunction with the development of a new large scale industry.

## Hydro

In the 1970s and 80s a number of potential hydro schemes on the East Coast were investigated by Eastland Energy. With changes in the economic environment with respect to generation Eastland Generation Limited continues to reviewing these opportunities.

In addition to its own investigations, Eastland Generation Limited is liaising with private investors who have identified other potential hydro schemes within the Gisborne and Wairoa regions.

Waihi Power Station improvements include the possibility of increasing the storage capacity of the dam by dredging sediment from the lake floor, and/or by raising the height of the existing dam wall. Investigations have proven both these proposals to be uneconomic at this time.

## Gas Co-generation

Investigations into Gas Cogeneration have shown it to be uneconomic without process heat off take. There are also constraints on the regions gas supply, limiting any generation to around 6MWe. To make this type of generation cost effective it is imperative that an industry capable of utilising the process heat is found (e.g. timber drying). Also access to long term supply of gas with price certainty is required. Eastland Generation Limited continues to review any opportunities should they arise.

## Customer installed Standby generation

Some opportunity exists for Eastland Network Limited to utilise customer installed standby generation as peaking plant. This opportunity is however limited as few industrial customers in the region have at this time felt it necessary to make provision for or invest in security of supply. Currently the existing customer generators are not suitable for use in a peaking role without significant upgrade cost. The reduced life expectancy and increased maintenance cost in a peaking role when compared with the targeted life of the equipment in a standby role are additional issues affecting the viability of these options currently.

## Solar

Over the next decade it is expected that there will be significant reductions in solar and battery technology costs. This has the potential to significantly alter the way electricity networks perform. Consequently, Eastland are to commence a solar trial in 2016 to gain a technical understanding of how PV solar and battery technology performs and also to assess the impact on the existing network infrastructure and security of supply. Further it is hoped to understand how customers behave with such systems in respect to electricity use. Once the results of this trial are available, Eastland can assess futher developmental requirements.

#### 4.7.1.4 Distribution Development

#### Security reinforcement due to Growth

Section 4.4.3 of this document identifies when growth will or has caused 11kV capacity constraints either in terms of demand or more commonly in terms of voltage stability over distance.

Feeders selected for duty as tie feeders providing contingency capacity to other feeders/substations need to maintain spare capacity.

CBD expansion necessitates the upgrading and development of reticulation in specific areas of the Gisborne and Wairoa CBD's. This upgrading includes the undergrounding of existing overhead circuits on the CBD fringe with allowance for capacity upgrade.

In cases involving upgrade of existing lines or cables the justification for the identified projects incorporates a renewal component that has not been included in the renewal projections. Refer section 5.4.

11kV Lines and Cables that need to be upgraded for growth within the next 10 Years are indicated below. The cable projects are small in nature involving upgrades of old cables to a larger size.

As these projects have similar success outcomes and risk assessment factors the rating of these options are the same and identified as having a reasonably high priority in section 6.2.3.

| Year | Location | Existing Size | New Size | Cost |
|---|---|---|---|---|
| 2028+ | Ngatapa to Otoko Hill (50kV Underbuild line) 8km | N/A | Dog | $279,208 |
| 2026/27 | Stanley Rd cable link for Anzac and Awapuni Road | N/A | 300mm Al | $167,525 |
| 2022/23 | Wainui link Sponge Bay to Lloyd George line, 1.55km | 7/14cu | 300mmAl/Dog | $150,772 |
| 2026 - 2028 | Moana Rd Bypass Dalton Feeder 1.4km | N/A | 300mm Al | $ $536,078 |
| 2020/21 | Plunket Sub to Ormond Rd (Peel St Bridge) | 70mm Cu | 300mm Al | $111,683 |
| 2021/22 | Kahutia St Feeder cable (Carnarvon-Barry) | 70mm Cu | 300mm Al | $307,128 |
| 2024/25 | City Feeder cable (Carnarvon-Pak'n'Save) | 70mm Cu | 300mm Al | $156,336 |
| 2022/23 | Gladstone to Hirini Street cable | 95mm Al | 300mm Al | $89.346 |
| 2018 - 2020 | Awapuni/JNL to Makaraka link , cable | N/A | 300mmAl | $550,000 |

Allowances to accommodate growth triggered 11kV line network extension work typically arising and completed during the financial period are as follows.

| | |
|---|---|
| Lines | 1.0km p.a. @ $110,000/km = $110,000 |
| Cables | 0.5km p.a. @ $220,000/km = $$110,000 |

### Development of Load Control System

Identified as an opportunity to optimise network performance and defer investment in demand side growth, options for development of the load control system has been considered. The main disadvantage identified is the inability to provide reliable control and achieve the necessary benefits. In addition there is a lack of incentive for consumers to invest in energy storing appliances which limits the effectiveness of any investment. Without products that are tailored to, for example, hot water cylinders of different sizes, there is no incentive to install storage capacity.

Control in the non-domestic sector is at present virtually non-existent. There is a potential market for controlled products specific to dairy sheds, irrigation and freezer loads. A further option that can be offered to businesses is supply with lower security levels, for example, a "first off – last on" priority load control for non-essential load such as air-conditioning.

Since Eastland Network Limited is dependent on retailers passing through pricing to consumers, there is a major barrier to optimise load control. Concerns in the industry over this perceived lack of retail sector maturity are likely to be addressed at some point.

Future options regarding the future development and any investment in load control needs to consider in depth the possible impacts of emerging technologies such as Solar DG, smart meters and smart appliances. These emerging technologies have the ability to potentially significantly influence and alter traditional consumerenergy consumption patterns. Accordingly traditional network peak demand operational issueswill diminish/change and hence any associate investment in the likes of load control assets and capability needs to be reviewed.

In 2000 the Gisborne city load control system included a significant amount of outdated pilot control. This was a hardwired cascaded relay system that had high maintenance costs. Because the system could only support one control option it could not be tailored to different loads. The system had no potential to capture the entire controllable load.

From 2000 to 2008 the Gisborne pilot system was replaced with ripple receivers to minimise on-going costs. While the project successfully eliminated the high maintenance costs the entire system relies on a single injection transmitter.

Wairoa has a particular problem due to the frequency selected for its ripple control system. High frequency signals have difficulty propagating through networks and therefore control is very unreliable for the rural portion of the Wairoa controllable load. Load control development in Wairoa is further complicated in that the incumbent energy retailer owns the signal receiving equipment.

The Wairoa CBD and township operates on a pilot system with a centralized control point. Investigation of options for replacement of the existing Wairoa plant do not realise sufficient benefits currently. The best option at present is to maintain the pilot wire system with a view to shutting down the injection plant when it fails.

Bypass the existing Wairoa load control plant providing direct control to the pilot system in the CBD.

### Summary of Actions

Install 2nd Injection point Gisborne though budgeted for 2023 – 2025, ($560k), is likely to be deferred indefinitely until sufficient benefits improve viability.

Monitor the viability of a new load control plant and frequency change at Wairoa while maintaining the pilot wire system.

Monitor opportunities to implement demand side management. Currently no effective opportunities identified

### Network Loss Reduction

Distribution network companies do not suffer any significant cost penalty for high losses. Hence there is little investment signal for reducing losses. This would imply that if voltage standards can be maintained in line with the regulations then it is a valid commercial approach to minimize capital upgrades by not maintaining low loss levels.

Where security provision by way of interconnectivity is prominent and reserve capacity is built into the network for growth, overall loss figures are likely to be lower.

It can also be argued that it is more economically efficient for the community to pay for losses than to fund capital expenditure on conductor size and/or voltage upgrades to decrease losses, particularly on rural feeders with poor economics. Where transmission is constrained the value of reducing losses can be measured against:

1) The cost of kWh of avoided transmission (i.e. imbedded generation)

2) The cost of new investment to increase transmission capacity

Networks also have an obligation to manage their networks to good industry practice.

While voltage problems are not widespread on the network they do exist. An indicator of high losses is voltage sensitivity to load regulation. These issues are regularly evident in the following areas within Eastland Network Limited's network.

#### Frasertown-Raupunga ring
Essentially distance is beyond the capability of 11kV reticulation and sub transmission support is required.

#### Mahia
A large seasonal load at the end of the feeder suggests conductor reinforcement and sub transmission extension is required.

#### Matawai
Load, distance and voltage contribute to marginal performance.

#### Whangara
The long distance between Kaiti and Tolaga substations combined with high growth at Wainui is exceeding the conductor capacity and the Tatapouri voltage regulator limits.

#### Ormond
Load, distance and voltage contribute to marginal performance

While losses are higher in certain other locations the number of supplies affected is small and load diversity may mitigate this to some degree. If the areas identified above were to see significant load growth, voltage performance would quickly become unsatisfactory.

When designing new or replacement networks the following loss standards are applied.

| Design Loss Standards | Design % | Max. % |
|---|---|---|
| Transmission/Sub transmission Lines | 1 | 2 |
| Zone Transformers | 1 | 2 |
| Distribution Lines | 3 | 5 |
| Distribution Transformers | 2 | 4 |
| LV Distribution | 3 | 6 |
| TOTAL | 10% | 19% |
| Non-network losses | | |
| Service Line | 3% | |
| Metering | 2% | |
| Installation | 3% | |

| | | |
|---|---|---|
| TOTAL | 8% | |

## Loss Analysis

Prior to April 2015 Eastland Network Limited's total system losses were around 8.2%. From April 2015 following relocation of Transpower's GXP Metering from Gisborne and Wairoa Substations to the Tuai GXP the losses increased by a further 2%. The cost of these transmission Losses previously allocated via Transpower's pricing model were allocated to the Electricity Retailers suppling Customers in the Gisborne and Wairoa Regions.

The losses can be broken down to technical and non-technical losses. While the dynamics of the network load makes calculation of technical losses impractical use of load flow analysis applied to a snapshot of the network may provide a relative comparison or distribution of losses for the network segments. Using a snapshot load of 1 standard deviation above the normal average load and a load distribution based on installed transformer capacity, the total loss for the Eastland Network's high voltage network was determined to be 3.1 %. This figure being made up of 50 kV line losses of around 0.8%, 11 kV line/cable losses of around 1.1% and the losses from the zone substation transformers of around 1.2%. The average loss of the Eastland Network's Low Voltage network was determined to be in the region of 2 %.

Old zone transformers offer the greatest opportunity to reduce losses on Eastland Network Limited's network. There are 4 banks of 4 single-phase units on the network. These transformers have losses in the order of 6% as a result of the following factors:

High loss iron (all pre-1964 development using steel alloy).

4 separate units contain more iron to magnetize.

Sub-optimal load.

In all cases savings in losses and reduced maintenance justifies replacement with modern 3-phase IMP units within a 25 year pay-back period.

| Location | Capacity MW | Losses kW | Value p.a. $ |
|---|---|---|---|
| Tolaga T1 | 5 | 300 | 30,000 |
| Puha T1 | 5 | 300 | 30,000 |
| Patutahi T1 | 5 | 300 | 30,000 |
| Patutahi T2 | 5 | 300 | 30,000 |

The following table indicates the calculated high voltage losses in terms of load per feeder. When compared to the design standard it shows that there is considerable diversity in losses of components and load (of which loss is a function). High % losses for a given feeder can be an indicator of either low utilisation or an under-designed/overloaded feeder. Hence consideration of each feeder in terms of length, location and purpose is necessary when interpreting the information.

| Substation | Feeder | Feeder I (A) | Feeder Length (km) | Feeder Vdrop (V) | Vdrop (V/km) | load (KVA) | line loss (KVA) | % losses |
|---|---|---|---|---|---|---|---|---|
| Te Araroa | Awatere | 4.49 | 48.76 | 180 | 3.7 | 99.8 | 16.0 | 16.1 |
| | Hicks Bay | 13.73 | 73.52 | 590 | 8.0 | 252.1 | 21.5 | 8.5 |
| | Te Araroa | 7.51 | 13.95 | 50 | 3.6 | 143.1 | 4.0 | 2.8 |
| | | 25.73 | 136.23 | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| Ruatoria | Ruatoria | 23.78 | 21.88 | 50 | 2.3 | 467.4 | 22.1 | 4.7 |
| | Makarika | 9.90 | 53.47 | 290 | 5.4 | 186.2 | 19.1 | 10.2 |
| | Tiki-Tiki | 15.98 | 123.15 | 380 | 3.1 | 324.1 | 40.5 | 12.5 |
| | | 49.65 | 198.50 | | | | | |
| | | | | | | | | |
| Tokomaru | Inland | 10.55 | 55.06 | 400 | 7.3 | 217.1 | 18.6 | 8.6 |
| | Seaside | 6.29 | 6.09 | 30 | 4.9 | 118.5 | 5.0 | 4.2 |
| | Mata Rd | 14.32 | 129.08 | 380 | 2.9 | 268.3 | 39.2 | 14.6 |
| | | 31.15 | 190.23 | | | | | |
| | | | | | | | | |
| Tolaga Bay | Toko-Tie | 3.93 | 38.66 | 90 | 2.3 | 85.9 | 15.0 | 17.5 |
| | Town | 13.84 | 2.61 | 10 | 3.8 | 259.5 | 5.0 | 1.9 |
| | Rototahi | 11.88 | 43.08 | 120 | 2.8 | 227.4 | 20.0 | 8.8 |
| | Tauwharepare | 8.03 | 113.78 | 420 | 3.7 | 162.9 | 35.2 | 21.6 |
| | | 37.68 | 198.13 | | | | | |
| | | | | | | | | |
| Kaiti | Herschell | 8.92 | 0.68 | 0 | 0.0 | 160.0 | 7.0 | 4.4 |
| | Dalton | 45.33 | 93.18 | 740 | 7.9 | 875.7 | 37.2 | 4.2 |
| | Tamarau | 74.75 | 14.17 | 230 | 16.2 | 1451.2 | 41.6 | 2.9 |
| | Wainui | 37.36 | 3.07 | 30 | 9.8 | 720.1 | 13.2 | 1.8 |
| | Whangara | 34.11 | 22.26 | 280 | 12.6 | 649.4 | 30.3 | 4.7 |
| | | 200.47 | 133.36 | | | | | |
| | | | | | | | | |
| Carnarvon | Kahutia | 35.01 | 3.68 | 70 | 19.0 | 684.1 | 33.4 | 4.9 |
| | City | 72.16 | 2.19 | 40 | 18.3 | 1374.9 | 15.3 | 1.1 |
| | Watties | 65.40 | 3.01 | 30 | 10.0 | 1242.1 | 35.1 | 2.8 |
| | Anzac St | 23.72 | 2.31 | 20 | 8.6 | 480.0 | 27.0 | 5.6 |
| | Childers Rd | 55.59 | 5.73 | 60 | 10.5 | 1100.6 | 51.2 | 4.7 |
| | Awapuni Rd | 44.36 | 5.40 | 50 | 9.3 | 855.9 | 33.1 | 3.9 |
| | Gladstone Rd | 72.18 | 6.36 | 140 | 22.0 | 1393.9 | 72.1 | 5.2 |
| | Aberdeen Rd | 70.62 | 10.25 | 160 | 15.6 | 1283.8 | 47.4 | 3.7 |
| | Palmerston Rd | 68.10 | 3.04 | 30 | 9.9 | 1290.1 | 28.1 | 2.2 |
| | | 507.13 | 41.96 | | | | | |
| | | | | | | | | |
| Parkinson | Lytton Rd | 50.08 | 2.90 | 60 | 20.7 | 951.9 | 17.4 | 1.8 |
| | Willows Rd | 4.45 | 10.18 | 10 | 1.0 | 88.9 | 31.0 | 34.9 |
| | Elgin | 77.91 | 7.96 | 140 | 17.6 | 1484.2 | 32.5 | 2.2 |
| | Chalmers | 56.64 | 5.43 | 40 | 7.4 | 1098.0 | 31.1 | 2.8 |
| | Cedenco | 94.92 | 1.16 | 20 | 17.3 | 1800.0 | 13.3 | 0.7 |
| | Solander | 44.93 | 1.54 | 10 | 6.5 | 825.1 | 21.0 | 2.5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Innes St | 10.74 | 0.84 | 0 | 0.0 | 165.0 | 12.0 | 7.3 |
| | | 339.66 | 30.01 | | | | | |
| | | | | | | | | |
| Makaraka | Campion | 60.57 | 9.35 | 190 | 20.3 | 1004.3 | 46.1 | 4.6 |
| | Nelson Rd | 106.38 | 14.77 | 450 | 30.5 | 1940.6 | 51.7 | 2.7 |
| | Haisman Rd | 64.92 | 38.22 | 360 | 9.4 | 1117.5 | 46.5 | 4.2 |
| | Bushmere Rd | 53.84 | 136.97 | 720 | 5.3 | 964.0 | 57.5 | 6.0 |
| | | 285.71 | 199.31 | | | | | |
| | | | | | | | | |
| Patutahi | Lavenham Rd | 9.77 | 33.35 | 90 | 2.7 | 192.4 | 10.0 | 5.2 |
| | Waimata | 33.40 | 65.18 | 230 | 3.5 | 618.0 | 30.2 | 4.9 |
| | Muriwai | 24.48 | 68.79 | 340 | 4.9 | 461.8 | 34.7 | 7.5 |
| | Te Arai | 22.67 | 82.20 | 350 | 4.3 | 425.1 | 23.8 | 5.6 |
| | | 90.31 | 249.52 | | | | | |
| | | | | | | | | |
| Pehiri | Wairengao Kuri | 9.81 | 18.10 | 80 | 4.4 | 183.9 | 4.1 | 2.2 |
| | Parikanapa | 1.04 | 27.01 | 40 | 1.5 | 23.1 | 6.0 | 25.9 |
| | Tiniroto | 7.29 | 76.19 | 510 | 6.7 | 138.2 | 20.3 | 14.7 |
| | Tahunga | 3.20 | 30.93 | 260 | 8.4 | 63.8 | 9.0 | 14.1 |
| | | 21.33 | 152.24 | | | | | |
| | | | | | | | | |
| Ngatapa | Ngatapa | 4.91 | 30.88 | 210 | 6.8 | 96.5 | 7.0 | 7.3 |
| | Tahora | 9.02 | 84.55 | 610 | 7.2 | 172.4 | 22.3 | 12.9 |
| | Totangi | 0.41 | 12.06 | 110 | 9.1 | 19.5 | 4.0 | 20.5 |
| | | 14.34 | 127.48 | | | | | |
| | | | | | | | | |
| Puha | Whatatutu | 14.07 | 95.62 | 380 | 4.0 | 284.7 | 28.5 | 10.0 |
| | Kanakanaia | 12.95 | 43.23 | 260 | 6.0 | 249.4 | 17.0 | 6.8 |
| | Te Karaka | 12.66 | 28.22 | 140 | 5.0 | 245.8 | 9.1 | 3.7 |
| | Matawai | 26.07 | 230.17 | 450 | 2.0 | 503.2 | 59.8 | 11.9 |
| | | 65.75 | 397.24 | | | | | |
| | | | | | | | | |
| JNL | JNL | 192.28 | 2.68 | 40 | 14.9 | 3604.3 | 11.7 | 0.3 |
| | | | | | | | | |
| Matawhero | Dunstan | 59.13 | 3.26 | 80 | 24.5 | 1115.3 | 9.2 | 0.8 |
| | JNLa | 117.86 | 4.78 | 130 | 27.2 | 2172.7 | 18.2 | 0.8 |
| | Waipaoa | 41.65 | 1.22 | 40 | 32.8 | 787.5 | 18.1 | 2.3 |
| | Bell Rd | 21.95 | 18.75 | 80 | 4.3 | 410.3 | 19.0 | 4.6 |
| | | 240.59 | 28.01 | | | | | |
| | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Port | Port | 6.15 | 2.28 | 0 | 0.0 | 130.1 | 29.0 | 22.3 |
| | Crawford | 44.30 | 7.43 | 30 | 4.0 | 841.7 | 15.1 | 1.8 |
| | Esplanade | 92.53 | 7.06 | 30 | 4.2 | 1749.9 | 81.1 | 4.6 |
| | Harris | 97.33 | 7.82 | 60 | 7.7 | 1796.8 | 38.4 | 2.1 |
| | | 240.31 | 24.60 | | | | | |
| | | | | | | | | |
| Kiwi | Brickworks/ | | | | | | | |
| | Affco | 148.29 | 8.81 | 280 | 31.8 | 2651.3 | 85.7 | 3.2 |
| | Nuhaka/ | 9 | 30 | 280 | 4.4 | 328 | 23 | 7 |
| | Borough 1 | 73.59 | 10.81 | 160 | 14.8 | 1332.0 | 51.5 | 3.9 |
| | Borough 2 | 103.87 | 12.13 | 180 | 14.8 | 1823.7 | 63.9 | 3.5 |
| | | 433 | 61 | | | | | |
| | | | | | | | | |
| Wairoa | Blacks | 33.72 | 95.09 | 300 | 3.2 | 592.9 | 23.8 | 4.0 |
| | Tahaenui | 17.49 | 64.29 | 280 | 4.4 | 328.8 | 23.4 | 7.1 |
| | Raupunga | 36.98 | 190 | 750 | 3.4 | 614.9 | 59.9 | 9.7 |
| | Frasertown | 50.66 | 254 | 630 | 2.5 | 952.2 | 76.1 | 8.0 |
| | | 136 | 603 | | | | | |
| | | | | | | | | |
| Tuai | Tuai | 23.94 | 133.77 | 1040 | 7.8 | 465.3 | 60.9 | 13.1 |

Despite losses being high in terms of percentage, on some rural feeders the cost of re-conductoring is prohibitive unless needed for other reasons or attended to as part of a renewal program.

While Eastland Network Limited does not bear the cost of network losses it does bear cost of increased demand and transmission upgrade if losses are significant.

Reducing Eastland Network Limited losses is a relatively expensive although justifiable option for gaining 1MW of transmission capacity. Economics favor concentration on reduction of losses contributed by the older zone transformers on the system.

### Power Factor Correction

Identified as an opportunity to optimise network performance and defer investment in capacity upgrades, options for improving levels of power factor correction have been considered.

Eastland Network Limited pricing conditions require all network connections to maintain a power factor of 0.95 lag or better. Consequences of not meeting this requirement is that Eastland Network Limited reserves the right to apply a higher demand tariffs fixed daily charge to the ICP until the power factor issue is remedied.

Power Factor is poor in most rural areas of the network and correction would increase capacity at the 50 kV Gisborne bus by approximately 900 kW. This poor performance is the result of inadequate policing of standards for connection of motors.

The approaches to addressing this are:

Installations are reviewed on a regular basis and customers notified of the need to add capacitors/correction. Eastland Network Limited believes that the most effective approach for dealing with non-compliance is penalty payment via pricing rather than attempting disconnection.

Selected feeders can be corrected in bulk via the installation of static capacitors. As identified in the loss analysis, approximately 7 feeders on the network are considered suitable for the application of reactive compensation by capacitors. This viability of this option is generally restricted to rural feeders where loads are less than 400KW. And losses exceed 5%. The capacitors are expected to cost in the order of $40,000 per site. There is currently no commitment to this option as distributed generation strategies are expected to provide for voltage support, reducing losses at high load times.

Additional capacitance could be installed as an option at the Transpower substation but this is the most expensive option and does not realise the benefit of reduced network losses. This option is not being pursued at this time.

#### Uneconomic Rural Lines and Connections

Twenty percent of Eastland Network Limited distribution lines, are considered uneconomic. Calculation of value objectives has indicated the need to reduce value in remote and rural areas and hence improve the economic performance of these network segments or current levels of subsidization by urban customers will need to be maintained or increased in the future. The option of disconnection of uneconomic lines will have negative potential social and economic effects on rural customers and communities hence Eastland Network Limited is currently discounting this option.

Eastland Network Limited has been developing the following strategies for the management of uneconomic lines.

Assets classed as rural and remote will be allowed to age to an average remaining life of 25 to 30 years. Following this the lines will be maintained at this minimum level via a combination of renewal at lower cost, service line handover and cost contribution strategies.

Alternative energy supply options are also expected to be part of the economic outcome and Eastland Network Limited has supported investigation into this technology. Further, Eastland Network Limited supports investigation into embedded generation options.

Renewal of the remote assets at a lower cost design solution can be achieved via reduction to single-phase in place of 3-phase construction. This is limited to lines where the existing customers are prepared to convert 3 phase equipment to single phase or operate it using converter equipment.

Investigation of a number of construction options and voltages has been considered. The most economical solution for the terrain on Eastland Network Limited's network appeared to be 22kV single wire earth return. However other factors including new easement negotiation, telecom interference issues, and re-insulation costs, have now been considered and suggest conversion to single phase 11kV is the most practicable in terms of a viable and sustainable solution.

300km of network in the Gisborne region in uneconomic zones has provisionally been identified as suitable for conversion. Preliminary communications indicate that customer contribution options to fund the rebuild work are unacceptable. In addition there is no mechanism under the Targeted Control Regime to recover costs via specific price schedules. Eastland Network Limited is continuing to monitor options on an appropriate mechanism to address the viability of having uneconomic lines.

The current approach to determining the best mix of options is to manage the risk and failures in a lowest cost manner.

### 4.7.1.5 Performance Enhancement

#### Overhead to Underground Conversion

Eastland Network Limited recognises that renewal of overhead lines with underground cables can provide benefits in the areas of public safety and reliability.

Projects of this nature are generally not considered due to funding constraints. However where growth projects are undertaken in urban areas, upgrades in conjunction with the undergrounding option are considered.

### Ground Fault Neutralisers

An option exists to use Ground Fault Neutraliser technology, which reduces the amount of electrical arcing at the point a fault occurs on the network. This reduces the level of threat to human life and risk of fire. It also allows the power supply to be maintained to homes and businesses, while repair crews are dispatched to fix the fault. Transient or momentary faults can be neutralised as well, eliminating most cases of flickering lights and short term interruptions to power supply. The estimated cost to install units at 8 rural zone substations averages $250,000 per site or a total of $2,000,000. The system is effective on avoiding a single earth fault per substation which is up to approximately 5% of SAIDI. The cost of establishing this technology is currently prohibitive given regulated revenue constraints and increased reliability at a cost to the customer is not signaled from customer surveys. Currently service level improvements of this nature are a lower priority than inspection and maintenance activities associated with safety.

### Urban/Rural Automation

Previously Eastland Network Limited has invested in automation of approximately 80 key sites in the region to minimise disruption times to areas outside the immediate fault area. A small allocation of the Performance and improvement funding is allocated to increasing the level of automation over the life of this plan. Sites are selected that provide the greatest benefit after considering where faults are occurring and who is affected. As faults in the urban area are rare and response times in urban areas are low, rural automation projects are generally favored over urban projects.

### Standby Distributed Generation

In partnership with Eastland Generation Limited Eastland Network Limited has established sites used to enhance performance of the network in contingent events and for maintenance activities. Eastland Network Limited is reviewing options to increase the level of distributed generation targeting vulnerable rural and remote lines that have performance issues identified from analysis of Distribution performance in section 8.2.4.

Areas include:

– Frasertown

- Raupunga

- Matawai

- Hicks Bay

- Rukaturi

- Mata road

At an estimated cost of $300,000 per installation, reduced SAIDI for both planned and all types of unplanned outages can be achieved on the feeder where the generation is connected. Operational costs can also be recovered from delivered energy in some cases and demand management benefits exist. If the generation is supplied under contract via a third party up front capital costs are avoided. Currently service level improvements of this nature are a lower priority than inspection and maintenance activities associated with safety

### Portable/Emergency Generation

Diesel generation is generally used in the region for contingency arrangements for this are between the end-user and generator rental companies.

The key emergency facilities that have a requirement for emergency generation are:

-Gisborne Hospital

-Gisborne Airport

-Gisborne supermarkets

-Petrol Stations

-Fastfood providers eg MacDonalds, KFC, Carl'sJnr, Burgerking

-Gisborne District Council, various infrastructure facilities

-Eastland Group, key offices

In some cases the generators are on site or have provision for quick connection of the generators.

Eastland Network Limited uses small portable generators to supply customers during planned work and in emergencies. The use of the generators is dependent on criteria of availability, cost, assessed need, duration of need, and size of load. The emergency generator portfolio comprises 3 units as follows.

- 500kW Crane and Trucks (Currently not in service) Replacement options are being considered

- 200kW Truck mounted

- 60kW Trailer mounted (new 2011)

Additional units are being considered in the medium term. As the equipment is considered mobile plant funding is via existing allocation in the maintenance/operational budget. Currently service level improvements of this nature are a lower priority than inspection and maintenance activities associated with safety.

### 4.7.2 Development Co-ordination

Capacity and security constraints impact different components of the transmission and distribution system and vary with growth expectations. Growth cannot be excluded at transmission level because it has the ability to outstrip the best laid development plans.

A high degree of co-ordination exists to implement approved transmission, sub-transmission and generation options so that investment is complimentary and supports the strategic objectives. Also it is preferable that development options are where possible implemented incrementally so that adjustments can be made in response to changing circumstances.

### 4.7.3 Development program

Expenditure forecasts based on the options considered for major initiates are given below. The lack of significant development actions for major initiatives supports the minimal growth trends experienced and forecast in the region.

| Year | Action | Cost |
|---|---|---|
| 2018 - 2021 | Information systems renewal | $450k |
| 2018-2019 | Tuai T1 Install New TX and Substation Reconfiguration | $1.1m |
| 2018 - 2021 | Mahia 2.5MW substation and 33kV Line extension | $1.1m |
| 2020 - 2025 | Wahi/AFFCO/Wairoa 33kV Supply & Rationalisation | $1.3m |
| 2023 - 2025 | Mangapapa Zone Substation 12.5MW | $1.1m |
| 2025 - 2028 | Whangara Zone Substation 2.5MW | $1.1m |
| 2020 - 2028 | Provisional Tuai – Gisborne 110kV Line Reconductor | $10 - $20mill |
| 2019 - 2021 | Provisional Patutahi Zone Substation Capacity increase 12.5MW | $950,000 |
| Post 2028 | Provisional Tuai – Gisborne 3rd 110kV Line & new Transmission Substation at Patutahi | $80mill |
| As needed | Provisional Embedded Generation, (Hydro, wind, biomass, gas) | $100,000 |
| As needed | Provisional Connection of Customer installed Generation | $50,000 |

# 5. Managing the assets lifecycle

All physical assets have a lifecycle, and Eastland Network Limited's electricity assets are no exception. This section describes how Eastland Network Limited manages its assets over the entire lifecycle from "conception" to "burial".

## 5.1 What is the lifecycle of an asset

The lifecycle of an existing asset is outlined in Figure 5.1(a) below:

***Figure 5.1(a) – Asset lifecycle***

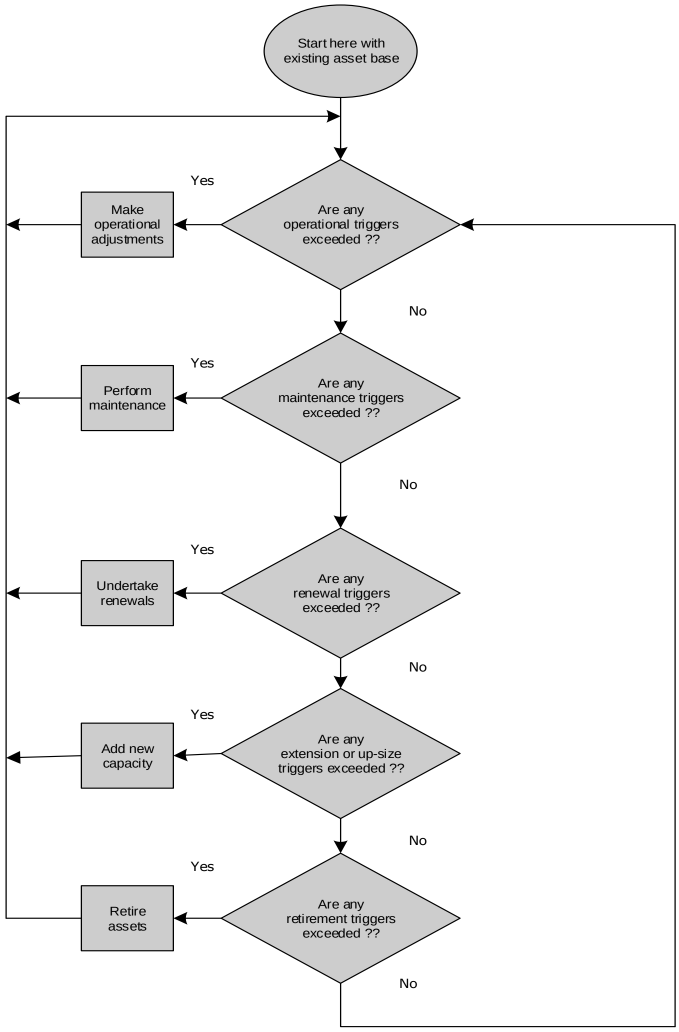



Table 5.1(a) below provides some definitions for key lifecycle activities:

### Table 5.1(a) – Definition of key lifecycle activities

| Activity | Detailed definition |
|---|---|
| Operations and Support | Involves altering the operating parameters of an asset such as closing a switch or altering a voltage setting. Doesn't involve any physical change to the asset, simply a change to the assets configuration that it was designed for. In the case of electrical assets, it will often involve doing nothing and just letting the electricity flow. |

| | |
|---|---|
| | Involves systems and management functions necessary to monitor record and measure trends and generally manage the assets from conception to removal. |
| Maintenance | Involves replacing consumable components like the seals in a pump, the oil in a transformer or the contacts in a CB. Generally, these components will be designed to wear out many times over the assets design lifecycle and continued operation of the asset will require such replacement. There may be a significant asymmetry associated with consumables such as lubricants in that replacing a lubricant may not significantly extend the life of an asset but not replacing a lubricant could significantly shorten the assets life. |
| Renewal | Generally, involves replacing a non-consumable item like a pole or transformer with a replacement item of identical functionality (e.g. strength, capacity). Such replacement is regarded as a significant mile-stone in the life of the asset and may significantly extend the life of the complete asset (e.g. the section of line and poles).<br>Renewal also includes the replacement of components or items that no longer comply with initial design criteria, regulatory requirements or safety standards. (e.g. a rotten poles cannot support conductor design load, new regulatory standards for earthing, new safety requirements for switchgear operation)<br>Renewal tends to dominate the Capex in low growth areas (Quadrant 1 of Figure 4.1.2(b)) because assets will generally wear out before they become too small.<br>The most typical criteria for renewal will be when the capitalised costs of ops and maintenance exceed the cost of renewal (including any loss of availability). Key issues with renewal are technological advances that generally make it impossible to replace assets such as SCADA with equivalent functionality, and creeping regulation that make certain assets (e.g. compressed air vessels over 100psi) unviable. |
| Up-sizing | Generally involves replacing a non-consumable item like a conductor, busbar or transformer with a similar item of greater capacity but which does not increase the network footprint ie. Restricted to Quadrants 1 and 2 in Figure 4.1.2(b). |
| Extensions | Involves building a new asset where none previously existed because a location trigger in Table 4.1.3(a) has been exceeded e.g. building several spans of line to connect a new factory to an existing line. This activity falls within Quadrants 3 and 4 of Figure 4.1.2(b). Notwithstanding any surplus capacity in upstream assets, extensions will ultimately require up-sizing of upstream assets. |
| Retirement | Generally involves removing an asset from service and disposing of it. Typical guidelines for retirement will be when an asset is no longer required. Retirement can be considered "replacement with nothing". |

### 5.1.1 Operating the assets

5.1.1.1 System Operations

The long term planning function undertakes asset planning and design work and Technical support services. The function includes the systems to achieve the monitoring recording and reporting of asset information.

The short term system operations function implements work programs, and manages contractors. This function ensures delivery of reliability, budget cost, and safety performance by implementation of specific capital and/or maintenance activities and budgets as determined in the AMP.

The real time operations function operates the network and involves monitoring of the electricity flow from the supply points to consumers' premises, with intervention when a trigger point is exceeded.

Intervention usually involves carrying out or coordination of activities to reconfigure the asset in real time on a short or medium term basis to address the trigger point.

As outlined in Figure 5.1(a) the first efforts to relieve excursions beyond trigger points are control room operational activities and may include:

Operating a tap-changer to correct voltage excursions (which generally occurs automatically).

Opening and closing ABS's or RMU's to relieve an over-loaded asset.

Opening and closing ABS's or RMU's to reconfigure the power flow, to shut down or restore power (which can be either planned or fault related).

Operating load control plant or dispatching embedded generation to reduce demand.

Activating fans or pumps on transformers to increase the cooling rate.

Control electricity consumption or demand in accordance with the Security of supply outage plan.

System Operations and Network Support expenditure includes expenditure where the primary driver is the management of the network.

For the planning period the total $20.104m System Operations and Network Support expenditure is 17% of the total operational expenditure forecast for the period.

Increases in System Operations and Network Support expenditure has been driven in part by an increase in engineering and associated support staff as a result of the increase in regulatory compliance and additional transmission assets. Eastland Network Limited is embarking on a strategy to increase its resourcing to improve its asset management practices (in conjunction with the replacement of its core asset management systems). It is expected that this investment will improve the AMMAT scores over the coming 2-3 years.

#### 5.1.1.2 Service Interruptions and Emergencies

All fault response work is contracted to two service providers.

Firstly the provision of 24 hr. x 7 day dispatch service is currently contracted to a company based in Hastings. This contract covers the receiving of fault calls and the direct dispatch of fault response resources.

A second contract for the provision of field resources for fault restoration and minor repairs is currently held by Eastech Limited which in order to service the contract provides resources in Wairoa, Gisborne, and Tokomaru Bay. As specified in the contract any renewal required following the initial fault response is determined as maintenance or capital in accordance with Eastland Network Limited accounting policies.

The annual Fault Management cost of $ $600,000 associated with these contracts is allocated, (in proportion to the faults forecast by extrapolation of historical trends), across asset classes as follows;

| | |
|---|---|
| Transmission and Subtransmission Lines | $26,000 |
| 11kV Lines & Cables | $500,000 |
| 400V Lines & Cables | $25,000 |
| Load Control | $6,000 |
| Zone Substations | $10,000 |
| Transformers (Distribution) | $10,000 |
| 11kV GM Switches | $13,000 |
| Pole Mounted Isolation Equip | $10,000 |

The annual Fault Management cost includes costs of the third party dispatch centre.

#### 5.1.1.3 Security of Supply Outage Plan

The Security of supply outage plan has been produced to comply with the Electricity Commission requirements. The plan documents procedures for reducing demand or consumption in response to a shortage of generation or failures of the National Transmission Grid. In extreme events the plan documents priorities for disconnection of supply to consumers.

#### 5.1.1.4 Operational Triggers

Table 5.1(b) outlines the key operational triggers for each class of Eastland Network Limited's assets. Note that whilst temperature triggers will usually follow demand triggers, they may not always e.g. an overhead conductor joint might get hot because it is loose or rusty rather than overloaded.

*Table 5.1(b) – Operational triggers*

| Asset category | Voltage trigger | Demand trigger | Temperature trigger |
|---|---|---|---|
| LV lines and cables | Voltage routinely drops too low to maintain at least 0.94pu at consumers switchboards.<br>Voltage routinely rises too high to maintain no more than 1.06pu at consumers switchboards. | Consumers' pole or pillar fuse blows repeatedly. | Signs of burning or melting. |
| Distribution substations | Voltage routinely drops too low to maintain at least 0.94pu at consumers switchboards.<br>Voltage routinely rises too high to maintain no more than 1.06pu at consumers switchboards. | Load routinely exceeds rating where MDIs are fitted.<br>LV fuse blows repeatedly.<br>Short term loading exceeds guidelines in IEC 354. | Inspection reveals signs of heating |
| Distribution lines and cables | | Load flow analysis identifies sections in the danger zone, followed by verification from loggers.<br>SCADA set point alarms routinely triggered | Joint fails or shows signs of heating |
| Zone substations | Voltage drops below level at which SCADA set point alarms triggered.<br><br>OLTC can automatically raise taps. | Load exceeds guidelines in IEC 354. | Top oil temperature exceeds manufacturers' recommendations.<br>Core hot-spot temperature exceeds manufacturers' recommendations.<br>Infra-red survey reveals hot joint<br>Gas analysis indicates burning in Transformers |
| Transmission, sub-transmission lines and cables | Load flow analysis identifies sections in the danger zone, followed by verification from loggers.<br>SCADA set point alarms triggered | Load flow analysis identifies sections in the danger zone, followed by verification from loggers.<br>Load alarms triggered<br>Analysis of load data shows excessive levels | Infra-red survey reveals hot joint<br>Joint fails in service |

#### 5.1.1.5 Business Support and System Operations Network Support

Business support activities to ensure efficient operation of the assets include:

Finance management

Management of IT systems

Management of Human Resources

Management of non-network assets

Coordination and communication with stakeholders

Business Support expenditure is accounted for via an annual shared service fee and associated service provision agreement details the allocation of Business Support costs to Eastland Network Limited from Eastland Generation Limited.

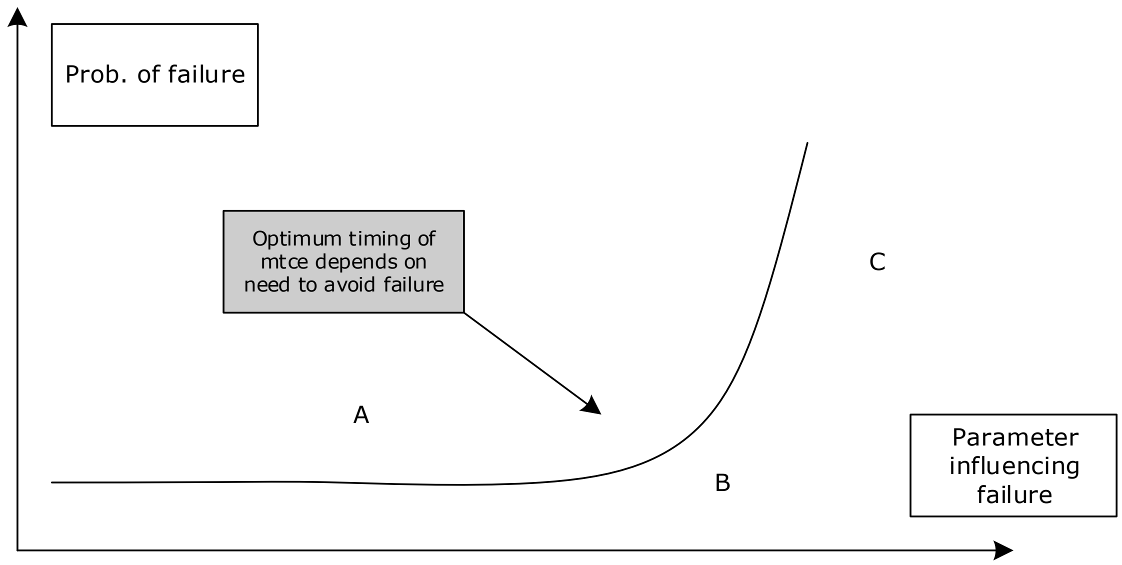
For the planning period the total $40.075m Business Support expenditure is 34% of the total operational expenditure forecast for the period.

Business Support costs have been forecast 'steady state' for this plan. These business support costs include charges in relation to the 'backbone' IT platform and financial system (which are supplied by Eastland Group to Eastland Network Limited). Eastland Group have recently commenced work on investigating the replacement of their legacy financial system, and the replacement of this system will likely result in an increase in Business Support costs (and an associated improvement in services). Eastland Network Limited intends to update the Business Support costs in the 2020 AMP.

### 5.1.2 Maintaining the assets

As described in Table 5.1(b) maintenance is primarily about replacing consumable components. Examples of the way in which consumable components "wear out" include the oxidation or acidification of insulating oil, pitting or erosion of electrical contacts, and wearing of pump seals. Continued operation of such components will eventually lead to failure as indicated in Figure 5.1(b) below. Failure of such components is usually based on physical characteristics, and exactly what leads to failure may be a complex interaction of parameters such as quality of manufacture, quality of installation, age, operating hours, number of operations, loading cycle, ambient temperature, previous maintenance history and presence of contaminants – note that the horizontal axis in Figure 5.1(b) is not simply labelled "time".

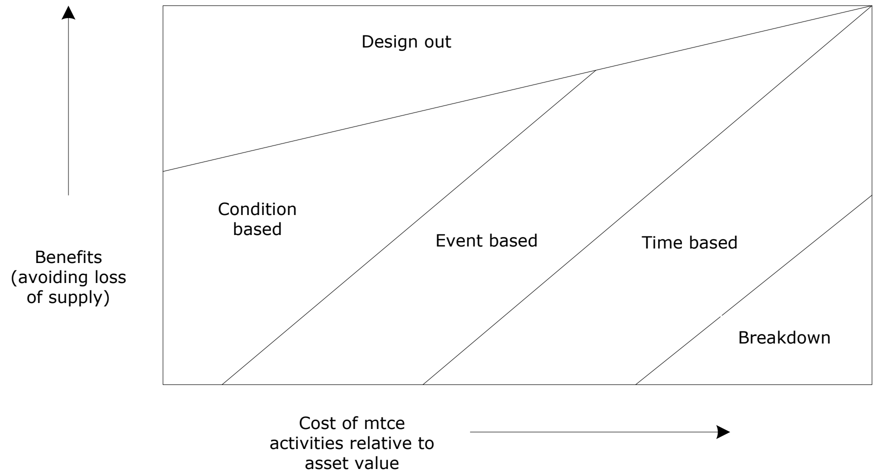
***Figure 5.1(b) – Component failure***




Exactly when maintenance is performed will be determined by the need to avoid failure. For instance the need to avoid failure of a 15kVA transformer supplying a single consumer is low, hence it might be operated out to point C in figure 5.1(b) whilst a 50/11kV substation transformer may only be operated to point B due to a higher need to avoid failure. In the extreme case of, say, turbine blades in an aircraft engine it would be desirable to avoid even the slightest probability of failure hence the blades may only be operated to point A. The obvious trade-off with avoiding failure is the increased cost of labour and consumables over the assets lifecycle along with the cost of discarding unused component life.

Like all Eastland Network Limited's other business decisions, maintenance decisions are made on cost-benefit criteria with the principal benefit being avoiding supply interruption. The practical effect of this is that assets supplying large consumers or numbers of consumers will be extensively condition monitored to avoid supply interruption whilst assets supplying only a few consumers such as a 15kVA transformer will more than likely be run to breakdown. The maintenance strategy map in Figure 5.1(c) broadly identifies the maintenance strategy adopted for various ratios of costs and benefits.

***Figure 5.1(c) – Maintenance strategy map***




This map indicates that where the benefits are low (principally there is little need to avoid loss of supply) and the costs of maintenance are relatively high an asset should be run to breakdown. As the value of an asset and the need to avoid loss of supply both increase Eastland Network Limited relies less and less on easily observable proxies for actual condition (such as calendar age, running hours or number of trips) and more and more on actual component condition (through such means as DGA for transformer oil).

Component condition is the key trigger for maintenance. However the precise conditions that trigger maintenance are very broad, ranging from oil acidity to dry rot.:

5.1.2.1 Maintenance triggers

The following table 5.1(c) describes the maintenance triggers that have been adopted

Table 5.1(c)

| Asset category | Components | Maintenance trigger |
|---|---|---|
| LV lines & cables | Poles, arms, stays & bolts | Evidence of dry-rot or spalling<br>Loose bolts, moving stays<br>Displaced arms<br>Foundation/erosion issues<br>Location Safety Issues |
| | Pins, insulators & binders | Obviously loose pins.<br>Visibly chipped or broken insulators<br>Visibly loose binder |
| | Conductor | Visibly splaying or broken conductor<br>Poor clearances<br>Visibly Uneven sag<br>Trees in lines |
| | Cable | Failure of insulation |

| | | |
|---|---|---|
| Service connections | Distribution Pillars | Visible Rust<br>Graffiti/Vandalism<br>Safety issues |
| Distribution substations | Poles, arms & bolts | Evidence of dry-rot or spalling<br>Loose bolts, moving stays<br>Displaced arms<br>Foundation/erosion issues |
| | Enclosures | Visible rust.<br>Cracked or broken masonry<br>Overgrown access<br>Safety issues<br>Graffiti/Vandalism |
| | Transformer | Excessive oil acidity (500kVA or greater)<br>Visible signs of oil leaks<br>Excessive moisture in breather<br>Visibly chipped or broken bushings<br>Visible rust<br>Earthing issues<br>Safety issues |
| | LV Switches and fuses | Buildup of contaminants<br>Operations at recommended maintenance levels<br>Failure of fuse elements<br>Alignment or lubrication issues<br>Safety issues |
| Distribution lines and cables | Poles, arms, stays and bolts | Evidence of dry-rot<br>Loose bolts, moving stays<br>Displaced arms.<br>Foundation/erosion issues<br>Location Safety Issues |
| | Cables | Failure of insulation<br>Oil leaks<br>Depth/clearance issues |
| | Pins, insulators and binders | Obviously loose pins<br>Visibly chipped or broken insulators<br>Visibly loose binder<br>Radio interference |
| | Conductor | Visibly splaying or broken conductor<br>Poor clearances<br>Signs of clashing<br>Visibly Uneven sag<br>Trees in lines |
| Distribution Switchgear | Ground-mounted switches | Detectable discharge<br>Detectable hot spots<br>Buildup of contaminants<br>Oil/Gas leaks<br>Visible Rust<br>Graffiti/Vandalism<br>Access and Location Safety Issues |
| | Fuses ABS's, Switches | Loose mechanisms<br>Binding Mechanisms<br>Earthing issues<br>Visibly burnt contacts<br>Oil/Gas leaks |

| | | |
|---|---|---|
| | | Corrosion |
| Voltage Regulators | Transformer | Excessive oil acidity (500kVA or greater)<br>Visible signs of oil leaks<br>Excessive moisture in breather<br>Visibly chipped or broken bushings<br>Visible rust<br>Binding mechanisms |
| | Control Equipment | Inaccurate readings<br>Miss operation |
| Zone substations | Fences & enclosures | Visible damage<br>Visible rust<br>Leaks<br>Safety issues |
| | Buildings | Visible damage<br>Leaks<br>Visible deterioration<br>Backed up pipes<br>Leaking taps<br>Visible Rot<br>Broken fittings |
| | Bus work & conductors | Visibly splaying or broken conductor.<br>Poor clearances<br>Signs of clashing Visibly Uneven sag<br>Corrosion of Fittings<br>Insulation Failure |
| | 33kV/50kV switchgear | Detectable discharge<br>Detectable hot spots<br>Failure to operate<br>Operations at recommended maintenance levels |
| | Transformer | Excessive oil acidity<br>Visible signs of oil leaks<br>Excessive moisture<br>Visibly chipped or broken bushings<br>Visible rust<br>Excessive noise<br>Excessive gas content |
| | 11kV switchgear | Detectable discharge<br>Detectable hot spots<br>Failure to operate<br>Operations at recommended maintenance levels |
| | Instrumentation | Unreadable<br>Inaccurate readings<br>Miss operation |
| | Poles, arms, stays & bolts | Evidence of dry-rot or spalling<br>Loose bolts, moving stays<br>Displaced arms |
| Sub-transmission lines & cables | Pins, insulators & binders | Obviously loose pins<br>Visibly chipped or broken insulators<br>Visibly loose binder<br>Radio interference |
| | Conductor | Visibly splaying or broken conductor<br>Poor clearances<br>Signs of clashing |

| | | |
|---|---|---|
| | | Visibly Uneven sag<br>Trees in lines |
| | Radios and repeaters | Communications fade or unavailability over limits<br>Levels out of allowable limits<br>Frequencies out of range |
| Communications | Radios | Non operational<br>Loss of signal<br>Levels out of allowable limits |
| SCADA | RTU's | Loss of data<br>False indication occurs<br>Fails to indicate<br>Measurements suspected as being out of valid range<br>Equipment Lockup Controls fail to function<br>Miss operation<br>Nuisance alarms |

#### 5.1.2.3 Maintenance Activities

The following maintenance sub sections per asset category of the lifecycle management plan describe details of the regular on-going work that is necessary to keep assets operating to their minimum design levels, maintain the assets to an acceptable condition (e.g.no graffiti) and ensure the assets are performing safely. The details include the basis for condition monitoring, equipment standards, planned activities and provisions for unplanned actions in response to faults or incidents. Condition monitoring activities have been developed that are appropriate for each type of asset. These are presented by individual asset category using the same nomenclature as the Capex plans. Maintenance inspection and testing work relating to safety is generally based on regular time intervals and for condition assessment the time interval period varies over the life of the asset. Other maintenance activities are driven from condition and reliability monitoring.

#### 5.1.2.4 Maintenance Management Process

During annual planning budgeted activities identified for each asset category are time lined for completion over the year to optimise resources. The Asset management team members are allocated the activities to complete. The works management system is used to manage the contracts for the maintenance activities. Paper based systems are used to obtain the information relating to asset condition and maintenance completed. Pertinent details relating to condition and maintenance undertaken are entered into the GIS system for reporting. Schedules of defects and corrective actions are prepared from the field returns and fed back into the works management system and dispatched to field contractors for correction. Separation of the GIS and Works database entry/reporting functions, ensure that all required condition assessments are obtained and the defects identified are rectified. Field audits and periodic changes to the allocation of activities to both Asset management and field staff ensure the maintenance procedures and activities are being carried out correctly.

### 5.1.3 Asset Health Assessment

The Asset health is the measure of the useful remaining life of an asset. The poorer the health of an asset, the nearer it is to the end of its life and the more likely it needs to be retired or replaced due to the risks associated with the asset.

To ensure a consistent approach to decision making a five step Asset Health Indicator scale is used. The scale is aligned with the EEA Asset Health Indicator Guide but different from the four stage Commerce Commission's information disclosure requirements for distribution lines companies. The five stage scale shown below, provides more precision than four and it aligns with similar scales used in Australia and the UK.

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

To convert between five and four scale measurement, Grade H1 and H2 remain the same, Grade H3 and H4 are combined to match the Commerce commission H3 Grade and H5 becomes the Commerce commission H4 Grade.

A 2 stage approach to determine Asset health is used.

Stage 1 is the determination of Asset condition

To account for the deterioration of assets over time that is exhibited by all physical electricity network infrastructure, the age of the asset forms the basis of asset health. The age attribute is modified by applying factors that correct for observed and monitored conditions. E.g, results from recent condition based inspections, location and duty are considered to determine a condition related age.

The condition related age is then compared to the assets expected life (generally derived from a combination of historical and industry data) to determine the asset's remaining life.

A three-point condition index (CI) scale is used to categorise assets in terms of their expected remaining life. The criteria for determining each of the three categories varies to suit each asset class based on its expected life.
Typically:
•CI1 indicates assets with more than 50%, of expected life remaining. These assets present a very low probability of failure given they are assessed as being in a good condition.
•CI2 indicates assets with between 0% and 50% of expected life remaining. These assets present a low probability of failure given they are assessed as being in a reasonable state of deterioration.
•CI3 indicates assets beyond their expected life. These assets present a reasonable probability of failure given their condition is assessed as poor or very poor.

The expected life is key in the asset condition assessments. In most cases ODV Lives have been used however the life assessment section for each asset category indicates an assessed life based on assessments and performance to date.

For each asset category in the subsections of this section the criteria used to determine the condition index are documented.

Stage 2 is the determination of asset criticality

The criticality of assets generally doesn't change, or changes infrequently, as it is based on the network function and impacts on customers rather than the individual asset. In contrast asset condition changes more quickly and can be observed to change over a number of years for most assets.

The failure of an asset results in a consequence. E.g. this could range from a localised loss of supply, to an outage over a large area, or a near miss incident to a fatality the criticality of the asset is linked to severity of the consequence. E.g. assets supplying critical infrastructure (hospitals, water treatment plants, data centres) are more critical than assets supplying residential dwellings. or from a safety risk perspective, assets in high density areas (e.g. Central City) are considered more critical than those in less dense areas (e.g. rural).
While it is recognised that the relative criticality assessments between an asset in 1 category and another are subjective the used of 3 classifications applied broadly to asset groups is sufficient to link the Condition and Criticality of an asset to produce an overall Health Index.
The Criticality Index applied to each asset is between C1 and C3 where C1 is the least critical classification and C3 is the most critical classification.
For each asset category in the subsections of this section the criteria used to determine the critically index are documented.

The outcomes of the asset categorisation in terms of condition and criticality are presented in a condition and criticality matrix below providing a resulting Health index for the asset.

| | CI1 | CI2 | CI3 |
|---|---|---|---|
| C1 | H5 | H4 | H3 |
| C2 | H4 | H3 | H2 |
| C3 | H3 | H2 | H1 |

The change in Asset Health is demonstrated in the movement in the number of assets from the left to the right of the matrix as assets deteriorate in condition and from top to bottom as their criticality increases

### 5.1.4 Renewing assets

In accordance with the Information Disclosure capital expenditure categories Eastland Network Limited classifies work as renewal when an asset is replaced due to physical deterioration of the asset or as a result of the obsolescence of the asset. The key criteria for renewing an asset is when the capitalised operational and/or maintenance costs exceed the renewal cost .This can occur in a number of ways:
Operating costs become excessive e.g. Addition of inputs to a SCADA system requires an increasing level of manning.
Maintenance costs begin to accelerate away. E.g. a transformer needs more frequent oil changes as the seals and gaskets perish.
Supply interruptions due to component failure become excessive (and what constitutes "excessive" will be a matter of judgment which will include the number and nature of customers affected).
Renewal costs decline, particularly where costs of new technologies for assets like SCADA decrease by several fold.
The asset does not comply with design, regulatory or safety requirements.

Because of the low growth and surplus capacity in the network, Capital expenditure is dominated by renewals. The rate of renewal can therefore be used to manipulate the age of each asset category relative to its rate of depreciation. Most of the asset categories are being renewed at a rate less than the depreciation but commensurate with constrained revenue, hence the overall asset is aging.

The forecast renewal targets and renewal actions identified in the Asset renewal Lifecycle Assessments for each asset category consider:
-The historical population age profile
-The health assessments for each asset category which introduce consideration of varied behaviour of parts of the population, potentially to an individual asset level and criticality.
-The degree to which alternative options for like for like renewal influence the forecast target

Ideally the target renewal rate is closely aligned with the steady state renewal rate historically observed and higher than the population size of assets with a H1 critical health score to ensure the current levels of risk do not decline.
While the renewal rate manipulates the age of the population for each asset category, the historical population age profile and Health assessment information provide sufficiently accurate forecast renewal rates.

### 5.1.5 Up-sizing or extending the assets

If any of the capacity triggers in Table 4.1.3(a) are exceeded Eastland Network Limited will consider either up-sizing or extending the network. These two modes of investment are, however, quite different as described in Table 5.1(d) below.

Table 5.1(d) – Distinguishing between up-sizing & extension

| Characteristic | Up-sizing | Extension |
|---|---|---|
| Location | Within or close to existing network footprint (within a span or so). | Outside of existing network footprint (more than a few spans). |
| Load | Can involve supply to a new connection within the network footprint or increasing the capacity to an existing connection. | Almost always involves supply to a new connection. |
| Upstream reinforcement | Generally forms the focus of up-sizing. | May not be required unless upstream capacity is constrained. |
| Visible presence | Generally invisible. | Obviously visible. |
| Quadrant in Figure 4.1.2(b) | Either 1 or 2 depending on rate of growth. | Either 3 or 4 depending on rate of growth. |
| Necessity | Possible to avoid if sufficient surplus capacity exists. Possible to avoid or defer using tactical approaches described in section 4.2.1. | Generally can't be avoided – a physical connection is required. |
| Impact on revenue | Difficult to attribute revenue from increased connection number or capacity to up-sized components. | Generally results in direct contribution to revenue from the new connection at the end of the extension. |
| Impact on costs | Cost and timing can vary, and be staged. | Likely to be significant and over a short time. |
| Impact on ODV | Could be anywhere from minimal to high. | Could be significant depending on length of extension and any consequent up-sizing required. |
| Impact on profit | Could be anywhere from minimal to high. | Could be minimal depending on level of customer contribution. |
| Means of cost recovery | Most likely to be spread across all customers as part of on-going line charges. | Could be recovered from customers connected to that extension by way of capital contribution. |
| Nature of work carried out | Replacement of components with greater capacity items. | Construction of new assets. |

Despite the different nature of up-sizing and extension work, similar design and build principles are used as described for each asset category in the following sub sections .The forecasts for new assets and asset extensions other than those identified in the development program are difficult to predict as they are generally short term customer driven activities. The predictions for these activities are idendified for each asset category in the following sub sections.

#### 5.1.5.1 Designing new assets

Eastland Network Limited uses a range of technical and engineering standards to achieve an optimal mix of the following outcomes:
-Meet likely demand growth for a reasonable time horizon including such issues as modularity and scalability.
-Minimise over-investment.
-Minimise risk of long-term stranding.
-Minimise corporate risk exposure commensurate with other goals.
-Maximise operational flexibility.
-Maximise the fit with soft organizational capabilities such as engineering and operational expertise and vendor support.
-Comply with sensible environmental and public safety requirements.
Given the fairly simple nature of the network Eastland Network Limited tends to adopt standardised designs for all asset classes with minor site-specific alterations. These designs, however, will embody the wisdom and experience of current standards, industry guidelines and manufacturers recommendations.
Typical Design criteria for each Asset Category is documented in the Subsections of this section below

#### 5.1.5.2 Building new assets

External contractors are used to up-size or extend assets. As part of the building and commissioning process information records are “as-built” and all testing documented.
The forecasts for new assets and asset extensions other than those identified in the development program are identified for each asset category in the subsections below:

*Distribution*

The majority of distribution funding is specifically identified in the development program. Customer driven funding for distribution lines and cables is identified in the section 4.7.1.4. In most cases this funding only contributes to a portion of the total project funded by the private developer or customer. The contribution provides for the cost of increases in line or cable size beyond the minimum required for the customer which will provide for growth over the applicable planning period

*LV Lines and Cables*

Detailed analysis is only undertaken on the urban overhead network to identify exact capacity constraints when alterations are being made or to correct issues as they are identified. The cable network, which supplies commercial areas, is monitored more closely.
The trigger for upgrade is therefore a fuse blowing. Voltage complaints and transformer MDI readings can give an early warning. With load growth ranging between 0.5 and 11% it can be expected that in many cases conductor and cable will require capacity upgrade long before age replacement.
Typically capacity is addressed by additional transformer installation.
Growth on the LV network erodes contingency capacity which is typically offset by availability of portable generation.

*Service Connections/Load Control*

New service connections are typically associated with subdivision work or infill housing developments. Funding is generally not provided by Eastland Network Limited for the work directly associated with these new connections.
Provision to accommodate any contribution by Eastland Network Limited for new service connections is included within the provision for LV Lines and Cables above.

*Transformers*

To cater for typical growth allowance is made for Eastland Network Limited’s contribution for additional transformers and capacity upgrades. Negative growth or shifting of load centres creates redundancy of transformer installations.

*Switchgear ground mounted*

Growth associated with this switchgear is triggered by industrial load or underground subdivision development. There are no constraints associated with the switchgear as the equipment is rated appropriately to the feeder capacities.

In general Eastland Network Limited is not involved with the funding for this development, allowance for 3 units or 9 switches per year is sufficient.

*LV Frames*

Capacity upgrades assume reuse of existing LV frames.
Frame Installation as required with transformers.
Installation of new Distribution boxes as Eastland Network Limited removes its connection fuses from shared Meter boxes on customer boundaries is covered in the renewal section of this plan

Communications

Allowance for 2 additional automated sites per year from 2021/22 onward is considered sufficient for long term development. These communications costs are included in the Scada section.

SCADA

As the number of sites increases on the network the capacity of the Abbey Master station will be increased. Functionality improvements of the system are also being developed on an ongoing basis to keep the system current.

### 5.1.6 Retiring of assets

Retiring assets generally involves doing most or all of the following activities:
De-energising the asset.
Physically disconnecting it from other live assets.
Curtailing the assets revenue stream.
Removing it from the Fixed Asset Register.
Either physical removal of the asset from location or abandoning in-situ (typically for underground cables).
Disposal of the asset in an acceptable manner particularly if it contains SF6, oil, lead or asbestos.

Identifying end-of-life criteria for an asset can be complex as there are often multiple factors that drive a decision to replace or retire. For example, the decision to retire may be due to one or more of the following factors:
-Its physical presence is no longer required (usually because a customer has reduced or ceased demand).
-It creates an unacceptable risk exposure, either because its inherent risks have increased over time or because emerging trends of safe exposure levels are declining. Assets retired for safety reasons will not be re-deployed or sold for re-use.
-Where better options exist to create similar outcomes (e.g. replacing lubricated bearings with high-impact nylon bushes) and there are no suitable opportunities for re-deployment.
-The asset no longer meets the current and future requirements for functionality and capacity?
-The operating economics of the asset are no longer viable. i.e. Is it less costly to utilise a new asset or different solution to meet the need?
-The asset does not comply with current legislation, codes of practice, standards or good practice.
-Where an asset has been up-sized and no suitable opportunities exist for re-deployment.

## 5.2 Lifecycle Management by Asset Category

### 5.2.1 Bulk supply assets

The Bulk supply Transmission assets described in Section 2.2.1 are owned and operated by Transpower in accordance with their asset management policies and procedures. Generation Assets used for supply of energy are managed by the owners of the assets.

### 5.2.2 Transmission and Sub-transmission Lines

#### 5.2.2.1 Overview and strategy

The configuration of Transmission and Subtransmission is described in section 2.2.2

The Transmission and Subtransmission lines are predominately overhead. The lines have a mix of steel tower, concrete and wooden poles. Historically the wood poles were Australian Hardwood, and more recently NZ softwood poles have been used

These assets are critical to reliability. While risk of failure is maintained to a low level the consequence of asset failure in this category is often significant.

When considering the pole and conductor replacement strategies it is important to realise that maintaining the asset in a newer state will not necessarily improve the key performance measures. Pole and conductor failures occur on both new and old assets as they are usually influenced by external factors. (Refer 5.2.2.3 Asset health)

From an asset strategy perspective, the objectives for the subtransmission assets are to:

- Mitigate the risk of unassisted failure in both urban and rural assets in this category by implementing renewal programs aimed to renew assets before failure in service
- Ensure the security standards for contingency and backup, should a failure occur, are maintained. Eg backup generation operational and strategic spares available.
- Maintain better than industry average failure rates on the Subtransmission system.
- Deal promptly with any known defects.
- Achieve overall asset renewal at a steady state that is broadly consistent with depreciation.

#### 5.2.2.2 Maintenance

Minor and Major inspection schedules are used for 110kV Lines. Inspection s include visual aerial inspections followed up by ground-based tower and pole inspections. Specific issues and defects are documented in inspection reports and programmed for correction in appropriate time frames and outages.

A ground based visual patrol of urban 50 and 33 kV poles and conductors is carried out every twelve months

A visual helicopter patrol of every rural 50 and 33 kV line is carried out every twelve months. The patrols are often incorporated into the patrols necessary as a result of a fault occurring.

The following points are included in the inspections:

-Structure foundation erosion (weather or excavator work)
-Structure movement and conductor clearance
-General hardware, insulator and conductor condition
-Early signs of cross-arm burning
-Damaged or broken binders
-Monitor vibration dampener performance
-External interference (e.g. trees)
-Sabotage
- Access conditions bridges track condition fencing and gate condition
-Safety Issues e.g. buildings/structures/road widening

While detailed 110kV lines are inspected at regular scheduled frequencies more detailed inspection is carried out on 50 & 33 kV poles as the lines near their forecast end of life. This inspection includes updating health index information on the poles through pole testing and/or visual inspection techniques. Visual inspection includes excavation and/or climbing to categorically determine the poles below ground and/or head condition. Any components on the poles, identified from the inspections that require renewal are categorised in terms of risk and scheduled for correction typically within 1 year.

Discharge detection and thermal scans of selected areas of line close to terminal points at zone substations are undertaken 3 yearly, corresponding with the checks at zone substations. Repairs required as a result of the scans are categorised in terms of risk and scheduled for correction typically within 1 year.

The inspection process for Transmission lines manages poles and towers in a discrete way as location distance and access factors associated with inspection work result in lower costs. In contrast the inspection process for Subtransmission lines manages poles in sections of line to give optimum cost efficiency. The line sections are chosen based on terrain, significance/importance and levels of public exposure. Over the period 1990 to 2005 a number of ultra-sound or quantitative methods were used to identify at risk poles. Since 2005 qualitative assessments by suitably qualified and competent inspectors have been used to classify poles in terms of risk. This method has been more effective at ensuring poles identified for replacement will provide the best overall outcome when considering safety, reliability, performance and value.

The modern protection relays are used to alert momentary earth-faults (Earth fault pickup) that do not trip the lines. This information is used to target inspection and corrective actions more effectively than was historically possible. The information has proven effective at identifying swinging wires that have broken free of insulators and rogue tree issues.

The pole inspection and testing regime used to assess sub-transmission lines, is also used to assess and rate 11kV and 400V distribution poles.

The strategy for any corrective actions identified from inspections is to carry out the work necessary to achieve the standard pole/conductor standard life, rather than extend the life beyond the standard life. Where viable when corrective actions are required the standard of the asset is brought into line with current standards adopted for new/replacement assets.

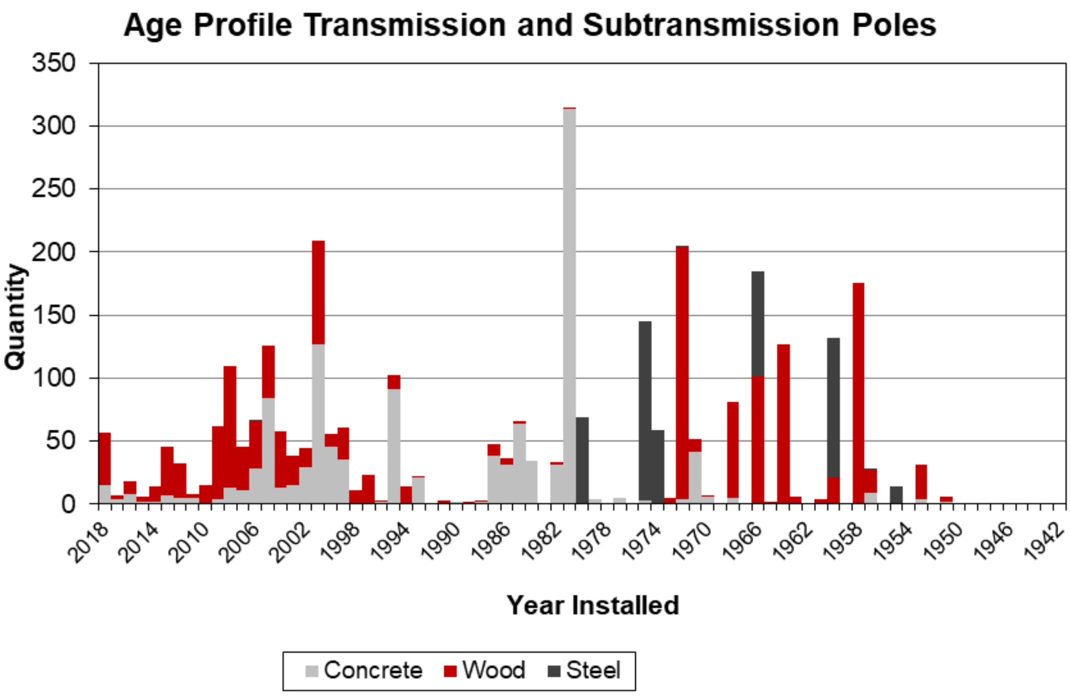
Pole Assessment Criteria

At installation every pole has a safety index which rates the poles current strength capabilities against the required pole strength. During a detailed inspection the remailing strength of wooden poles is assessed against its initial strength. (E.g. A pole with an initial diameter of 300mm may have 1/2 of the initial diameter below ground at the weakest point softness within the pole may also be detected). Where the inspection shows a significant reduction to its initial strength the overall health assessment is modified to indicate current condition.
Other factors that affect the overall health of the pole are considered with the reported health result reflecting the dominant failure condition. Eg head cracks, pole rot, or foundation collapse.
In most cases this assessment is sufficient to categories' and schedule replacement priority.

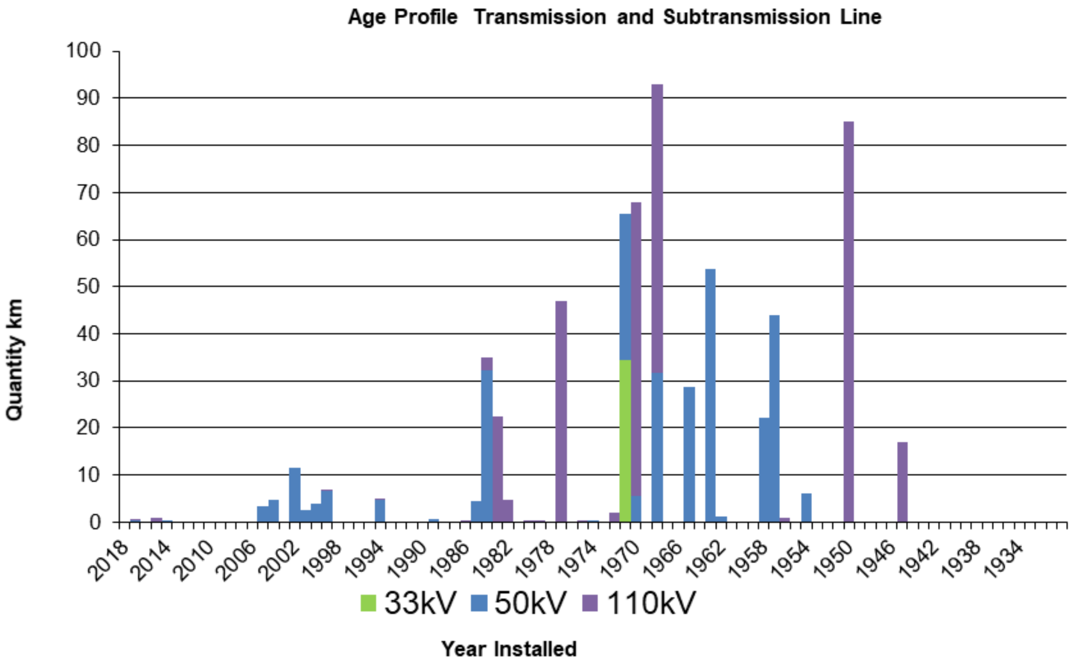
In cases where poles are assessed to have reduced in strength to the extent the pole strength is below the normal loading requirement, i.e. a safety index less than 1.0, they are red tagged to signify that the pole could fail under normal loads. The targeted replacement time frame for red tagged poles is 3 months.
In cases where poles are assessed to have reduced in strength to the extent the pole strength is below the ultimate loading requirement, i.e. a safety index less than 1.2, they are blue tagged to signify that the pole could fail which signifies that the pole is capable of supporting normal loads but not ultimate design loads. The targeted replacement of blue tagged poles located in populated areas or other risk areas is within 12 months. Other blue tagged poles are targeted to be replaced within 2 years.

#### 5.2.2.3 Age

The age of sub-transmission poles is as follows:




The age of sub-transmission conductor is as follows:




The population increase period between 2003 and 2006 is associated with urban reinforcement.

### 5.2.2.4 Asset Health

#### Condition

Typical failure modes unrelated to asset health include-

- Contact with foreign objects e.g. metallic balloons airborne beach umbrellas. Bird strikes
- Lightning strikes
- Impact by falling Trees or vehicle collision
- Significant landslides or earthquakes.

- Flooding

Failures in this category are more common than failures linked to asset health below and can only rely on robust fault identification and restoration procedures to minimise the consequences.

With the 100kV transmission lines sharing towers there will continue to be an exposure to rare but significant outage events in the region.

The forestry corridors associated with outages from falling trees are well known. Work continues to negotiate wider corridors and promote a tree falling distance clearway for both Subtransmission and transmission lines.

Failure indicators linked to asset health include-

- Foundation Erosion
- Wooden pole rot or decay (top or bottom)
- Cracking of concrete poles or spalling
- Underestimated initial design loading parameters e.g. snow/wind loading
- Incorrect initial design specifications e.g. pins insulators used where shackle insulators are required. or no line guards fitted.
- Missing possum guards or stay fences.
- Repetitive tree contacts

Inspection and maintenance programs continue to identify and correct these issues.

Detailed condition assessment of the existing Tuai-Gisborne-Tokomaru transmission lines indicate the lines are generally in good condition with a number of isolated assets and components at replacement criteria. Although the Tuai-Gisborne circuits are in excess of 60 years old, the basic structures and conductors are in good condition. Condition assessment reports have highlighted end of life in distinct groups. This is mainly related to foundation works (grillage) for wooden pole structures and insulators along with associated attachments. Renewal Programs are in place to manage these end of life asset components.

Detailed condition assessment of the Tuai Wairoa Transmission Lines was completed in 2016 and the lines are in excellent condition

The 60 year old population of wooden poles, predominantly hard wood are located in dry areas and have surpassed the standard 45 year life but are likely to need replacement before 80 years. The concrete population is still new it is likely the standard 60 year life will be reassessed to 80 years or more confirmed by future assessments. The condition index allocation (less than 0%, 0 to 50% and >50% remaining life) from section 5.1.6 has been applied considering the higher standard life indicated by the historical performance.

Conductor is lasting longer than poles in terms of condition and the age profile is predominantly showing the initial installation pattern. Failure modes are predominately due to external interference and not linked to the conductor condition. Despite some conductor being old Condition assessments have identified no corrosion or strength issues and .indicate the conductor will last beyond the 60 year standard life with a current expectation of the standard life reaching 90+ years

## Criticality

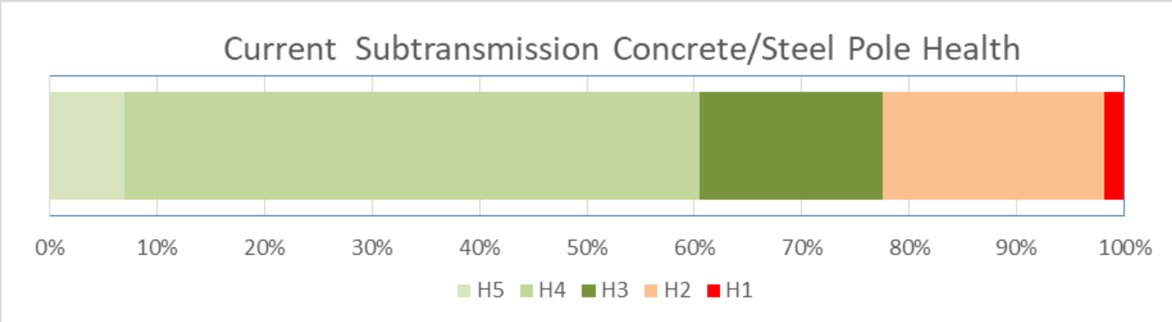
The criticality of the transmission and Subtransmission pole and tower assets within the network has in the first instance been based on the expected contribution to the system reliability risk resulting from asset failure. Where appropriate criticality level adjustments have been made to reflect the contribution to public and worker safety risk.

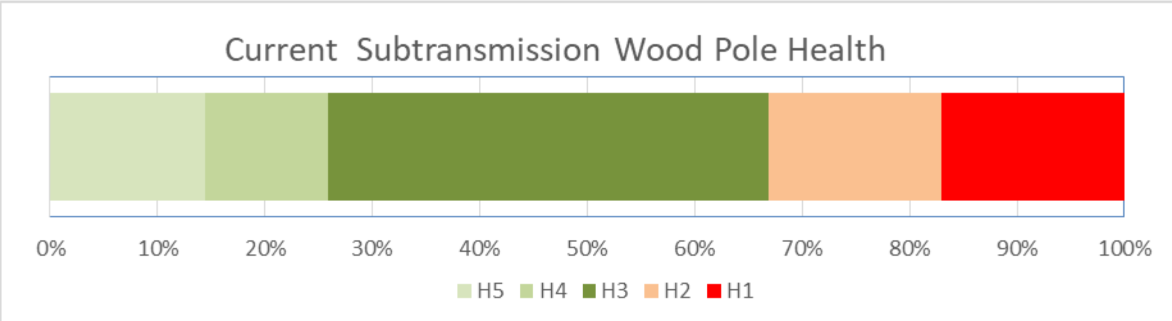
The Transmission lines to Wairoa and Gisborne are assigned a rating of C3 based on the impact of contingencies on the security of supply and impact on reliability.

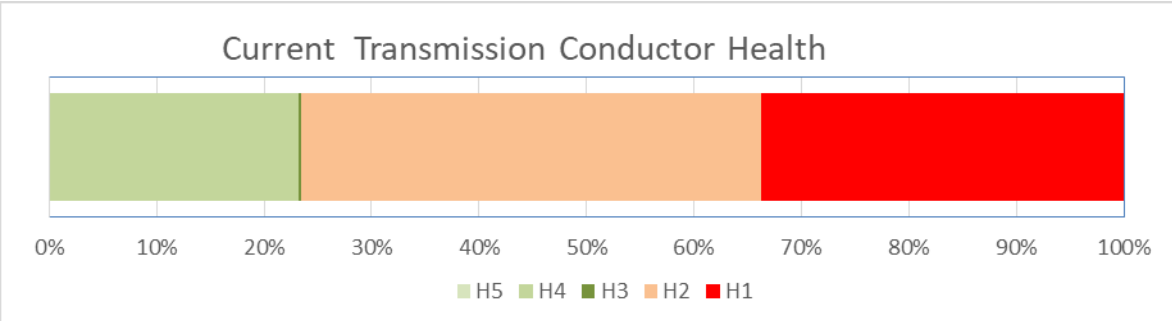
The Transmission line to Tokomaru Bay is assigned a rating of C1

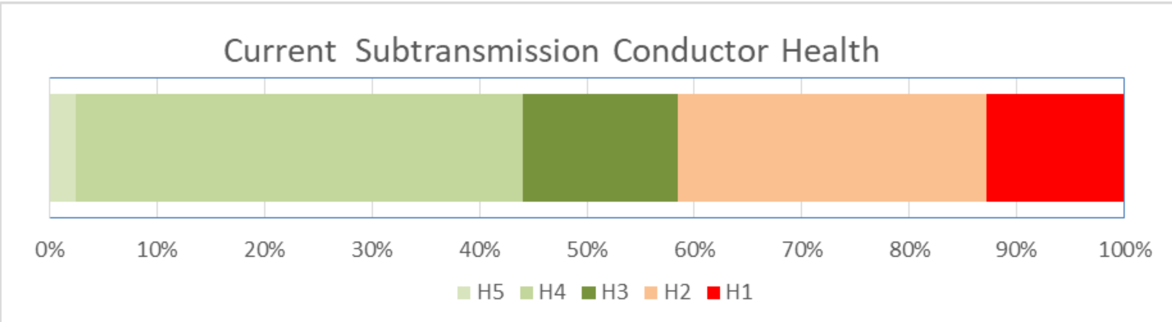
Criticality ratings for the Subtransmission lines are assigned to feeder sections based on the expected reliability impact as result of a failure. I.e. customers served. With additional consideration to public safety in the Gisborne city urban area.

### Current Health Assessment




Given the strategy to renew assets at a predictable steady state rate it is unlikely that the condition assessments shown above will change over time. If an increase in H1 and H2 categories is detected the rates will be adjusted to compensate in future revisions of this AMP. In addition should a decrease in H1 and H2 population size occur targeted replacement rates will be reduced to avoid over investment and maintain lowest cost. It is expected that analysis of trends over a minimum 5 year period would be needed to filter out fluctuations.

The population of H1 for conductors is influenced by the use of ODV standard life. The conductor does not need replacing.

Specific asset health related observations for the Transmission and sub transmission lines are as follows:

- Tower 204 on the Gisborne Tokomaru 110kV Line has a foundation stability issue design work to identify a solution to stabilise the hill is underway. Note the line is not required to supply customers hence consequence of failure is low.
- There is past problem of pole fires caused by failures NGK 10 skirt insulators. These are only rated at 45kV and problem is more prevalent in areas close to the coast. Between 2000 and 2008 the majority of the problem insulators were replaced. No allowance is made for further replacement until problem sites are identified.
- The original suspension strings on the Mahia Line were discovered to have severe wearing on the top hook (40% worn through) in 2001. They had also been stressed through incorrect operating voltage (corrected in 2000). A majority of these insulators were replaced between 2001 and 2003. The Mahia line also has no amour rods fitted to protect the conductor which may shorten conductor life. Remaining problems will be addressed as identified.
- Glazing is failing on OB insulations. This is believed to be the result of age, agricultural chemical and sun damage. Previously this issue resulted in TV interference complaints, which we were obligated to repair in an acceptable time frame. With the change in frequency for Free-view and Sky Television the complaints have reduced significantly. Correction of interference issues is more expensive than coordinating replacement with other planned work. Less than 5 sites p.a. are identified and corrected.
- Some vibration damage has been identified during past inspections. Conductor and bindings are repaired and vibration clamps are fitted as identified. Vibration damage is initially picked up by visual inspection of binders
- There are approximately 750 strings of blue and brown ceramic insulators that are in the order of 80 years old. These insulators were received in 1960, 2nd hand from NZED. Industry experience indicates that we cannot expect much more life out of this type of insulator. The usual allowance for 5OkV line component replacement of $50,000 p.a has been increased by $100,000 for 2018/19 and 2019/20 in order to address these identified insulator and crossarm age related replacement requirements on the 50kV Kiwi - Waihi Hydro line
- A few faults associated with failure of 1995-2005 porcelain insulators sheering off at the base. The issue is believed to be a random manufacturing flaw with no patterns emerging.
- Some polymer shackle insulators were removed after partial discharge testing. The insulators were washed with no improvement however application of a cut and polish corrected the discharge issue. While cost effective maintenance options are limited to address the buildup of contaminants of polymer insulators failure rates to date even from insulators displaying discharge is rare.

#### 5.2.2.5 Asset renewal Lifecycle Assessment

The following table summarises the current lifecycle assessment for Transmission and subtransmission lines

Includes 110kV 50kV and 33kV

| | Poles | Lines 50kV/110kV |
|---|---|---|
| ODV Standard Life (Wood/Concrete/Steel) | 45/60/60 | 60/60 |
| Assessed Standard Life | 60/80/90 | 80/90 |
| Population Size (Wood/Concrete/Steel) | 1503 /1162/481 | 334/306km |
| Average Age years | 35/27/47 | 46/51 |
| Steady state renewal rate p.a. (based on ODV life) | 34/19/8 | 5/5 km |
| Steady state renewal rate p.a. Assessed Life | 25/14/5 | 4/3 |
| Premature failures /Opportunistic renewal | 7 | 0.2km |
| Start of failure period | 55years | 70years |
| Failure period duration | 20 years | 40years |

| | | |
|---|---|---|
| Targeted renewal rate | 60 | 0km |
| Rate of Growth Additions/Upgrades | 0 | 0 |
| Steady state less renewal/Upgrade gap | 0 | 7km |

Renewal actions related to transmission lines are driven primarily from comprehensive asset condition and rating surveys which target distinct/specific contributory asset parts such as tower steel work, insulators, conductors and tower foundations.

Transmission line renewal expenditure forecast for the planning period is based on asset condition survey information driven forecasts from Transpower. As Eastland Network Limited gains operational experience of the transmission line assets and completes its own asset condition surveys, renewal expenditure forecasts for these assets will be updated accordingly in future versions of the AMP.

The renewal rate required over the next 10 years is the same is the steady state rate. Supported by condition assessments.

Premature failures account for renewal of poles that fail due to external causes. E.g. Car-hit-pole, Land slips, Falling Trees, Severe storms.

Where insulator, cross-arm, conductor spans or partial pole condition issues are identified the entire (pole) asset or line section is replaced if the total required maintenance expenditure exceeds 50% of the cost of new asset. This is common in cases where future shutdown or travel costs to correct arising defects are likely. In addition where high outage cost or helicopter work is associated with a group of poles being renewed opportunistic renewal of associated poles approaching end of life is carried out to reduce overall costs. This is typical for the East-coast 50kV and Mahia 33kV spur line renewal work.

The target renewal rate to accommodate the 10year renewal rate, premature renewal and correction of defects is set at 60 sub-transmission poles p.a.

Age renewal for conductor assumes 60 to 80 year life hence no planned replacement is currently undertaken or required. There is a risk that when the conductor eventually needs to be replaced the ability to fund the work from forecast expenditure will need to be increased.

### 5.2.2.6 Expenditure Forecasts

| | Quantity | Total |
|---|---|---|
| Planned Actions | | |
| 110KV Tower/foundation/conductor/access track inspection & maintenance | | $114,232 |
| 110kV tree control | | $115,000 |
| Patrols 50 & 33kV (Ground & Heli) | 2,000 | $24,000 |
| Inspection 50 & 33kV | 135 | $20,000 |
| Testing of Poles 50 & 33kV | 200 | $10,000 |
| Component Renewal/Maint 50kV | 50 | $150,000 |
| | | |
| Unplanned Actions | | |
| 110kV fault response/defect /fault repairs | | $197,933 |
| Tree control 50kV | | (refer Distribution Lines and Cables) |
| Defect / Fault repairs 50kV | | $12,000 |
| Fault response (incl. Helicopter) 50kV | | $20,000 |
| Radio Interference correction | | $6,092 |
| | | |
| Capex | | |

| | | |
|---|---|---|
| Transmission pole rrenewal | 6pa (110kV) | $321,000 |
| Sub-transmission pole renewal | 60 pa (50kV& 33kV) | $396,000 |
| Transmission tower component renewal | | $495,000 |
| Fault replacement 50kV & 33kV Line | | $44,673 |

The usual allowance for 5OkV line component replacement of $50,000 p.a has been increased by $100,000 for 2018/19 and 2019/20 to address insulator health issues identified.

**5.2.2.7 Design**

Specific designs are used for Transmission lines and Towers
Pole and line designs are undertaken using CATAN line design software.
Design Safety index Urban >1.6, Rural >1.3
Standards used include the following:

- -NZS 3115:1980 for concrete poles,
- -AS 2209 for wooden poles.
- -AS/NZS 4676 for Structure design

Standard Pole types used are:

- Steel Towers – Specific Designs
- Concrete Pole 11.0m Busck
- Concrete Pole 12.5m Busck
- Concrete Pole 11.58m Firth
- Concrete Pole 12.2m Firth
- Concrete Pole 12.8m Firth
- Concrete Pole 14.4m Firth
- Softwood Pole 11.0m
- Hardwood Pole 11.0m
- Hardwood Pole 12.5m

Construction of new or replacement asset generally adhere to following;

- Concrete poles are used unless they are limited by weight for helicopter use typically on rural Subtransmission circuits.
- Cross-armless delta configuration and cross-armless angles for live line compatibility
- If phase separation dictates use of cross arms, then steel arms with flat post insulator construction are used
- Polymer strain insulators – no strings
- No LT under building
- Avoid main highway line routes
- Standard conductors: Cockroach – urban, Dog – rural
- All poles to be fitted with possum guard
- Line make-offs/staying approximately every 12th pole if there are no intermediate make-offs or angles. This is more important for concrete poles as they a less tolerant of shock loading along line than wooden poles.
- Conductor spacing and insulation to 66kV standard on 50kV lines. This provides for a future shift to 66kV if the need arises.

### 5.2.3 Distribution Lines and Cables

#### 5.2.3.1 Overview and strategy

The configuration of Distribution Assets is described in section 2.2.4
The Distribution lines are predominately overhead using concrete and wooden poles. Historically the wood poles were Australian Hardwood, and more recently NZ softwood poles have been used

When considering the pole and conductor replacement strategies it is important to realise that maintaining the asset in a newer state will not necessarily improve the key performance measures. In particular Pole and conductor failures occur on both new and old assets as they are usually influenced by external factors.

From an asset strategy perspective, the objectives for the Distribution Lines and Cables assets are to:

- Deal promptly with any known defects.
- Achieve overall asset renewal at a steady state that is broadly consistent with depreciation.
- For lines in Urban areas where line renewal with cable options are uneconomic maximise public safety by implementing renewal programs aimed to renew assets before failure in service.
- Apply a continued focus to reduction of the external factors causing failure that are not related to Asset health.

### 5.2.3.2 Maintenance

A visual patrol of every pole and its associated line hardware and conductors is carried out at a maximum interval of two years. Poles and lines located in urban areas and rural townships are inspected every twelve months. The patrols are often incorporated into the patrols necessary as a result of a fault occurring.

A more detailed inspection is carried out every five years as the lines near their end of life. This inspection includes updating safety index information on the poles through pole testing/inspection techniques. Visual inspection includes excavation and/or climbing as necessary to categorically determine the poles below ground and/or head condition. Any components on the poles, identified from the inspections that require replacing are categorised in terms of risk and scheduled for correction within 1 year. Renewal of partial pole components e.g. cross-arms is not capitalised.

As with sub-transmission poles the mechanical strength requirements for all individual 11kV poles have been determined and recorded. The health indices for wooden poles are updated following inspection. At risk poles are identified from the inspection returns and updated in pole database records, using the same criteria as for sub-transmission poles. Replacement and monitoring strategies are as per the Pole Assessment in Subtransmission Lines section.

Due to the unavailability in the market of insurance cover for significant events affecting distribution network assets, Eastland Network Limited has in place;

Transformers, Switches and line sections the become surplus to requirements through changes to land use and load are identified during patrols and reporting systems. Specific funding is allocated to the removal of this unnecessary equipment.

Concrete poles only require a visual inspection per the above as below ground rot does not occur.

No planned cable maintenance activities are deployed. Replacement is programmed in capital works budget from analysis of performance from fault statistics.

#### Pole Assessment Criteria

The pole assessment criteria for distribution lines is the same as that used for Subtransmission lines and is described in section 5.2.2.2

### 5.2.3.3 Tree Control

A tree control program consisting of hazard identification and notification in accordance with the Electricity (Hazards from Trees) Regulations 2003 has been developed. Elements of this program include:

Patrolling of the network to identify and record tree interference/ hazards. These patrols are undertaken on 12-18 month cycles.

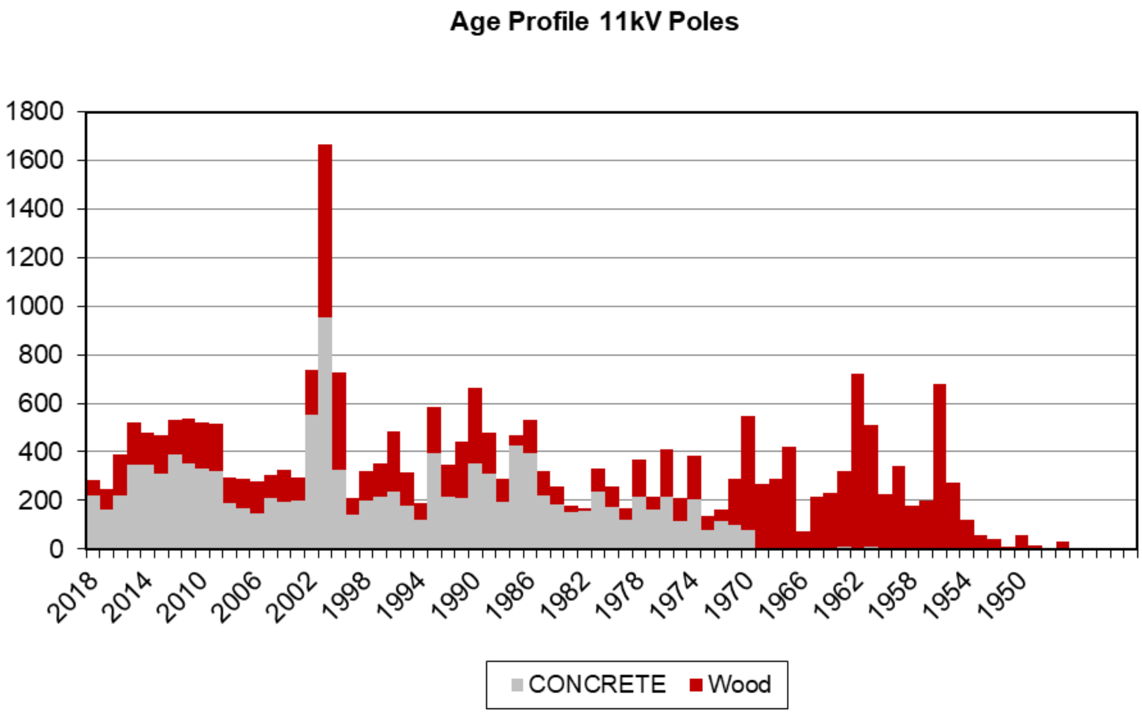
The identification of tree owners whose trees are a hazard and the issuing of Hazard Warning Notices or Cut/Trim Notices and subsequent negotiations.

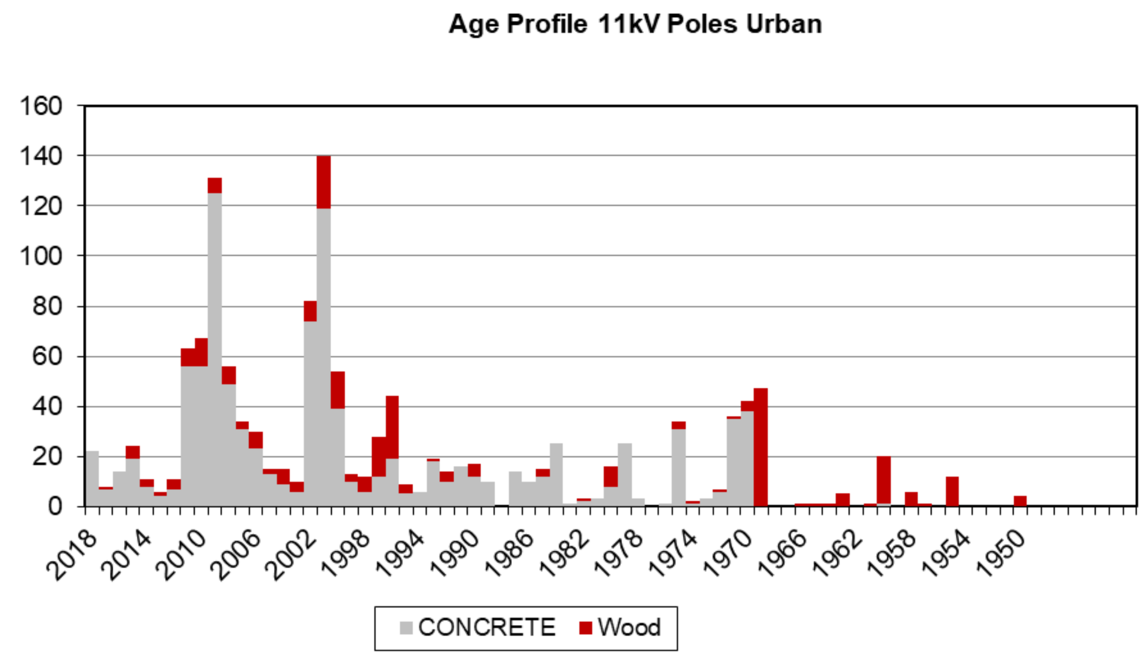
The engagement of accredited contractors to undertake Eastland Network Limited funded first cuts and/or the removal of “no interest” trees.

In 2010 a specific program to target tree control associated with commercial forestry blocks was commenced and continues to maintain improved performance.

**5.2.3.4 Age**

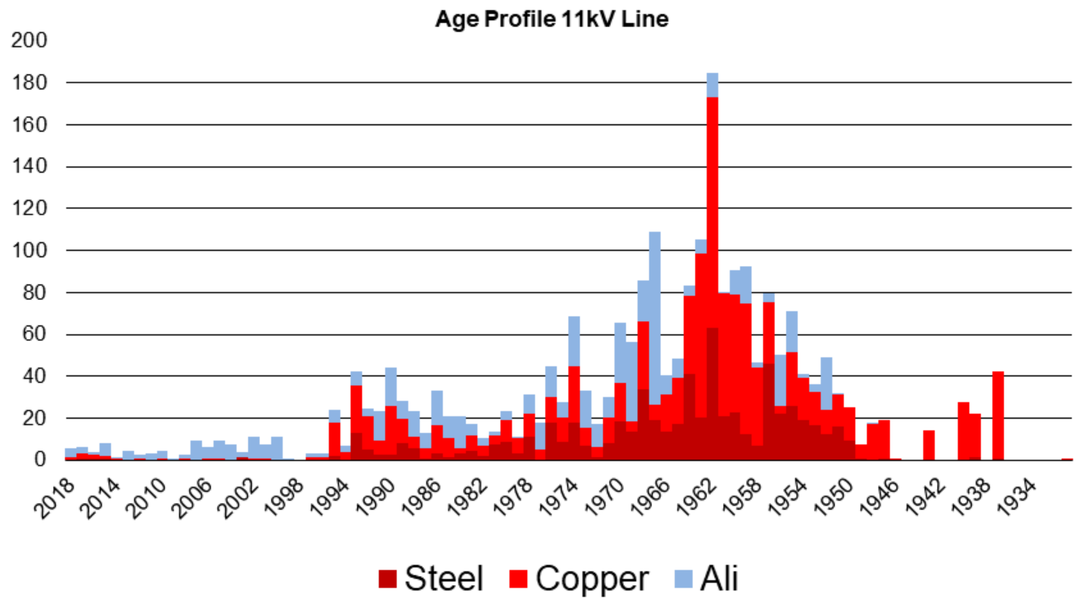
The age of 11kV poles is as follows:



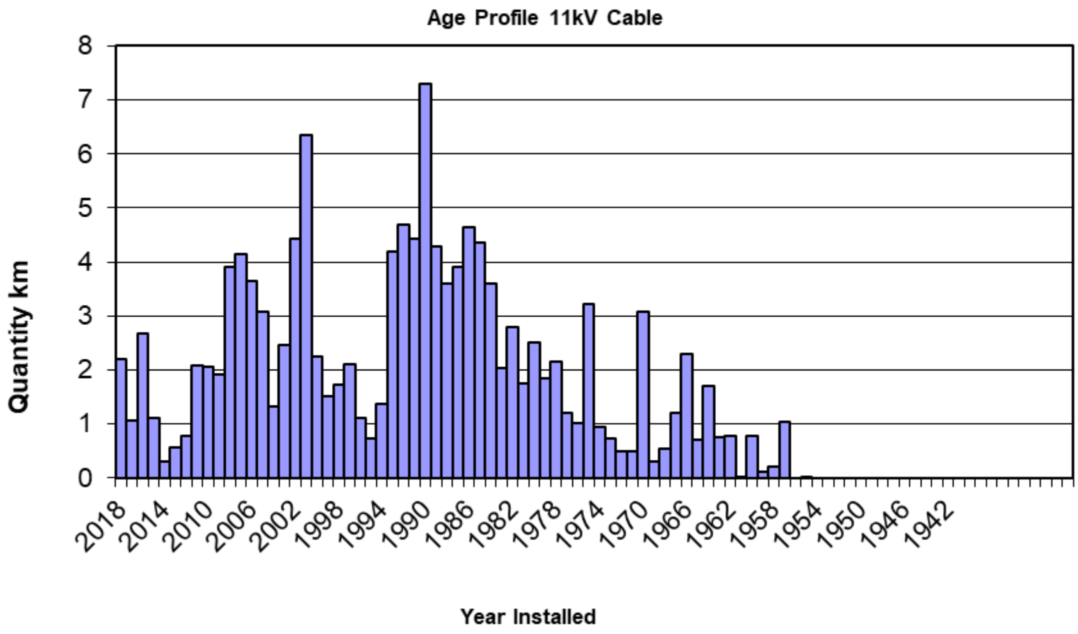

The urban pole age profile shows the newer population of mainly concrete poles.

The age of 11kV conductor is as follows:




The installed 11 kV conductors consist of aluminum (22%), steel (27%) and copper (51%) construction.

The age of 11kV cable is as follows:




Due to sample size of cables and the relative new age of the asset the profile is showing an installation pattern rather than renewal.

### 5.2.3.5 Asset Health Condition

Typical failure modes unrelated to asset health include-

- Contact with foreign objects e.g. metallic balloons airborne beach umbrellas. Bird strikes
- Interference with cables by digging activities.
- Changes to ground contours reducing conductor clearance
- Lightning strikes

- Impact by falling Trees or vehicle collision
- Significant landslides or earthquakes.
- Flooding

Failures in this category are more common than failures linked to asset health below and rely on robust fault identification and restoration procedures to minimise the consequences.

The forestry corridors associated with outages from falling trees are well known. Work continues to negotiate wider corridors and promote a tree falling distance clearway for distribution line

Failure indicators linked to asset health include-

Lines

- Foundation Erosion
- Wooden pole rot or decay (top or bottom) linked to soil type or conditions.
- Cracking of concrete poles or spalling
- Underestimated initial design loading parameters e.g. snow/wind loading
- Incorrect initial design specifications e.g. pins insulators used where shackle insulators are required. or no line guards fitted
- Missing possum guards or stay fences.

Conductors

- Conductor stretch reducing ground clearance
- Conductor Annealing related to thermal loading
- Conductor Corrosion
- Conductor Chaffing
- Conductor Fatigue due to wind movement or ice loading

Cables

- Thermal overloading.
- Cable installation methods
- Ground conditions
- Insulation failure of cable terminations

Poles

The age profile analysis and condition assessments indicate concrete population is still new with the exception of reinforced rather than pre-stressed concrete it is likely the standard 60 year life will be increased to 80 years or more confirmed by future assessments. The wooden population shows life out to 60 years. This older section of r hardwood poles are typically in the dryer locations. NZ Softwood and Larch poles typically align with the 45 year standard life.

The condition index allocation (less than 10%, 10 to 30% and >30% remaining life) from section 5.1.6 has been applied considering the higher standard life indicated by the historical performance.

Conductor

The conductor population is older than the pole population which reflects the expectation that Al and Cu conductor will exceed the 60 year life expectation. Analysis of conductor failures generally indicate underlying causes e.g. Falling Trees, foreign interference and hardware failure, have contributed to the perceived overall conductor condition.

Other than visual inspection there are limited options to test sample sets of conductors while it is in service. Condition assessments are typically derived from post fault analysis and applied to conductor type's locations and service duty.

There is 661 km of galvanised steel conductor on the network. While this conductor is achieving the standard 60year life. In some sections, typically located in shady damp conditions, rusting is causing breakages.

The conductor size in rural areas is typically small due to lack of historical capacity upgrades this smaller size is less resilient than the larger multi-stranded conductor types

The condition index applied to conductor broadly considers the differing conductor types sizes and location factors that have been obtained from performance post failure analysis.

Cables
The dominant failure mode for underground cables is insulation failure of the reychem terminations. Post fault analysis indicates a strong correlation between wet weather followed by hot humid conditions as a trigger. Open point terminations on switchgear appear to be more vulnerable than loaded terminations.
Inspection of terminations requires shutdowns which if undertaken would cause the current regulated outrage limits to be exceeded. It is likely even with shutdowns and inspections early identification of issues would often be unsuccessful as the onset of symptoms and signs is quickly followed by failure and time frames are shorter than practical inspection frequencies. Alternative heat shrink products and terminations using rollup or cold boot insulation have been tried with no apparent improvement in reliability As improved products become available they may reduce the issues over time however in the medium term no performance improvement is expected. Some modern switchgear designs have increased the clearances around terminations that may improve performance. Potentially real time discharge monitoring equipment and low cost communications options could be developed to detect and alert discharge. No suitable products have been identified to date.

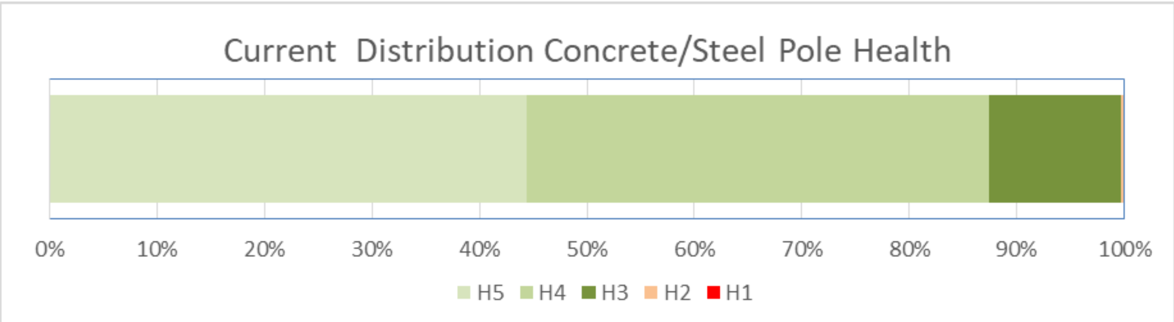
Robust processes and monitoring of third party activities are generally effective at minimizing third party damage to cables.

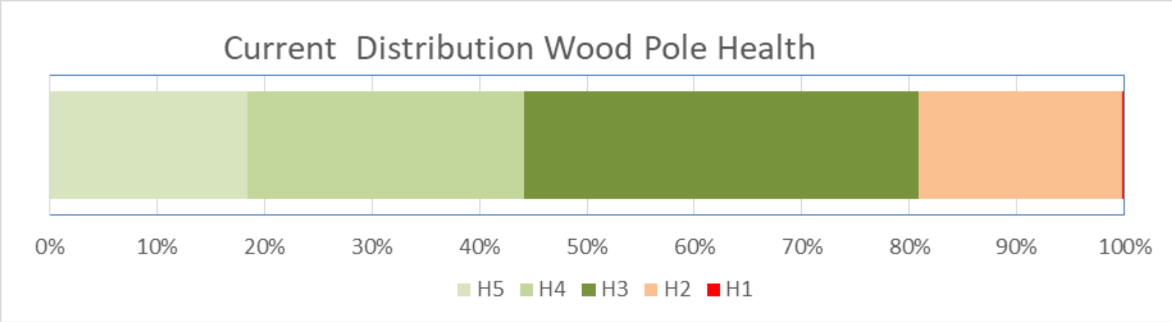
**Criticality**

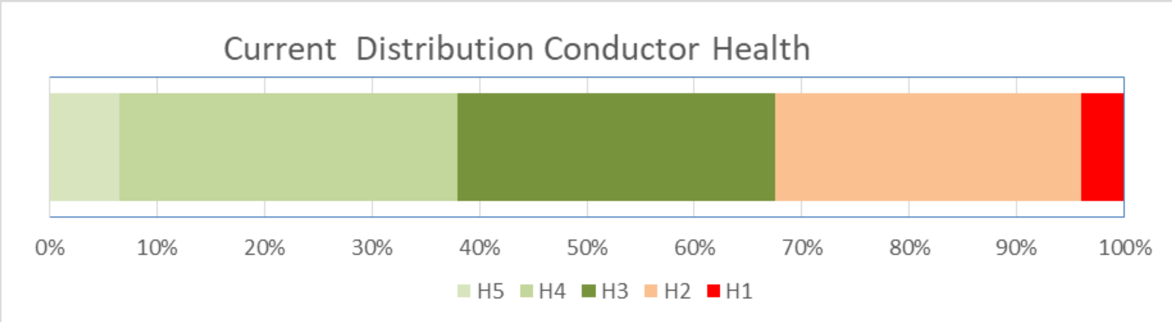
Poles
Distribution pole criticality across the asset class was allocated at feeder level based on customer density, relative redundancy, and relative performance approximated through the feeder categorisation. Assets on medium density rural feeders (medium density but low interconnectivity and redundancy) have been allocated to the highest criticality rating (C3), urban assets (high density and medium redundancy) to C2 and CBD (high redundancy) and long rural (low density, low redundancy) assets to the lowest criticality rating.

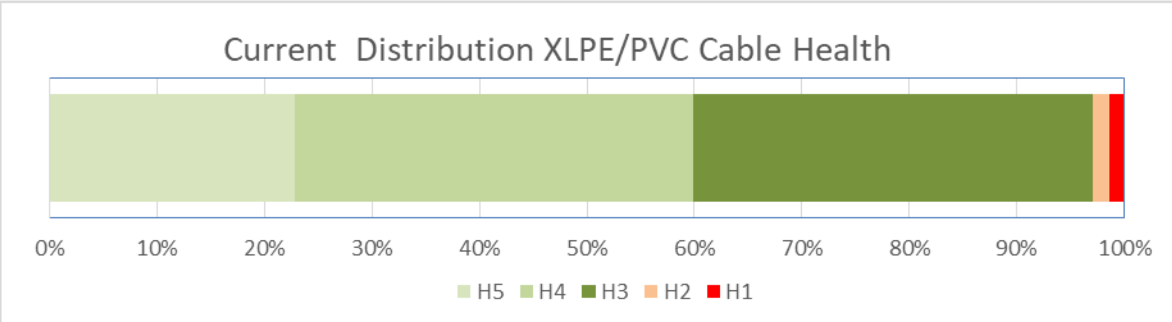
Conductor
Distribution conductor criticality across the asset class is aligned with the poles. In some cases, conductor loading is used to increase the criticality to the next highest rating.
Cables
Criticality ratings have been assigned at feeder level based on the impact of contingencies on the security of supply and system loading conditions.
Criticality allocations for distribution cables were made based on reliability risk as demonstrated through customer density and relative redundancy approximated through the feeder categorisation. Cables on spur feeders (medium density but low interconnectivity and redundancy), have been allocated to the highest criticality rating C3, Urban cables (high density and medium redundancy higher public interference likely) to C2 and CBD (high redundancy low public digging likelihood) assets to the lowest criticality rating C1

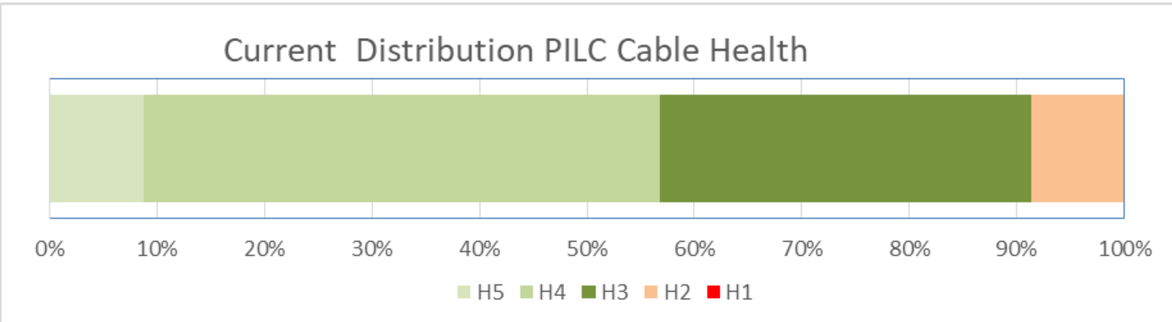
## Current Health Assessment






Given the strategy to renew assets at a predictable steady state rate it is unlikely that the condition assessment shown above will change over time. If an increase in H1 and H2 categories is detected the rates will be adjusted to compensate in future revisions of this AMP. In addition should a decrease in H1 and H2 population size occur, targeted replacement rates will be reduced to avoid over investment and maintain lowest cost. It is expected that analysis of trends over a minimum 5 year period would be needed to filter out fluctuations.

### 5.2.3.6 Asset renewal Lifecycle Assessment

| LIFE CYCLE ASSESSMENT (Lines) | Poles Wood/concrete | Lines |
|---|---|---|
| ODV Standard Life (Wood/Concrete) | 45/60 | 60 |
| Assessed Standard Life | 60/80 | 90 |
| Population Size (Wood/Concrete) | 18063/15534 | 2303km |
| Average Age years | 36/20 | 49 |
| Steady state renewal rate p.a. (based on ODV life) | 282/202 | 38km |
| Steady state renewal rate p.a. Assessed Life | 211/151 | |
| Premature failures /Opportunistic renewal | 30 | 1 km |
| Start of failure period | 35/55years | 60years |
| Failure period duration | 10 years | 20years |
| Targeted renewal rate | 650 | 3km |
| Rate of Growth Additions/Upgrades | 20 | 2km |
| Steady state less renewal/Upgrade gap | 0 | 35km |

Currently the incidence of conductor fatigue failure is rare when compared with failure due to interference from birds and trees and human elements. Fatigue failures nearly always occur at connections or insulators. These failures do not warrant replacement of entire sections of conductor as the in span portion of the conductor is in good condition.

The 35km p.a. gap between the 10 year renewal rate plus premature renewal and the targeted renewal rate plus the replacement due to upgrade work, is due to the conductor lasting beyond standard life expectations.
In previous plans the conductor renewal target of 9km p.a. until 2016 with a forecast increase beyond this time to 18km has been reviewed. Following analysis of the condition assessments, no increase in targeted rates appears necessary at this stage.

Some conductor renewal to replace 6 wire copper lines with 3 wire Aluminum “Dog” conductor is being carried out on the Tokomaru Inland and Ruatoria Makarika and Tikitiki feeders. This work is to improve tie capacity and conductor spacing and is not directly related to conductor condition.

In the medium term the effect of a shortfall in investment in renewal of 11kV conductor is addressed in part by Eastland Network Limited’s strategy for uneconomic lines described in Section 4.7.1.4

In the long term when condition assessments indicate renewal, investment will need to be ramped up. The corresponding increase in expenditure and planned outages to undertake the work will affect the ability to achieve customer expectations of steady state performance and regulatory performance targets.

| LIFE CYCLE ASSESSMENT (Cables) | PVC/PILC |
|---|---|
| ODV Standard Life (XLPE/PILC) | 45/60 |
| Assessed Standard Life | 80 |
| Population Size | 32/102km |
| Average Age years | 27 |
| Steady state renewal rate p.a. (based on ODV life) | 2 km |
| Steady state renewal rate p.a. (Assessed Life) | 1.5 |
| Premature failures /Opportunistic renewal | 0.5 km |
| Start of failure period | 50years |
| Failure period duration | 20years |
| Targeted renewal rate | 0 km |
| Rate of Growth Additions/Upgrades | 2 km |

| | |
|---|---|
| Steady state less renewal/Upgrade gap | 0 km |

As the majority 11kV reticulation in both Wairoa and Gisborne CBDs has been already undergrounded there is little undergrounding required during the planning period.

Cable replacement is solely driven by the need for capacity upgrades and new work which is identified on a project-by-project basis. Therefore, targeted replacement due to age is 0km. When multiple failures are experienced on sections of cable replacement is built into project work. Currently there are no projects specifically in this category.

#### 5.2.3.7 Expenditure Forecasts

| | Quantity | Total |
|---|---|---|
| Planned Maintenance Actions | | |
| Patrols and General maintenance | 40 feeders | $200,000 |
| Pole Inspection and testing | 1,600 | $80,000 |
| Tree control program | 1,200 | $600,000 |
| Forestry Tree control program | 10 | $250,000 |
| Equipment Removal | | $40,000 |
| | | |
| Unplanned Maintenance Actions | | |
| Defect / Fault repairs | | $263,978 |
| Fault response | 120 | $130,000 |
| Control and Switching costs | | $20,000 |
| Trees forced cutting | 250 | $50,000 |
| Storm contingency | | $100,000 |
| | | |
| Capex Actions | | |
| Renewal Conductor 9km p.a. | | $402,060 |
| Premature conductor replacement | 1km pa | $110,000 |
| Pole Renewal, | 650 pa | $2,508,000 |
| Premature pole renewal | 50 pa | $357,500 |
| Premature Cable renewal | 0.5km | $110,000 |

#### 5.2.3.8 Design

Pole and line designs are undertaken using CATAN line design software.
Design Safety index Urban >1.5, Rural >1.2
Standards used include the following:

- -NZS 3115:1980 for concrete poles,
- -AS 2209 for wooden poles.
- -AS/NZS 4676 for Structure design

Standard Pole types used on the 11kV network are:

- Concrete Pole 11.0m Busck
- Concrete Pole 12.5m Busck
- Concrete Pole 10.01m Firth
- Concrete Pole 10.67m Firth
- Concrete Pole 11.58m Firth
- Concrete Pole 12.2m Firth
- Concrete Pole 12.8m Firth

- Concrete Pole 14.4m Firth
- Softwood Pole 11.0m
- Hardwood Pole 11.0m
- Hardwood Pole 12.5m

Standard conductors are:

- Wire "Cricket" Aluminum Overhead
- Wire "Wasp" Aluminum Overhead
- Wire "Dog" Aluminum Overhead
- Wire "Ferret" Aluminum Overhead
- Wire "Squirrel" Aluminum Overhead
- Wire "Flounder" Aluminum Overhead
- Wire 7/.044 Bare Hard Drawn Copper Overhead
- Wire 7/.044 PVC Hard Drawn Copper Overhead
- Wire 7/.064 Bare Hard Drawn Copper Overhead
- Wire 7/.064 PVC Hard Drawn Copper Overhead
- Wire 7/.080 Bare Hard Drawn Copper Overhead
- Wire 7/.080 PVC Hard Drawn Copper Overhead
- Wire 19/.064 Bare Hard Drawn Copper Overhead
- Wire 19/.064 PVC Hard Drawn Copper Overhead

Construction of new or replacement asset adhere to following standards:

Lines

- Concrete poles (hard wood poles where load/strength characteristics cannot be matched)
- Cross arms mounted 200mm below top of pole
- Longer cross arms (2.4m) for live line friendly spacing
- Polymer strain insulators – no strings or kidney
- Line routes to adhere to road reserve where possible though a continuing issue exists with Transit NZ whose minimum draft standards for pole clearance in relation to the edge of road seal, (i.e. 9m clearance in 100km/hr. areas) is proving challenging.
- Standard conductors - Dog – Urban and Rural ties
- Insulators have a minimum 15kV standard and for coastal areas 25kV
- Insulators fitted 100mm in from cross arm ends
- All poles are fitted with possum guard, and pole cap if wooden
- Hardwood strain pole required every 2km in straight prop pole sections of line (to break cascade failures)
- Angle poles to be armless for live line capability.
- Mid span jumpers not permitted
- No stub poles to be used for stay anchors

Cables

- No pitch terminations are reinstated if any work undertaken
- Terminations on poles are protected with surge diverters
- Standard cable sizes: 300mm 185mm 95mm AL, 16mm CU
- No cable to cable T connections

### 5.2.4 LV Network

#### 5.2.4.1 Overview and strategy

The configuration of Low voltage network is described in section 2.2.7

It is recognised that the high population of ground level assets associated with the LV network pose a high level of exposure in terms of public safety should the assets become damaged. There is a key focus on ensuring these assets are electrically safe.

From an asset strategy perspective, the objectives for the Low Voltage assets are to:

- Deal promptly with any known defects.
- Apply systems that are standardised to minimise support and maintenance costs.
- Ensure the contingency spares, should a failure occur, are maintained.
- Achieve overall asset renewal at a steady state that is broadly consistent with depreciation.
- Accommodate growth by adding transformers.
- Apply a continued focus to reduction of the external factors causing failure that are not related to Asset health.
- Capital renewal of lines with cable options is a key strategy. As the LV lines are typically on one side of the street capacity upgrades take the form of cable installation on the opposite side of the street which halves the loading on the overhead lines.
- Achieve urban pole replacement prior to failure is a key public safety strategy. Note rural Low voltage is typically under built on distribution poles or privately owned.
- Achieve pillar renewal on all publicly accessible equipment before it becomes electrically unsafe.

**5.2.4.2 Maintenance**

A visual patrol of every pole and the conductors is carried out at a maximum interval of two years. Poles and lines located in urban areas and rural townships are inspected every twelve months. Should any mechanical strength defects be discovered then a full below ground inspection will be done within a year.

Health indices for all 400V poles are used to identify at risk poles using the same criteria as for sub-transmission and distribution poles. Replacement and monitoring strategies are as per the Pole Assessment in Sub-Transmission Lines section.

As real time monitoring systems such as SCADA are not deployed on the LV network LV lines and cables are managed in a more reactive mode by responding to calls when fuses overload and voltage complaints are received.

Tree patrols, notification and cutting are undertaken in conjunction with the 11kV Tree Control program.

No planned cable maintenance activities are deployed. Replacement is programmed in capital works budget from analysis of performance from fault statistics.

A general inspection of overhead LV switchgear is incorporated into line patrols.

A specific visual patrol of LV Disconnection and Link boxes is carried out every 5 years and larger link boxes are checked and cleaned during 3 yearly inspection to check electrical connections are secure and insure all labeling and security safety measures are in place

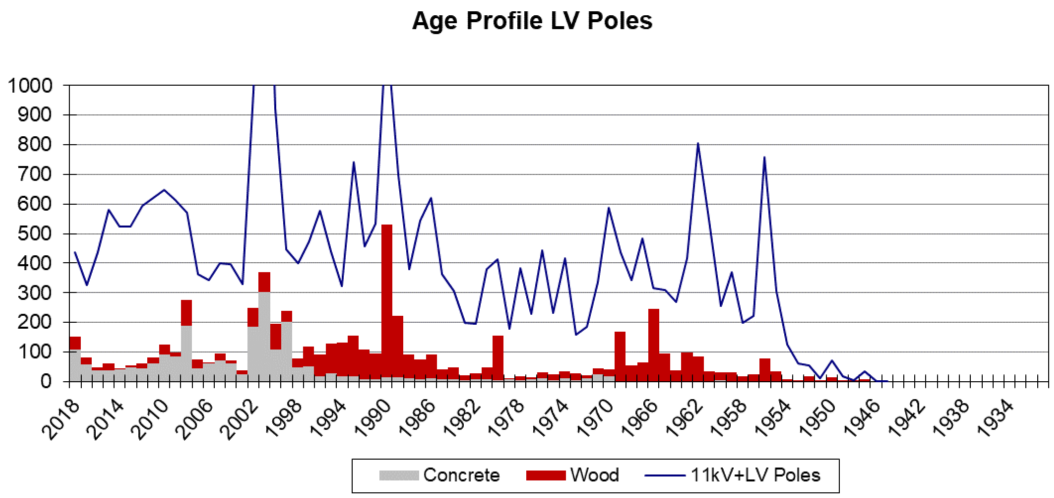
LV frames in ground mount substations are inspected in conjunction with transformer Inspections.

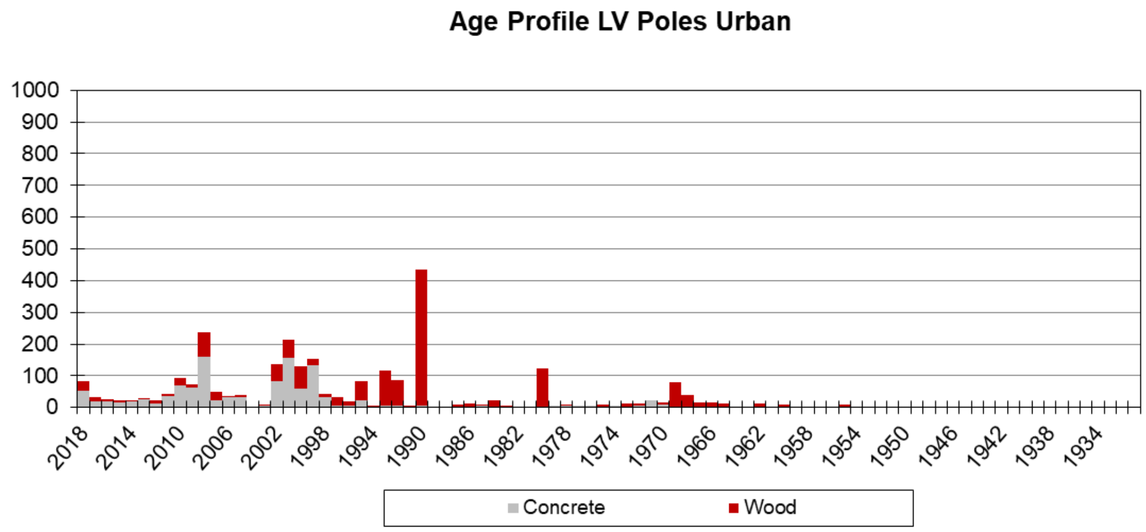
No routine maintenance activities are undertaken on overhead LV equipment.

A rapid inspection of all Pillars in the CBD is carried out a few weeks prior to Christmas every year to ensure the equipment is safe and secured prior to the high increase in public presence over the holiday period.

5.2.4.3 Age

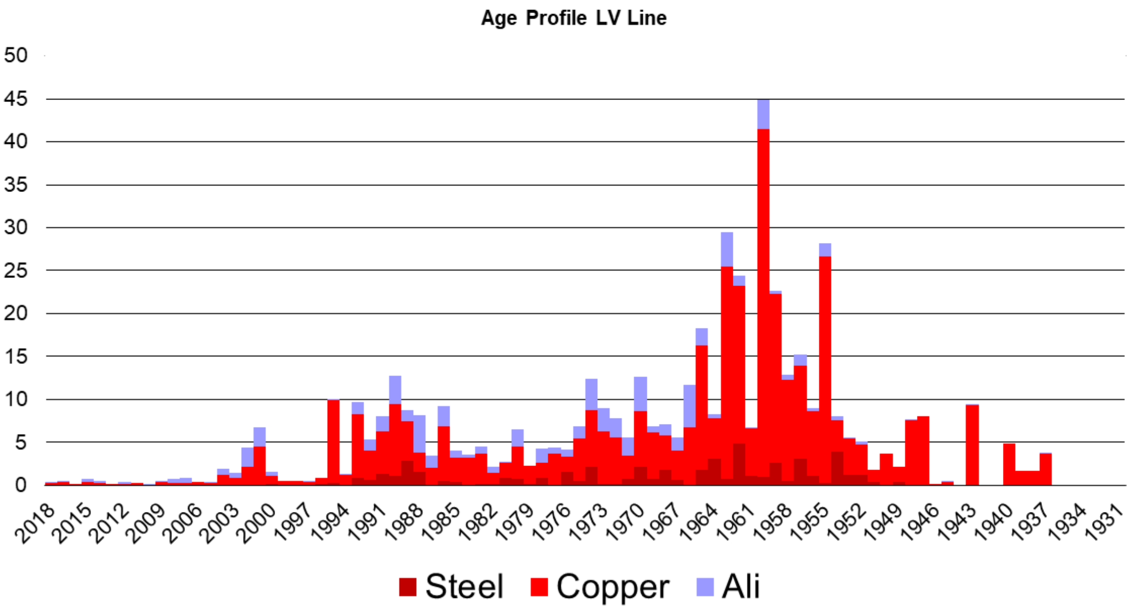
The age of LV poles is as follows:



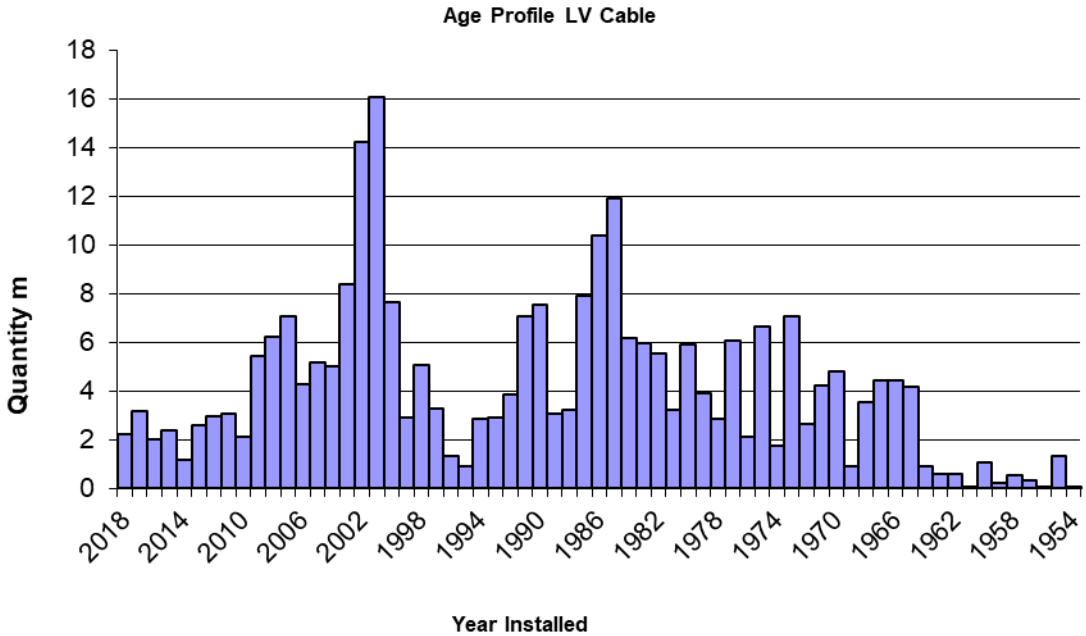

The urban population indicates the majority of poles are in the new population with an older population located in the urban fringe areas.

The age of LV conductor is as follows:



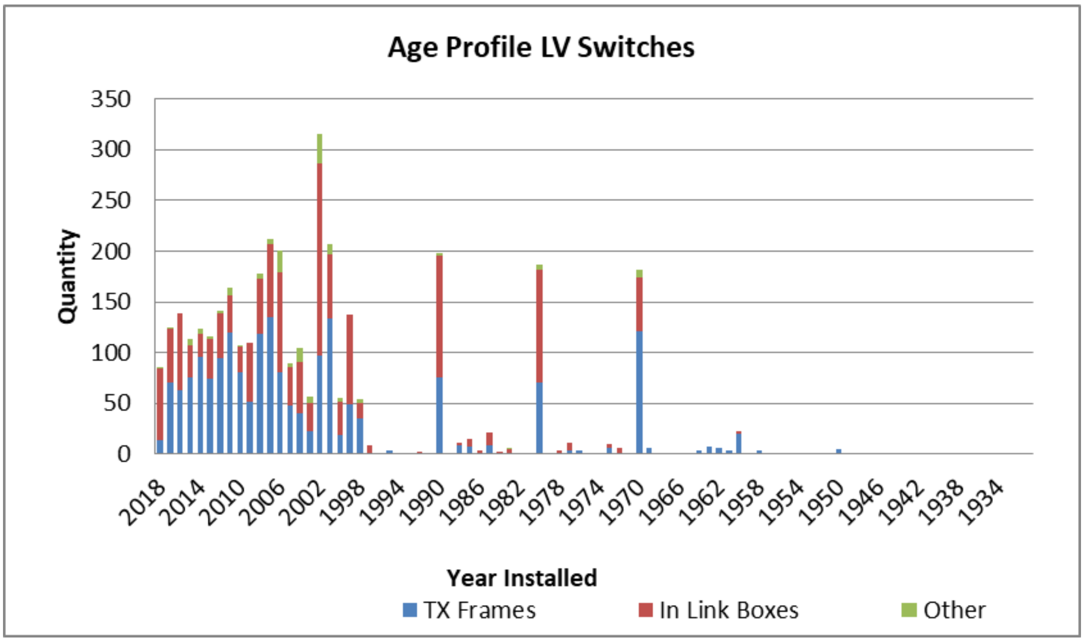

The low conductor and pole installation in recent years has some correlation with under-grounding.

The age of LV cable is as follows:



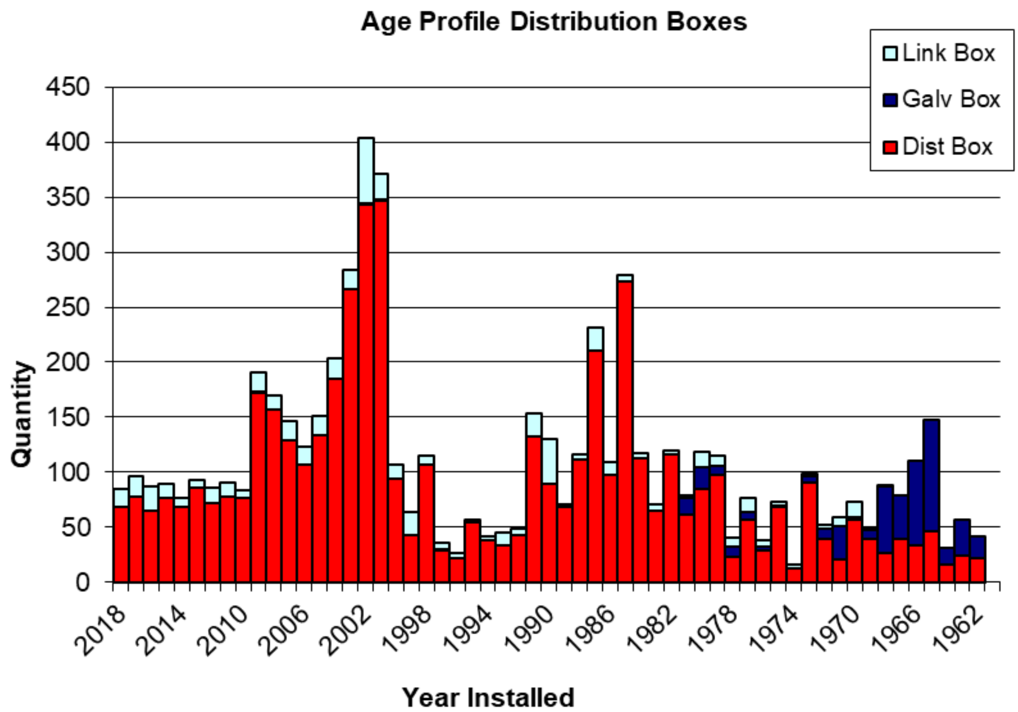

The cable installation rate shows a strong correlation with reduction in overhead line installation. Minimal replacement levels are evident.

The average age of LV switches is as follows:




The dataset for LV switchgear including Transformer and Link box frames shows an incomplete pattern and approximate age as past documentation was not considered necessary. This equipment has a relatively young average age because its installation is associated with cables and ground-mount transformers. Therefore it has to be aged to the point where survival can be accurately assessed. Safety standards and performance of early installations is driving replacement. Most of this is undertaken in conjunction with other work such as transformer renewal.

The age of Distribution Boxes is as follows:




### 5.2.4.4 Asset Health

#### Condition

Typical failure modes unrelated to asset health include-

- Interference with cables by digging activities.
- Changes to road corridors and ground contours reducing conductor clearance
- Impact by falling Trees or vehicle collision
- Flooding
- Vandalism of ground level assets e.g. pillar box vandalism

Failures in this category and rely on robust fault response and restoration procedures to minimize the consequences.

Failure indicators linked to asset health include-

Lines

- Wooden pole rot or decay (top or bottom) linked to soil type or conditions.
- Cracking of concrete poles or spalling

Conductors

- Conductor stretch or pole movement increasing sag and reducing ground clearance
- Conductor Annealing related to thermal loading
- Conductor fatigue due to wind movement
- Thermal cycling or corroding connections causing conductor burning
- conductor breakage after clashing or external interference

Cables

- Thermal overloading.
- Cable installation methods
- Ground conditions

LV Switches

- Thermal cycling causing loose connections and burnout
- Condensation and humidity causing tracking and corrosion

Pillars

- Thermal cycling causing loose connections and burnout
- Rust on metal pillars.
- External Impact damage typically from lawn mowers vehicles and people

Age profile analysis and condition assessments indicate concrete LV pole population is still new it is likely the standard 60 year life will be increased to 80 years or more confirmed by future assessments. The wooden population shows life out to 60 years. This older section of poles are currently scheduled for replacement.

Overhead LV Conductor in the urban area has an average span at 30m allowing more lea-way before design criteria is compromised. Load growth from in fill housing has been accommodated by underground of the street on the opposite side of the LV lines reflecting the low levels of replacement in favor of underground alternatives.

An additional Wairoa township undergrounding allowance has been budgeted to replace overhead LV which will coincide with the Chorus planned installation of Ultra-Fast Broadband fiber throughout the Wairoa urban area.

Generally, transformers overload before cables and this is allowing issues to be overcome through increasing transformer density thus reducing LV run lengths. This approach will be adequate until transformer capacity is not needed for the load density and it becomes more economic to re-conductor or increase cable size. Cable condition determined from post fault analysis indicates survival beyond 45 years can be expected currently the expected life has been revised to 60 years to improve the accuracy of forecasts.

After 45 to 60 years of in service life Replacement of the older galvanised boxes life is underway as overall deterioration is identified during inspection. While the majority of Link boxes and plastic pillars are aging well the external damage factors affecting condition indicate the standard 45 year life is appropriate

The age profile of the service pillars indicates a required 10 year renewal rate of 80 per year plus opportunistic renewal of 30 per year. Inspections and condition assessments confirm this renewal rate. Incorporated into the renewal rate is separation of Eastland Network Limited equipment from shared boundary-meter boxes by either relocating into separate new service fuse boxes and\or contributing to the relocation of the metering equipment. Primary justification for the separation work is to improve safety with age renewal being the secondary justification. An age deterioration and damage issue also exists with similar issue with sun damaged fiberglass service fuse boxes. Eastland Network Limited has a program in place to replace these boxes with new service fuse boxes.

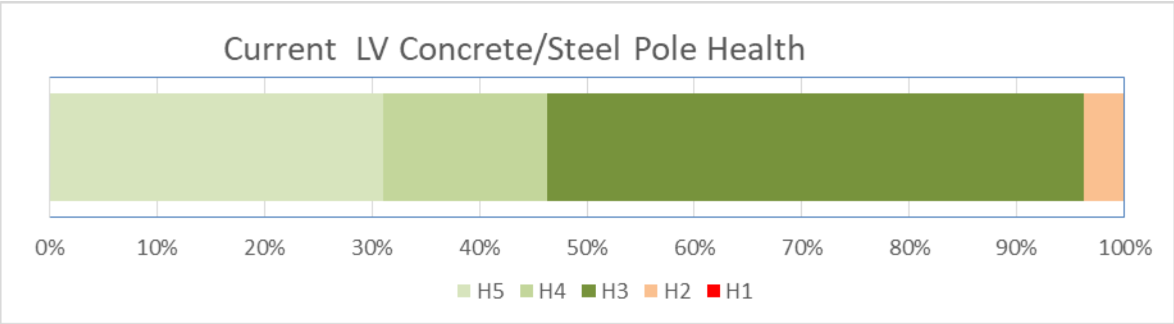
In some urban areas of the network metal clad pillars serve as combined meter boxes and LV pillars typically located on the front property boundary. These boxes were installed in the 1960's as a substitute to the traditional meter box. Many of these (approx. 300) boxes have become deteriorated with age or have been otherwise damaged and are in a potentially unsafe state. The current ownership of these boxes is not clear cut and as such a scheme is in place where the cost of replacement of the box is shared between Eastland Network Limited, the customer's energy retailer and the property owner. As these boxes are replaced the metering equipment is being separated from the LV assets.

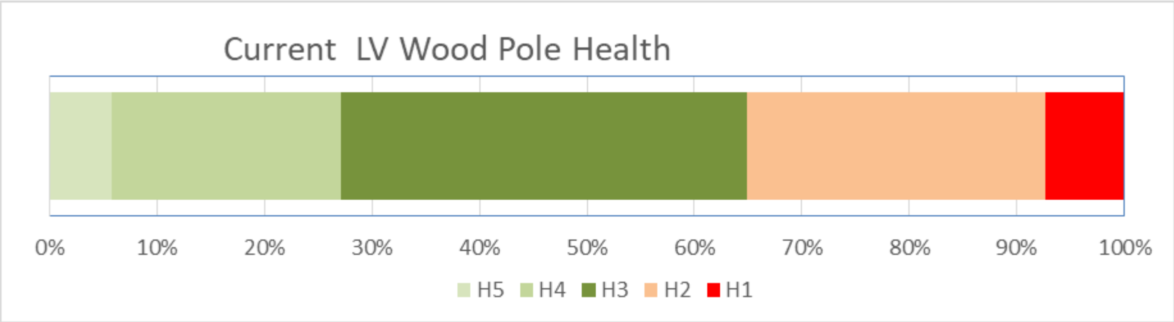
In some cases expenditure is warranted to allow other work on network assets to proceed. This is allowed for within the funding provided for the other assets.

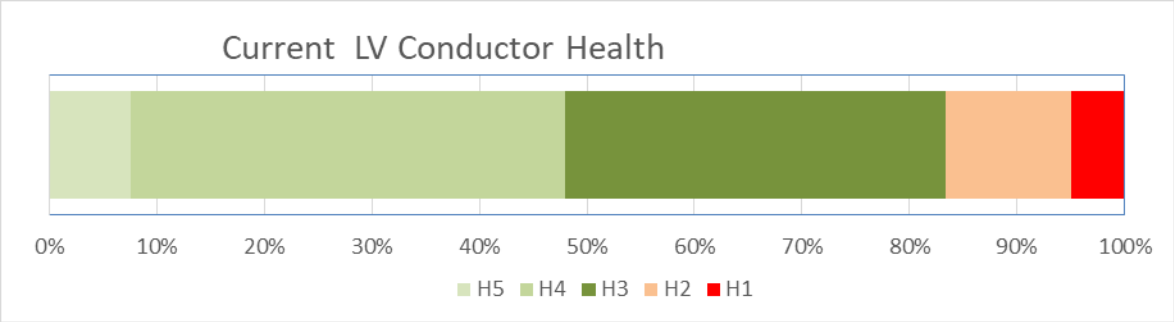
**Criticality**

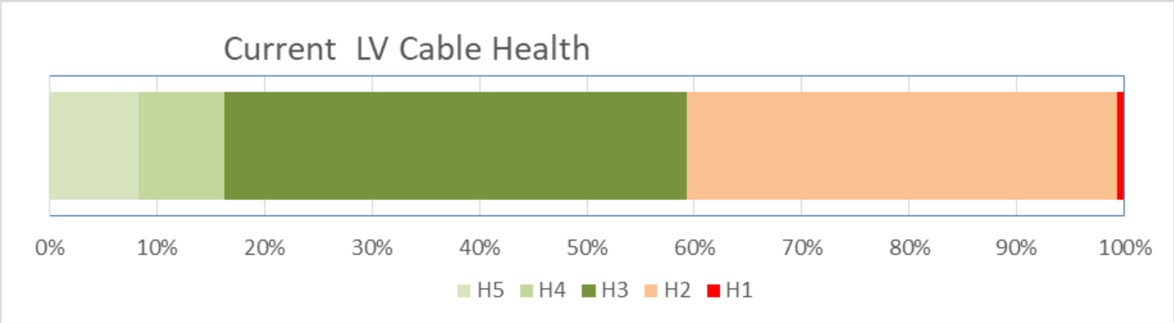
Reflecting the focus on public safety the LV assets criticality across the asset class is allocated at feeder level based on customer density. The assets associated with urban domestic feeders and the CBD have been allocated the highest criticality rating (C3), Assets associated with urban commercial areas to C2 and low density rural assets to the lowest criticality rating. (C1)

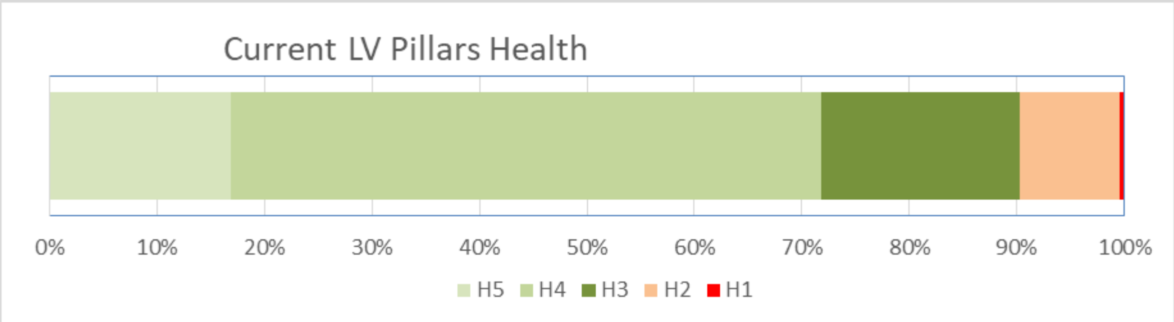
## Current Health Assessments






### 5.2.4.5 Asset renewal Lifecycle Assessment

| Lifecycle Assessment (Overhead) | Poles | Lines | OH Fuses |
|---|---|---|---|
| ODV Standard Life (Wood/Concrete) | 45/60 | 60 | |
| Assessed Standard Life | 60/80 | 90 | 45 |
| Population Size (Wood/Concrete) | 3888/2262 | 497km | 29740 |
| Average Age | 33/15 | 49 | 38 |
| Steady state renewal rate p.a. (based on ODV life) | 86/38 | 8km | 661 |
| Steady state renewal rate p.a. Assessed Life | 6/28 | 5km | 400 |
| Premature failures /Opportunistic renewal | 30 | 0.2km | 661 |
| Start of failure period | 45years | 65years | 45 |
| Failure period duration | 25 years | 20years | 10 |
| Targeted renewal rate | 100 | 0km | 500 |
| Targeted rate of Reduction | 20 | 1km | - |
| Rate of Growth Additions/Upgrades | 0 | 1km | - |
| Steady state less renewal /upgrade gap | 0 | 7km | |

Where appropriate underground conversion is undertaken at a rate of 1km per year. Considerations applied when selecting which streets to underground are;

The delivery of maximum safety, amenity value and aesthetic improvement, i.e. undergrounding of main arterial urban streets on the fringes of CBDs and/or adjacent to schools and public parks.

Currently the incidence of conductor fatigue failure is rare when compared with failure due to interference from birds and trees and human elements. Fatigue failures nearly always occur at connections or insulators. These failures do not warrant replacement of entire sections of conductor as the in span portion of the conductor is in good condition.

The 7km p.a. gap between the 10 year renewal rate plus premature renewal and the targeted renewal rate plus the replacement due to upgrade work, is due to the conductor lasting beyond standard life expectations.

| Lifecycle Assessment (Underground) | Pillars | Cables | LV Switches |
|---|---|---|---|
| ODV Standard Life | 45 | 45 | 45 |
| Assessed Standard Life | 45 | 60 | 45 |
| Population Size | 6244 | 265 | 3487 |
| Average Age | 26 | 29 | 17 |
| Steady state renewal rate p.a. | 138 | 6 | 17 |
| Premature failures /Opportunistic renewal | 30 | 1.0km | 17 |
| Start of failure period | 45years | 45years | 20 |
| Failure period duration | 10 years | 20 years | 25 |
| Targeted renewal rate | 120 | 1.0km | 18 |
| Rate of Growth Additions/Upgrades | 100 | 3.0km | 10 |
| Steady state less renewal /upgrade gap | 0 | 0km | 52 |

#### 5.2.4.6 Expenditure Forecasts

| | Quantity @ Unit Cost | Total |
|---|---|---|
| Planned Maintenance Actions | | |
| Patrols and minor maintenance | 50km | $10,000 |
| Pole Inspection/Testing | 300 | $15,000 |
| General Maintenance cable | | $10,000 |
| Tree control Program | | Refer 11kV |
| Pillars Inspections/servicing | 500 @ $30 | $15,000 |
| Inspections/servicing Shared Boxes | 150 @ $33 | $5,000 |
| OH Fusebase and Carrier Replacement | 250 @ $203 | $50,000 |
| | | |
| | | |
| Unplanned Maintenance Actions | | |
| Trees forced cutting | | Refer 11kV |
| Defect / Fault repairs LV | | $ 50,765 |
| Fault response | 100 | $ 25,383 |
| Defect /Fault repairs Pillars | | $ 10,000 |
| | | |
| Capex Actions | | |
| Pole Renewal | 100pa @ $3.3k | $330,000 |
| Chours pole component replacement (3 yrs) | (2018 – 2021) | $110,000 |
| Line renewal with underground | 1km pa | $167,525 |

| | | |
|---|---|---|
| Line renewal /undergrounding, Wairoa (2018-20) | | $110,000 |
| Cable replacement, (fault, rationalization) | 1km pa | $89,346 |
| LV switches Renewal | 6 link boxes pa | $44,673 |
| Service Discon Boxes to replace shared meter box | 100 pa | $341,000 |
| Service pillar renewal | 20 pa | $22,337 |
| Contribution for growth LV | urban/commercial | $44,673 |
| Growth Link Boxes | 6 new | $44,673 |
| Growth cables | As required | $89,346 |

#### 5.2.4.7 Design

Standards used include the following:

- NZS 3115:1980 for concrete poles.
- AS 2209 for wooden poles.

Standard Pole types used on the network are:

- Concrete Pole 9.5m Busck
- Concrete Pole 9.2m Firth
- Concrete Pole 10.01m Firth
- Concrete Pole 10.67m Firth
- Softwood Pole 9.0m

Various specific standards are used for line hardware and fittings.
Standard LV cable types used are:

- Cable Aluminum "Huhu"
- Cable Aluminium "Beetle
- Cable Aluminium "Kutu"
- Cable Neutral Screen 1/16mm Plus Pilot Copper Underground
- Cable Neutral Screen 3/16mm Copper Underground
- Cable PVC 6mm Copper Underground

Construction of new or replacement asset will adhere to the following standards:

- -No reinstatement of pilot
- -No reinstatement of O/H street lighting
- -Wasp PVC covered conductor for overhead
- -Beetle (106mm2) domestic cabled LV reticulation
- -Huhu (185mm2) commercial cabled LV reticulation
- -25mm2 NS Cu. For road crossings
- -No under-building on 50kV poles
- -Cables to be run for first span from distribution sub.
- -No more than 1 termination per pole.
- -Designs to consider elimination of road crossings, overhead crossovers, mid span jumpers and substation by-pass via overhead circuit.
- -LV conductors are fused to full duty capacity, i.e. no short duration duty cycle peaks are permitted. This prevents accidental overload as no monitoring is undertaken and there is little control over the load connected in customers' installation. No de-rating is made for damage, aging or trenching conditions. This sets the upper limits on conductor capacity at its rating.
- -The low level of protection and management of load is traded off against longevity of service.
- -Overhead conductor is installed with an excess contingency capacity of 20% while cables have a contingency capacity of 33%. This contingency erodes with load growth until load equals rated capacity.

New LV panel installations are constructed using DIN style equipment which is mounted independently from the transformer. Incomer links are fitted to provide the ability to isolate between the transformer and the LV bus bars. This facilitates easy removal and replacement of failed transformers or connection of mobile generators.

LV tie switches are not normally installed on overhead networks interconnections are made using portable jumper sticks in fault conditions. In underground domestic reticulation bolted tie connections are made available at the open points of the LV runs.

### 5.2.5 Load Control

#### 5.2.5.1 Overview and strategy

The configuration of Load Control is described in section 2.2.9

From an asset strategy perspective, the objectives for the Low Voltage assets are to:

- Replace defective relays promptly when they are identified.
- Maintain operational functionality of the system at lowest cost.
- Consider and address options to replace the system with alternatives provided by new technologies. E.g. battery storage.
- Address options for streetlight control and Injection plant redundancy

The load control system was initially designed to reduce domestic hot water cylinder load or demand at peak times. This avoided potential overloading on the network at the Transmission Subtransmission Distribution and LV Networks. The load control system is often thought to reduce energy used however the energy used to heat the water is shifted to a different time and no energy saving occurs unless the water becomes cold. Over time the benefits of the systems have declined due to:

- A shift to gas hot-water systems using bottle or network gas supplies.
- Use of instant hot water systems to heat water as needed reducing losses associated with hot water stored in cylinders. Note gas systems are more common than electric systems of this type.
- The reduction over time of cylinder temperatures for household safety and cylinder loss reduction.
- Increased usage of wetback systems on wood burners or solar hot-water systems reducing the need for electric systems.
- Changes to appliances e.g. washing machines and dishwashers heat their own water and cold wash strategies have become more common.
- Shifting of hot-water load to uncontrolled load meters when solar systems are installed and the use of smart systems to use the solar energy to charge hot-water cylinders.

In addition the following changes have also influenced the benefits:

- The designs of LV networks have changed to the extent that load control is not needed and in fact is more likely to cause issues when blocks of hot-water load are restored on LV circuits.
- Separation of Distribution lines businesses from Energy retail created a change in balance between strategies to reduce demand and strategies to coordinate shedding with generation dispatch and energy price, resulting in less effective use of the system.
- Levels of service to ensure Customers always have hot-water have changed. In the past warm water was tolerated to some degree compared with the desire to have the hot-water when the customer needs it not later on.
- Security of supply improvements have improved the ability of Subtransmission and Distribution Networks to cope with peak loads without the need to load control.
- Introduction of embedded generation for security of supply can also be used to avoid transmission peak charges providing the peak demand at a lower cost.

The introduction of time of use metering at a domestic level linked to smart appliances will allow the customer to manage the demand profile to suit their needs with the time of use price influencing the reduction of peak demand.

Smart meters with modern communications e.g. wireless cellular, for remote reading can switch controllable load without the need for additional relays and injection plant facilities.

In future the use of battery or EV storage and time of use pricing will provide the mechanism to reduce demand creating a potentially flat demand profile across network assets optimising asset utilisation across all voltage levels.

Currently the use of the injection plant to switch streetlights on and off is being reviewed. Installation of smart meters to streetlight circuits and/or daylight sensors will allow lights to be switched on as needed and managed

remotely using modern communications networks providing a potential cost reduction compared with average charging and bulk switching.
In the medium to long term when the new technology is in place the traditional ripple control system will be redundant.

#### 5.2.5.2 Maintenance

The Load control injection plant and coupling cells are tested and inspected each year prior to the main winter load period. Controllable load is updated prior to the main winter load period. Any defects found are repaired immediately
Injection equipment is maintained within the Manufacturers specifications for the operating frequency and voltage levels.
No maintenance or inspections are carried out on Relays. They are replaced when units fail off. Units that have failed in the on state are difficult to identify at an individual level however in large groups trends can sometimes be detected in the load shed data set.

#### 5.2.5.3 Age

Approximate numbers of remote load control devices are:

| Description | Number |
|---|---|
| Ripple relays installed in Gisborne between 1990 and 2009. | 10,875 |
| Pilot-wire controlled loads in Gisborne. | 2,755 |
| Trust Power-owned installations in Wairoa. | Approx. 2,000 |

#### 5.2.5.4 Asset Health

**Condition**

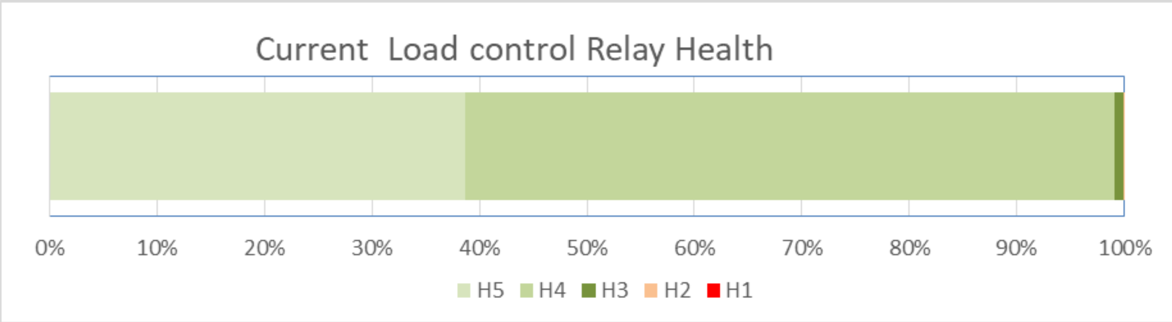
The Wairoa system operates at 1250 Hz, which is subject to high signal attenuation which potentially results in unreliable control. As a result of having high sensitivity receivers installed and issues relating to cost responsibility for Retailer owned receiver upgrading, the effectiveness of the load control system in rural areas has diminished to the point that it is no longer viable to renew the ageing injection plant.
The Gisborne frequency injection plant operates at 317HZ and signal attenuation issues at this frequency have proven to be less common.
As the age of the Injection plants increases the likelihood of breakdown has increased. The Gisborne injection plant is nearing maximum capacity. To overcome the capacity issue will require the installation of a new Injection transmitter facility.
Urban control in Wairoa is via a pilot wire system the condition of which is aligned with the LV assets in the area.
No inspection activities are undertaken on the receivers located typically on consumer installation switchboards.
Analysis of population samples and a low failure rate indicate good condition.
The age profile of Eastland Network Limited's relays averages 15 years due to the recent replacement of the pilot wire contactors with ripple relays in the Gisborne city. Renewal programs for ripple relays are reactive in nature and are triggered by failure of the units to operate.
Limited data on condition is available for accurate assessments to be made for the relays

**Criticality**

With only a single injection plant at Gisborne and the need to switch streetlights in the Gisborne region an index of C3 is assigned to this facility. The Wairoa Injection plant is only used to operate relays in the rural area. The streetlights are not switched using the injection plant. Load control in the Wairoa urban area is via a pilot cable system managed with the LV assets. A criticality index of C1 is assigned to the Wairoa injection plant.

**Current Health Assessment**

For both injection plants the current health assessment indicates an increasingly high risk of failure and renewal or replacement with alternative options is recommended.




#### 5.2.5.5 Asset renewal Lifecycle Assessment

| | Health Index |
|---|---|
| Gisborne Injection Plant | H2 |
| Wairoa Injection Plant | H2 |
| Gisborne Relay Population (average) | H4 |

Investigation is continuing into the timing and cost of renewal or addition of a contingency plant in Gisborne.

#### 5.2.5.6 Expenditure Forecasts

| | Quantity | Total |
|---|---|---|
| Planned maintenance Actions | | |
| Injection plant testing | 2 | $8,122 |
| | | |
| Unplanned Maintenance Actions | | |
| Defect repairs | | $5,077 |
| Fault response (Pilot circuits) | 20 | $5,077 |
| | | |
| Capex Actions | | |
| Ripple relay renewal | | $11,168 |
| relays for new service connections | | $11,168 |

#### 5.2.5.7 Design

Design and requirements for injection plants are outsourced specialised activities.

### 5.2.6 Consumer connection assets

#### 5.2.6.1 Overview and strategy

The configuration of electricity consumer connection assets is described in section 2.2.8

From an asset strategy perspective, the objectives for the customer connection assets are to:

- Ensure activities of a customer connection do not adversely affect others.
- Ensure customer installations are electrically safe prior to connection and reconnection.

#### 5.2.6.2 Maintenance

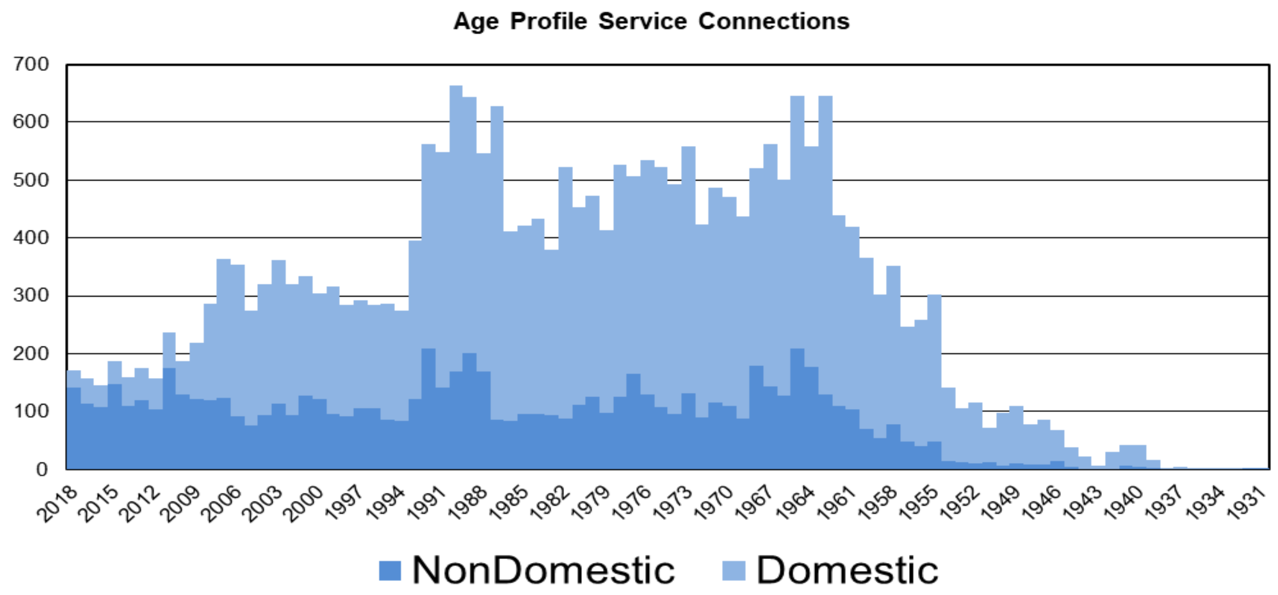
Service connections are inspected visually in conjunction with LV line inspections or pillar inspections for underground services. Only where the inspection identifies problems is information collected and passed via liaison directly with service connection owner. The repairs of the defects are the responsibility of the service connection owner within six months. In cases of high safety risk and no action by the service connection owner the service connection may be disconnected.

Inspection of private HV service connections every 5 years is the responsibility of the private owner. However, problems identified during visual patrols covered in the 11kV lines section are notified to the private owner for correction within 6 months.

Compliance with Voltage levels is monitored via voltage checks. This includes the investigation of customer reported quality of supply issues. Costs associated with the rectification of customer supply issues are allocated against the assets involved.

### 5.2.6.3 Age

The age of consumer connections is as follows:




### 5.2.6.4 Asset Health

**Condition**

Typical failure modes unrelated to asset health include-

- Fuse failure due to faults or overload from customer installations.

Failure indicators linked to asset health include-

- Corrosion of connections to fuse bases.
- Burning of connections due to thermal cycling or corrosion
- Environmental deterioration of plastic bases.

Failure of service fuses and connectors are the main faults. No preventive replacement programs are undertaken due to difficulty in predicting aging as this is dependent on loading conditions.

On overhead connections approximately 25% of fuse bases require replacement when the service fuse needs replacing. This is caused by burning terminals of loose connections or corrosion. The problems are related to quality of the products customer load e.g. thermal cycling and in some cases installation.

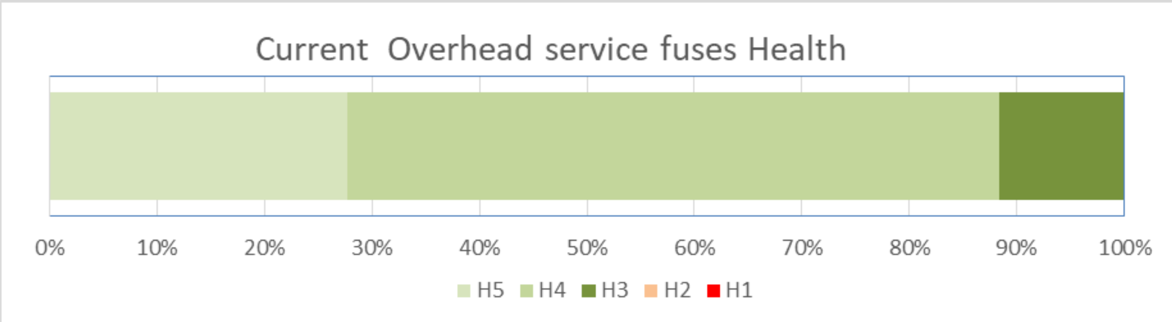
**Performance**

Voltage drop in the customers' service main is the main reason for poor performance. This is not actively managed as it generally only affects the service of the consumer responsible for it. The higher losses however do reflect into the costs of the network and are ultimately shared by all customers.
Poor power factor also affects service connection performance driving the need to invest unnecessarily in distribution and transmission capacity. Offending installations are notified to owners and failure to correct issues generally result in penalty charges by way of increased kVA assessments.
Harmonic generation is handled via penalty charging where it only affects Eastland Network Limited equipment. If it affects other consumers then disconnection and compensation to those consumers is enforced.
Issues with Customer metering equipment in shared LV boxes are addressed in section 5.2.4.4 above.

**Criticality**

Service failures are treated as non-critical because they affect only one connection.

### Current Health Assessment




#### 5.2.6.5 Asset renewal Lifecycle Assessment

Renewal of service fuses is undertaken in conjunction with pole replacement and pillar replacement

#### 5.2.6.6 Expenditure Forecasts

| | | |
|---|---|---|
| Planned Maintenance Actions | | |
| Patrols/inspection | 500 @ $10 pa | $ 5,077 |
| | | |
| Unplanned Maintenance Actions | | |
| Voltage Checks/Complaints | 100 pa | $20,306 |

#### 5.2.6.7 Design

Domestic installations have traditionally been supplied via 4 wire (2 phases, pilot, and neutral) service lines. This was a means of keeping conductor size small by meeting capacity requirement via more conductors.
Single phase connections, without pilot, are the preferred standard. This reduces the quantity of connection hardware by 66% and reduces the probability of equipment failure. This will be encouraged at the time of upgrades via a differential in fixed charges for multi-phase versus single phase connections.
All new connections and upgrades will encourage under grounding by providing the point of connection in a boundary located service fuse box, i.e. installation of pole fuses will be discontinued. This cleans down the structures of hardware, aids accessibility, and prepares the way for under grounding the main line.
Pole fuses will still be permitted in rural areas however preferred connection will be via cable only to eliminate pole loading issues.
For customers not wishing to underground a UDOS pole located on their property is an alternative.
During renewal programs no pilot wire is reinstated. The installation is converted to ripple control.

### 5.2.7 Major Substations

#### 5.2.7.1 Overview and strategy

The configuration of Transmission and Subtransmission is described in section 2.2.3
Life cycle activities associated with key assets within the substations are considered separately within the following asset subsections of this section.
From an asset strategy perspective, the objectives for the Major substation assets are to:

- Standardise design equipment and .configurations to provide operational functionality at the lowest cost
- 

#### 5.2.7.2 Maintenance

Each Substation is inspected every four months and includes inspection and minor maintenance activities associated with:

Transformers
Circuit breakers
Switchgear including connections or terminations
Protection and control equipment
Scada and communications systems
Structures, insulators and bus work
Overhead line connections
Voltage regulators
Zone substation LV switchboards
DC switchboards and battery systems
Earthing systems
Buildings
Fences
Oil containment
Pest control measures
Drainage
Emergency and contingency systems
Signage and Safety Systems

Safety equipment inspection and testing at each zone substation is undertaken annually.

Also an independent Occupational Health and Safety inspection of each zone substation is made annually.to assess: environmental factors and safety factors and verifies other maintenance activities have been carried out. Items covered include:

- drainage, roof and spouting condition
- Aesthetic issues e.g. exterior paint and finishing.
- Walkways, marking, safety or warning railing and surface conditions.
- Toilets and amenity facilities.
- Adequacy of heating cooling and lighting
- Noise issues.
- Security Issues

Thermo-vision and ultrasound scans are carried out three yearly at zone substations. The earthing system resistance at each zone substation is tested every five years. All urgent defects are repaired on discovery, major non urgent defects are repaired within four months, and other minor defects will be included in the normal maintenance program.

Time based maintenance schedules are maintained for equipment at each zone substation. These schedules are modified following evaluation of inspection and condition assessment results. The typical frequencies range from 2 to 5 years. The lower 2 yearly frequencies are largely due to older equipment. Required equipment maintenance based on usage recordings, inspection and condition monitoring is then carried out. The summary below shows the average annual costs for routine adjustment, testing, calibration and preventative maintenance of the zone substation and rural voltage regulator equipment.

**5.2.7.3 Age**

The substations consist of a range of equipment that is grouped by type of asset to establish trends indicated by a larger population. Assets of this nature are considered in the following sections
.Transformers 5.2.8
Circuit Breakers 5.2.9
Pole mounted Isolation Equipment 5.2.11
Control and Protection 5.2.14
Communications 5.2.15
Scada 5.2.16
The condition of other substation Assets is identified below.

### 5.2.7.4 Asset Health

#### Condition

Outdoor Yard Earth mats and Surfaces
Earth testing and inspection work indicates Earth potential rise and step-touch hazards are being managed within limits at all sites.

Oil Separation Facilities
Monitoring in real time and inspections indicate all facilities are in good condition.

Fencing and Security
The security systems and fencing are fully functional. Improvements are carried out as identified.
Some aging fences are being monitored however renewal is not justified yet.

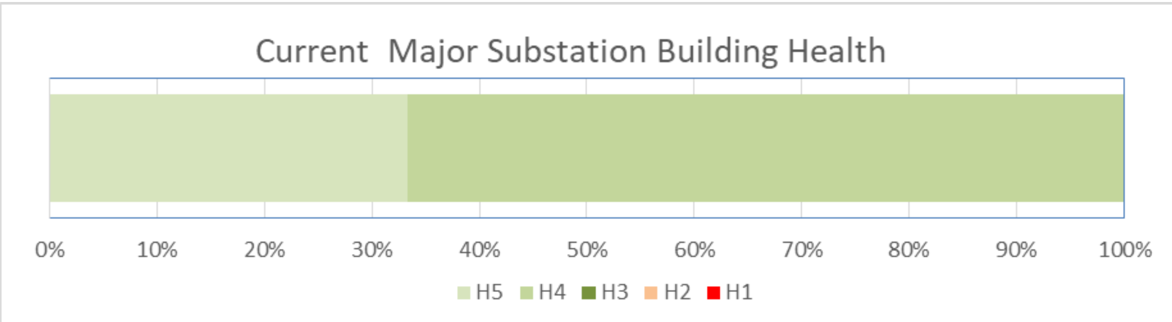
Buildings
Inspection indicate good average condition at all sites that is not expected to change provided the repairs and maintenance work is continued at current levels. Building electrical systems are included in the protection and control section of this plan.

Structures
Structures with poorer relative condition have been scheduled for replacement at Pehiri. Inspection indicates the structures are in good condition.

#### Criticality
While the auxiliary components such as Buildings and fences do not directly impact the electrical supply to customers an overall criticality index of C3 the highest level is given to all the sites reflecting the importance of security and safety aspects associated with the sites

#### Current Health Assessment

The current health assessment considers the overall Building condition and excludes key assets covered separately.




### 5.2.7.5 Asset renewal Lifecycle Assessment
Renewal of fences, failing drainage, building renovations (e.g. roofing) and other significant land and building related items as identified from condition inspections are;

- Carnarvon Substation Additional steel support bracing to reduce earthquake failure risk.
- Kaiti Substation improve perimeter fencing to address vandalism issues.
- Pehiri Substation Replace grass with all-weather stable surface for vehicles
- .TeAraroa Substation re-roof and cladding replacement
- Puha substation re-roof 2022
- Matawai Voltage Regulator control Building replacement

- Wairoa Substation Load Control Building re-clad

#### 5.2.7.6 Expenditure Forecasts

a. Transmission Substations, (includes transformers, switchgear, protection/control equipment)

| | |
|---|---|
| Gisborne | $170,000 |
| Wairoa | $100,000 |
| Tuai | $57,807 |
| Tokomaru Bay | $30,000 |

b. Other Major Substations

| | |
|---|---|
| Voltage Regulators | $3,000 |
| Te Araroa Sub | $5,000 |
| Ruatoria | $5,000 |
| Tokomaru Bay | $3,000 |
| Tolaga Bay | $4,000 |
| Kaiti | $4,000 |
| Carnarvon Street | $4,000 |
| Port | $2,000 |
| Valley Rd | $500 |
| Parkinson Street | $3,000 |
| Matawhero | $3,000 |
| Makaraka | $3,000 |
| Patutahi | $4,000 |
| Puha | $3,000 |
| Ngatapa | $4,000 |
| Pehiri | $4,055 |
| Hexton | $1,250 |
| Goodwin Rd | $1,000 |
| Wairoa load Control | $2,200 |
| Kiwi Substation | 4,000 |
| Blacks Pad | $1,000 |
| Tahaenui | $1,000 |
| TOTAL | $65,000 |

| Planned Maintenance Actions | Unit | Total |
|---|---|---|
| Protection Testing | 3 subs p.a. | $35,000 |
| Building maintenance (paint,doors, spouting) | | $10,000 |
| 3 Monthly Inspections | 25 sites 3 Visits | $25,383 |
| Grounds Maintenance | 20 sites 12 visits @ $290 | $70,000 |
| H&S inspection | 20 sites @ $250 | $5,000 |
| Thermal or ultrasound inspections | 10 @ $2,000 | 20,000 |
| Average Routine Maintenance | As above | $65,000 |
| | | |
| Unplanned Maintenance Actions | | |
| Transmission Substations Defect / Fault repairs | | $50,203 |
| Other Major Substations Defect / Fault repairs | | $25,383 |
| Other Major Substations Fault response | | $4,061 |
| | | |
| Capex | | |
| Land and Building security Refurbishment allowance | | $11,168 |
| Replace roof Te Araroa zone sub | 2019/20 | $65,000 |

### 5.5.1.7 Design

Environmental standards for noise control and oil contamination levels are maintained within council specifications.

Zone substations are designed within the requirements of Health and Safety, Electricity, Environmental and Building acts, regulations and codes of practice.

Earthing at Zone substations is carried out in accordance with the codes of practice. In general 70mm2 CU conductor is used with cad-weld connections and copper-clad rods driven at each conductor intersection. The design of the grid is specific to each site and varies depending on soil re-sensitivity factors.

The requirement for containment is determined by the quantity of oil that could spill in the event of a single rupture. For equipment with low oil quantities less than 200 liters oil spill kits and spill procedures provide for containment and clean-up to minimise environmental damage. Equipment that falls into the low oil quantity category includes switchgear and distribution transformers. For high oil quantities the work comprises, installation of concrete oil containment areas and the installation of oil separators to separate oil from the storm water under normal operating conditions. The requirement for oil containment at a site is dependent on the quantity of oil that could be spilt in any single event.

New building standards include raised buildings (approx 1 metre) to reduce risk from flooding and allow cable access from underneath.

Alterations carried out on the buildings, as maintenance is required include the removal of windows in buildings where indoor 11kV switchgear is used and replacement of wooden doors and window frames with low maintenance aluminum fittings.

The layout of substation yards has been designed to allow crane access for installation and removal of the large transformer without interference from the overhead 11kV and 50kV lines

Oil spill kits and handling procedures are located at all zone substations to cope with oil spills from circuit breakers with lower oil quantities.

### 5.2.8 Major Substation Transformers

### 5.2.8.1 Overview and strategy

The configuration of Transmission and Subtransmission is described in section 2.2.3

From an asset strategy perspective, the objectives for the transformers are to:

- Mitigate the risk of unassisted failure by implementing renewal programs aimed to renew assets before failure in service
- Standard designs and layout of transformers to provide flexibility with swapping units.
-

### 5.2.8.2 Maintenance

While standards concentrate on maintaining oil condition it is important not to confuse this with transformer condition. These standards must be maintained in order for the transformer to achieve standard life. Exceeding the standards results in permanent damage and shortening of transformer life. DGA analysis provides indication of developing faults and the need for internal maintenance. Trends are monitored to assess expected life/aging.

Activities include:

- Bi-annual DGA analysis
- Bi-annual Furans analysis
- Thermo vision as part of substation maintenance
- Minor painting and cleaning as required
- Tap changer oil flushing
- Tap changer overhaul per manufacturer's recommendations
- Process oil as required
- Major overhaul as required

Note - major overhauls are not undertaken on aged single phase banks. Replacement with a new 3 phase transformer is more economic.

### 5.2.8.3 Age

The age of Major Substation Transformers is tabulated as follows

| Zone Substation Transformers | | | | |
|---|---|---|---|---|
| Location | Type | KVA | Manufacture date | Health Index |
| 01 Te Araroa Sub | 50/11 - 3 Phase | 2500 | 1/01/1998 | H4 |
| 02 Ruatoria Sub | 50/11 - 3 Phase | 5000 | 1/01/2001 | H4 |
| 03 Tokomaru Bay Sub | 50/11 - 3 Phase | 2500 | 8/08/1997 | H3 |
| 04 Tolaga Bay Sub | 50/11 - 1 Phase O/Hauled 1996 | 1667 | 1/01/1965 | H2 |
| 04 Tolaga Bay Sub | 50/11 - 1 Phase O/Hauled 1996 | 1667 | 1/01/1965 | H2 |
| 04 Tolaga Bay Sub | 50/11 - 1 Phase O/Hauled 1996 | 1667 | 1/01/1965 | H2 |
| 04 Tolaga Bay Sub | 50/11 - 1 Phase Spare Unit | 1667 | 1/01/1965 | H2 |
| 05 Kaiti Sub | 50/11 - 3 Phase | 12000 | 1/08/2018 | H5 |
| 06 Carnarvon Sub | 50/11 - 3 Phase | 12000 | 1/08/2018 | H5 |
| 06 Carnarvon Sub | 50/11 - 3 Phase | 12000 | 1/08/2018 | H5 |
| 07 Parkinson Sub | 50/11 - 3 Phase | 12500 | 1/01/1986 | H4 |
| 07 Parkinson Sub | 50/11 - 3 Phase O/Hauled 2004 | 12500 | 1/01/1971 | H4 |
| 08 Makaraka Sub | 50/11 - 3 Phase | 12750 | 1/01/2001 | H4 |
| 09 Patutahi Sub | 50/11 - 1 Phase | 1667 | 1/01/1948 | H2 |
| 09 Patutahi Sub | 50/11 - 1 Phase | 1667 | 1/01/1948 | H2 |
| 09 Patutahi Sub | 50/11 - 1 Phase | 1667 | 1/01/1948 | H2 |
| 09 Patutahi Sub | 50/11 - 1 Phase Spare Unit | 1667 | 1/01/1948 | H2 |
| 09 Patutahi Sub | 50/11 - 1 Phase | 1667 | 1/01/1941 | H2 |
| 09 Patutahi Sub | 50/11 - 1 Phase | 1667 | 1/01/1941 | H2 |
| 09 Patutahi Sub | 50/11 - 1 Phase | 1667 | 1/01/1941 | H2 |
| 09 Patutahi Sub | 50/11 - 1 Phase Spare Unit | 1667 | 1/01/1941 | H2 |
| 10 Pehiri Sub | 50/11 - 3 Phase | 2500 | 8/07/1996 | H3 |
| 11 Ngatapa Sub | 50/11 - 3 Phase | 2500 | 1/01/2007 | H3 |
| 12 Puha Sub | 50/11 - 1 Phase | 1667 | 1/01/1949 | H2 |
| 12 Puha Sub | 50/11 - 1 Phase | 1667 | 1/01/1949 | H2 |
| 12 Puha Sub | 50/11 - 1 Phase | 1667 | 1/01/1949 | H2 |
| 13 Gisborne Sub | 110/50 – 3 Phase | 60000 | 1/1/2006 | H5 |
| 13 Gisborne Sub | 110/50 – 3 Phase | 60000 | 1/1/2006 | H5 |
| 13 Gisborne Sub | 110/50 – 1 Phase Not in Service | 10000 | 1/11954 | H1 |
| 13 Gisborne Sub | 110/50 – 1 Phase Not in Service | 10000 | 1/11954 | H1 |
| 13 Gisborne Sub | 110/50 – 1 Phase Not in Service | 10000 | 1/11954 | H1 |
| 14 Matawhero Sub | 50/11 - 3 Phase | 5000 | 1/01/1997 | H2 |
| 14 Matawhero Sub | 50/11 - 3 Phase | 5000 | 14/08/2000 | H4 |
| 15 Port Sub | 50/11 - 3 Phase | 12750 | 1/01/2001 | H4 |
| 16 JNL Sub | 50/11 - 3 Phase | 12750 | 1/1/2004 | H4 |
| 20 Tuai Sub | 110/11 – 1 Phase | 766 | 1/1/1946 | H1 |
| 20 Tuai Sub | 110/11 – 1 Phase | 766 | 1/1/1946 | H1 |
| 20 Tuai Sub | 110/11 – 1 Phase | 766 | 1/1/1946 | H1 |
| 20 Tuai Sub | 110/11 – 1 Phase Spare | 766 | 1/1/1946 | H1 |
| 20 Tuai Sub | 110/11 – 3 Phase | 5000 | 1/10/2018 | H5 |
| 31 Wairoa Sub | 33/11 - 3 Phase | 12500 | 1/01/2007 | H3 |
| 31 Wairoa Sub | 110/11 – 1 Phase O/Hauled 2007 | 3333 | 1/1/1954 | H3 |

| | | | | |
|---|---|---|---|---|
| 31 Wairoa Sub | 110/11 – 1 Phase O/Hauled 2007 | 3333 | 1/1/1954 | H3 |
| 31 Wairoa Sub | 110/11 – 1 Phase O/Hauled 2007 | 3333 | 1/1/1954 | H3 |
| 31 Wairoa Sub | 110/11 – 1 Phase O/Hauled 2007 | 3333 | 1/1/1954 | H3 |
| 31 Wairoa Sub | 110/11 – 1 Phase O/Hauled 2007 | 3333 | 1/1/1954 | H3 |
| 31 Wairoa Sub | 110/11 – 1 Phase O/Hauled 2007 | 3333 | 1/1/1954 | H3 |
| 32 Kiwi Sub | 50/11 - 3 Phase | 6300 | 1/01/1983 | H4 |
| 33 Blacks Pad Sub | 33/11 - 3 Phase | 1500 | 14/05/2000 | H4 |
| 34 Tahaenui Sub | 33/11 - 3 Phase | 1500 | 14/05/2000 | H4 |
| 35 Waihi Sub | 50/11 - 3 Phase | 6300 | 1/01/1983 | H4 |
| Spare - Mahia | 33/11 - 3 Phase Spare Unit | 2500 | 14/5/2000 | H4 |
| Spare ex Kaiti Sub | 50/11 - 3 Phase O/Hauled 2019 | 12500 | 1/01/1987 | H4 |
| Spare ex Carnarvon Sub | 50/11 - 3 Phase O/Hauled 2019 | 12500 | 1/01/2003 | H4 |
| Spare ex Carnarvon Sub | 50/11 - 3 Phase O/Hauled 2019 | 12750 | 1/01/1995 | H4 |
| | | | | |

### 5.2.8.4 Asset Health

Condition

Failure indicators used to determine asset health include

- Dissolved gas analysis and oil quality results;
- Rust and Corrosion levels of the transformer tank;
- The extent of oil leaks;
- Suitability of the transformer mounting
- Condition and performance of the tap changer;
- Condition of the transformer bushings
- Electrical Insulation test results.

The health index for each transformer has been determined based on the predominant failure indicator typically rust or tap-changer performance and the forecast maintenance cost.

The general expectation for transformer life is 60 years if the load has generally been low and overhaul work has been undertaken at 30 years alternatively 45 year life is expected if no life extension work has been carried out.

Tap changers are the weak link in transformer reliability. Eastland Network Limited carries a spare OLTC unit for its IMP transformers, Regular overhauls and checks are carried out to ensure optimum performance. A range of other spares such as bushings are also held for the transformers.

The Tap-Changer on the older Matawhero T2 has a history of reliability issues and is being considered for replacement.

Known performance issues and past events that have limited transformer life include the following: -

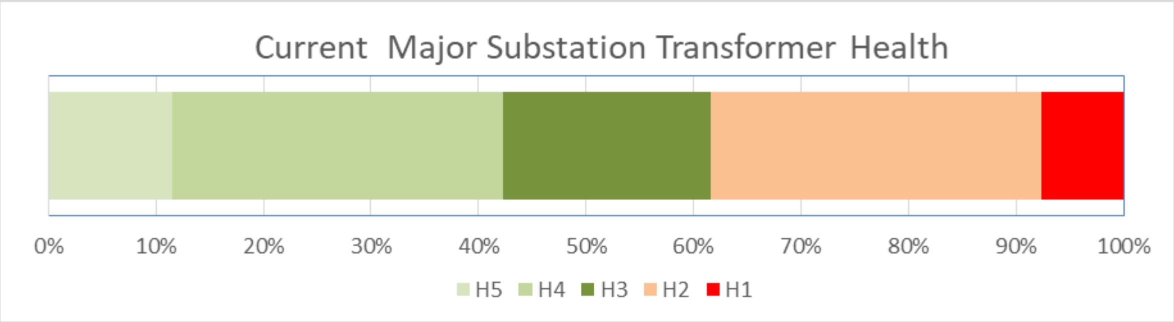
- Tuai-The tap changer is not operational. The Transformers are scheduled for age replacement. One transformer bushing has a low insulation test. The Tuai Substation Transformers are being replaced by the new 3 phase transformer purchased in 2018. Completion is expected in 2019.
- Wairoa-The Transformers are scheduled for age replacement.
- Gisborne-The old 30MVA transformer bank has been removed from service but has been kept onsite as a contingency.
- Puha-The alternative to defer T1 replacement is to construct an 11kV tie line between Ngatapa and Puha, improving the security support to Puha and reducing the area affected in the event of an outage. Currently the generator at Puha is providing the necessary security provision.
- Tolaga-The T1 transformer bank has had a major overhaul in 1996. A number of the radiators have had repairs in 2010 and 2011.

The ex-Carnarvon and ex Kaiti Transformers are currently being refurbished for reuse at Matawhero and Patutahi

Criticality
These transformers are considered critical equipment as the lead-time for replacement or repair can be months and they are generally too expensive to warrant holding spares. For this reason it is important that they are replaced before there is any risk of in-service failure
Renewal has been determined by consideration of each individual Transformer. Factors considered include external and internal condition, History of operation, development plans, losses, and age.
In 2018 4 Transformers were purchased to allow refurbishment and renewal of Transformers

There is a surplus of single phase units currently in service for the single phase transformer banks. Therefore a number of units can be allowed to fail in service before total replacement is required.

### Current Health Assessment




The development program describes the actions for renewal of these assets.

### 5.2.8.5 Asset renewal Lifecycle Assessment

| | Transformers | Voltage regulators |
|---|---|---|
| ODV Standard Life | 45 | 45 |
| Assessed Standard Life | 60 | 60 |
| Population Size | 55 | 9 |
| Average Age | 28 | 37 |
| Steady state renewal rate p.a. | 1 | 0.3 |
| Premature failures /Opportunistic renewal | 0 | 0 |
| 10year replacement rate p.a. | 0.3 | 0 |
| Start of failure period | 60years | 60years |
| Failure period duration | 20 years | 20 years |
| Targeted renewal rate | Discrete Program | Discrete Program |
| Rate of Growth Additions/Upgrades | 0 | 0 |
| Steady state less renewal /upgrade gap | 0 | 0 |

### 5.2.8.6 Expenditure Forecasts

| Planned Maintenance Actions | | Total | Year |
|---|---|---|---|
| Transformer painting | 1 p.a | $20,000 | All |
| DGA tests | 2 p.a | $11,574 | All |

| | | | |
|---|---|---|---|
| Average tap changer overhauls | 2 p.a | $15,230 | All |
| Average oil processing | | $12,184 | All |
| | | | |
| Planned Capex Actions | | | |
| Refurbish T2 Carnarvon | | $110,000 | 2019/20 |
| Replace T1 Patutahi with Refurbished T1 Kaiti | | $385,000 | 2020-2022 |
| Install Refurbished T1 and T2 Carnarvon at Matawhero | | $290,00 | 2019/20 |
| Replace T1 Tolaga with 1x 5/7MVA 3-Phase (ex-Matawhero | | $300,000 | 2020/21 |
| Replace T1 Puha with New 1x 5/7MVA 3-Phase (ex-Matawhero) | | $300,000 | 2021/22 |
| Install 1x 5/7MVA 3-Phase (ex-Matawhero) as spare at Gisborne substation | | $600,000 | 2019-2021 |

#### 5.2.8.7 Design
Based on BS 148, IEC 42 and Transpower standards.
- Oil acidity < 0.1 mgkOH/g
- Oil electrical strength > 40kV
- Moisture content < 30 ppm
- Resistivity 20 deg >=60 G ohms per metre

Dissolved gas limits
- -Hydrogen 50 ppm
- Methane 50 ppm
- Carbon Monoxide 300 ppm
- Carbon Dioxide 3000 ppm
- Ethylene 100 ppm
- Ethane 100 ppm
- Acetylene 15 ppm

### 5.2.9 Circuit Breakers
#### 5.2.9.1 Overview and strategy
The configuration of Circuit Breakers located in both major substations and the Distribution Network is described in section 2.2.3 and 2.2.6

From an asset strategy perspective, the objectives for Circuit Breakers are to:
- Deal promptly with any known defects..
- Implement renewal programs aimed to renew assets before failure in service.
- Carry out detailed assessments and regular maintenance to maximise life and operational reliability.
- Maintain contingency systems and spares to respond to premature failure.

#### 5.2.9.2 Maintenance
Substation circuit breakers are inspected visually during substation inspections.

All circuit breakers are equipped with SCADA remote control systems. The number of trip operations is monitored via SCADA along with spring, gas and coil health as appropriate.

Thermo-vision surveys include all substation circuit breakers. Trip testing is carried out in conjunction with protection testing.

Partial discharge testing is carried out on indoor circuit breakers. The frequency of the testing cycle increases as discharge levels increase over time. This is the main indicator of CB insulation condition and therefore CB life.

For rural pole mounted circuit breakers and remote controlled switches inspection and minor maintenance of is carried out yearly and trip testing for units that have not been operated is carried out at intervals not exceeding 3 years. As the rural automation circuit breakers are downstream of the primary distribution feeder circuit breakers protection testing is only carried out if issues are identified.

Di/dt circuit breaker wear monitoring is implemented where protection equipment has this capability. The information is recorded and assessed as part of the Zone substation inspection work.

Minor and major maintenance assessments are used to determine end of life and replacement triggers.

Work under taken during maintenance activities generally includes:

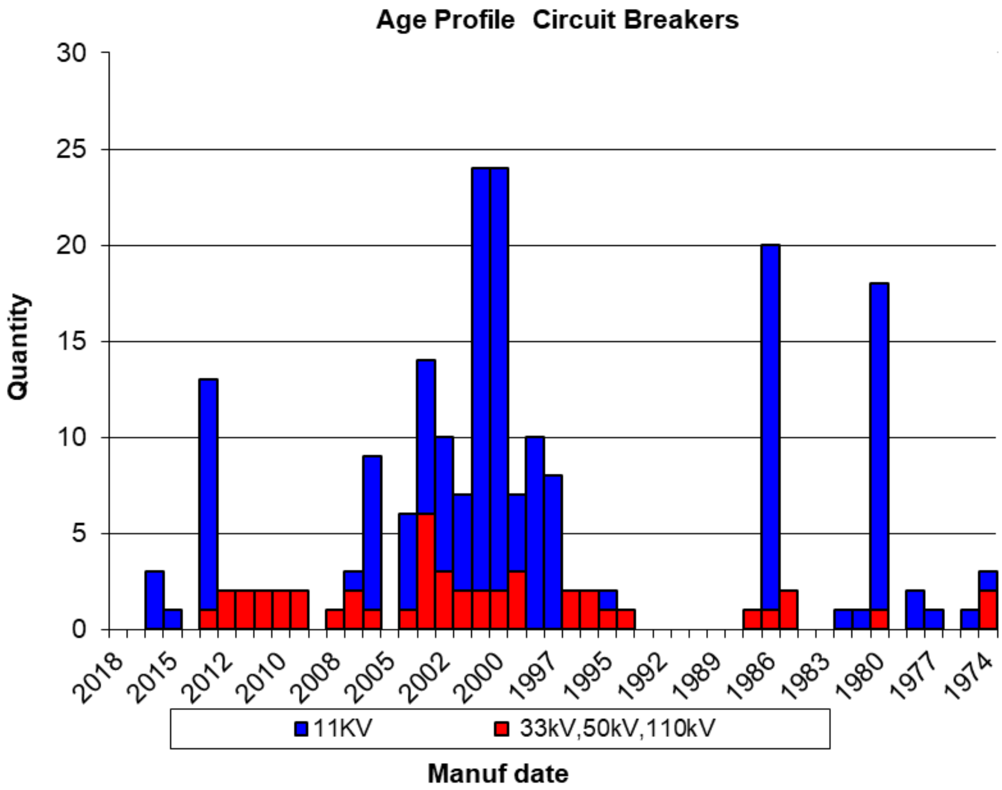
- Oil replacement
- Adjustment of travel and mechanisms
- Mechanism lubrication
- Contact replacement if required
- Cleaning, painting
- Trip testing, timing
- Re-insulation, replacement of damaged or worn components.
- Variation of discharge or thermo vision results from previous results triggers major maintenance of the circuit breakers

Oil circuit breakers servicing.

- 50kV — CB's after 6 fault trips or 8 years
- 11kV — CB's after 15 fault trips or 8 years

**5.2.9.3 Age**

The age of Circuit Breakers is as follows:



The data includes all 110kV 50kV, 11kV, indoor and outdoor equipment located within Major Substations and installed in the wider Network. There is insufficient population of any single type to draw conclusions. The period from 1999 to 2004 reflects rural CB installation and Substation renewal programs.

.

### 5.2.9.4 Asset Health

#### Condition

Typical failure modes for circuit breakers are

- Insulation failure due to oil contamination gas leaks or bushing failure.
- Insulation failure from Rodents
- Vacuum bottle failure from excess heat / fault currents
- Mechanism wear.
- Mechanism stiffness or jamming
- Tank rust
- Corrosion of bushing connections
- Component failure of limit switches, coils, springs and spring charge motors

Condition assessments are as follows:

- The Parkinson and Kaiti Substation Circuit Breakers have reliability issues with both the trip and close circuits. Currently in spite of the regular maintenance being undertaken the reliability is still intermittent. The Circuit Breakers are being considered for early renewal or modification of the trip and close actuator components.
- The outdoor PMR Circuit Breakers at Pehiri Substation are being considered for renewal as 40% of the population of this circuit breaker type has already failed in service. Due to failure of the SF6 insulation. The primary triggers for renewal for the PMR circuit breakers are Gas leaks, and failure of the controls for the units. Sudden failure with no known cause is also common for this CB type
- The Oil type Reyrolle CB trucks at Tokomaru and TeAraroa are scheduled for renewal following identification of worn mechanisms and degrading insulation during routine maintenance.
- The ABB Safeplus integrated CB,s at Ruatoria, Tolaga and Pehiri have begun to show performance issues related to the Mechanism design. While a full set of spare mechanisms has been acquired soon after installation replacement is being considered as the spares are used up.

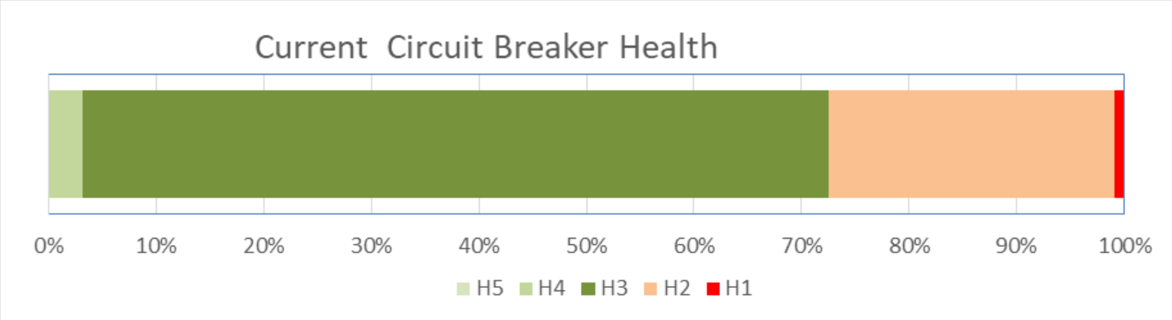
The small quantity of assets in this category allows individual condition ratings to be applied based on the performance and maintenance assessments carried out on the assets

#### Criticality

All 110kV CBs are have the highest criticality index of C3 due to both the impact on customers and long replacement lead times. The primary 50kV feeder CB’s and 11kV CB’s also have a criticality index of C3. 50kV line CB’s can be bypassed and supply restored hence a criticality index of C1 is applied. Rural automation CB’s downstream of the primary feeder CB’s have a Criticality index of C1. 11kV feeder CB’s on spur feeders have an index of C3 along with incomer’s at single transformers substations. The remaining CB’s, typically have a criticality index of C2

The 11kV switchboard reliability is considered more critical than the single CB configurations therefore early replacement is desirable.

#### Current Health Assessment




#### 5.2.9.5 Asset renewal Lifecycle Assessment

| Voltage | 110kV | 50kV | 11kV |
|---|---|---|---|
| ODV Standard Life | 40 | 40 | 40 |
| Assessed Standard Life | 40 | 40 | 35-40 |
| Population Size | 7 | 42 | 176 |
| Average Age | 18 | 18 | 23 |
| Steady state renewal rate p.a. | 0.1 | 0.8 | 4 |
| Premature failures /Opportunistic renewal | 0 | 0 | 1 |
| 10year replacement rate p.a. | 0 | 1 | 2 |
| Start of failure period | 35 | 35 | 25 years |
| Failure period duration | 10 | 10 | 25 years |
| Targeted renewal rate | Discrete Program | Discrete Program | Discrete Program |
| Rate of Growth Additions/Upgrades | 0 | 0 | 1 |
| Steady state less renewal /upgrade gap | 0 | 0 | 0 |

#### 5.2.9.6 Expenditure Forecasts

| Planned Actions | Quantity @ Rate | Cost | Year |
|---|---|---|---|
| Rural Automation annual inspection | 90 @ $152 | $13,707 | All |
| Rural Automation/CB Avg routine maint | 45 @ $406 | $18,000 | All |
| | | | |
| Unplanned Actions | | | |
| Defect /Fault repairs | | $20,000 | All |
| | | | |
| 50 kV Circuit Breaker Capex | | | |
| Carnarvon T1 | | $110k | 2019/20 |
| Makaraka Line to Patutahi | | $55k | 2019/20 |
| Makaraka Inject Plant | | $89k | 2028 |
| 11 kV Circuit Breaker Capex | | | |
| Rural automation CBs | 2 @ 27,500 | $55,000 | Annual |
| Pehiri Sub | | | Under Development |
| Tolaga Sub | 5 @ 30,000 | $150,000 | Under Development |
| Ruatoria Sub | 5 @ 30,000 | $150,000 | Under Development |
| Puha Sub | 5 @ 30,000 | $150,000 | Under Development |
| Parkinson Sub | 9 @ 30,000 | $270,000 | Under Development |
| Kaiti Sub | 9 @ 30,000 | $270,000 | Under Development |
| Tokomaru CB Trucks | 4 @ 12,000 | $48,000 | Under Development |
| TeAraroa CB Trucks | 4 @ 12,000 | $48,000 | Under Development |
| Kiwi Substation | 9 @ 30,000 | $270,000 | Under Development |

#### 5.2.9.7 Design

The standard used for selection of CB's is AS/NZS 2650, Common specifications for HV switchgear.
Indoor 11kV circuit breakers used for all Substations where multiple feeders are necessary.
Bypass and isolation arrangements are installed for 50kV CB's where no alternative supply is available.
Incomer and bus section configurations are used where dual transformer configurations exist.
All circuit breaker/feeder ratings are twice the normal feeder load to allow support of adjacent feeder loads.
50 kV Circuit Breakers

- Bulk oil circuit breakers are located within bunded containment areas.
- Outdoor CB's are used for all 50kV applications.
- New 50kV CB purchases have been standardised for compatibility and reduced long term costs. Standard features include:
- SF6 outdoor
- 66kV rated minimum
- DC 24 volt operation (reduces 110V DC battery costs currently incurred due to older CB designs)

11kV Circuit Breakers

- Min 400A rating and 12kA short time fault rating
- SF6 or Vacuum
- Indoor configurations for multiple feeder substations.

Standards

- Manufacturer's specifications for each type of equipment.
- Insulation levels are maintained within the manufacturer's specifications and are measured during servicing.
- Standards and recommendations for minor and major maintenance frequencies are derived from industry experience.
- Electronic protection with fully configurable curve types and settings including DNP3 or Modbus communications capabilities.
- 24v DC operating mechanisms
- Live line installation standard with bypass features using hot stick techniques
- SCADA control fitted to all remote recloser installations.
- Inclusion of Fault locators into recloser and protection schemes is also planned to optimise the overall network performance

The co-ordination density criteria for CB's, reclosers, sectionalisers, and fuses are as follows:

- Feeder CB per each substation feeder
- Field CB not more than 2 cascaded from Feeder CB
- Sectionaliser not more than 1 cascaded from Field CB
- Fuses Branch fusing on private spur lines

### 5.2.10 Distribution Transformers

#### 5.2.10.1 Overview and strategy

The configuration of Distribution Substations and transformers is described in section 2.2.5

From an asset strategy perspective, the objectives for the transformers are to:

- Standard designs and layout of transformers to provide flexibility with swapping units.
- Achieve overall asset renewal at a steady state that is broadly consistent with depreciation.
- Maintain a high standard of security and safety on all publicly accessible equipment.
- Minimise maintenance costs and focus on a fast replacement response for smaller overhead rural transformers

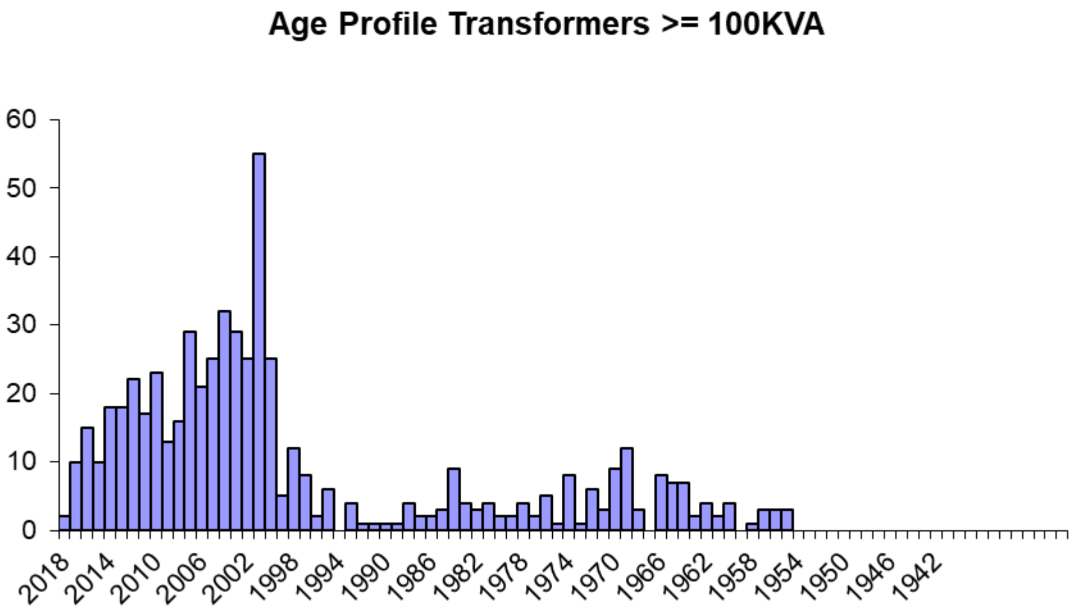
#### 5.2.10.2 Maintenance

Smaller transformers generally in rural locations are visually inspected in conjunction with earth testing programs and line inspections. Transformers are specifically checked to identify units with excessive external deterioration of the tanks or 11kV tails where they are internally connected, for replacement.

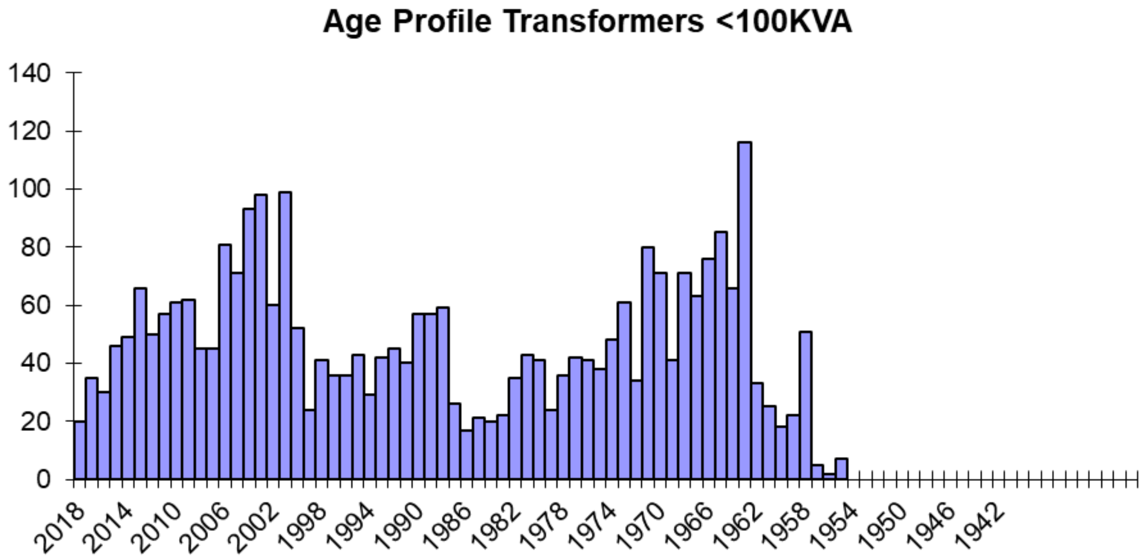
In all cases the units are checked during earth testing/switchgear inspections at intervals not exceeding 5 years.
Ground mount substations undergo an annual visual inspection. Items covered in the inspection include inspection of the LV panels, associated 11kV switchgear, Load readings, high voltage terminations, earthing, warning/danger notices and security equipment, (i.e. door locks and equipment covers).
General maintenance activities carried out in conjunction with inspections include painting on site, vegetation/rubbish clearing, LV panel cleaning and label upgrading.
Transformer loading on ground mount substations is monitored annually via MDI readings.
Other than 5 yearly earth testing and inspections during the course of line patrols no maintenance activities are carried out on smaller in-service transformers.
Transformers returned from the field for service, receive minor refurbishment work where the age of the units is less than 20 years old.
Earth testing is carried out on a 5 year cycle. Earths include distribution substations, switch sites and LV earths.
Earthing system repairs are undertaken on the worst 20% of earth tests. Earth tests between 0 and 50 ohms are considered adequate in terms of the expected seasonal variation in ground moisture content.
Refurbishment is only considered if the transformer condition is such that it has 15 years remaining service life and cost is less than 25% of a new transformer. Economics of refurbishment is limited by the frequency of relatively expensive recovery and installation.

**5.2.10.3 Age**

The age of transformers rated at 100kVA or greater is as follows:




The age of transformers rated at less than 100kVA is as follows:




Transformers have a reasonably fast roll-off in survival spanning a 5-10 year period indicating sudden total failure mechanisms (e.g. tank rusting through, lightning strike, structure collapse or fault overload.) The transformers therefore have high reliability and good overall condition. Due to the rapid decline in condition over a period less than the inspection cycle for smaller units below 50kVA the optimum replacement time for these units is post failure. Opportunistic replacement in conjunction with structure replacement is also carried out where appropriate in terms of the Transformer age/condition.

Large transformers (>=100kVA) have an even installation profile. On average 12 were installed per year from 1960-1985, and 5/yr. after 1985- 2000.
The Compliance program in 2000 eliminated the majority of the older group of pole mounted 250kVA units.
Smaller transformers have been in a replacement cycle since 1988 at an average rate of around 60/yr.
Residual survival is considered negligible as it is only evident in large transformers which reflects the past maintenance attention they have received.

The Age of Voltage Regulators is tabulated as follows:

| Location | Size | Year Installed |
|---|---|---|
| Pehiri | 1500kVA | 1965 |
| Kopuaroa (between Ruatoria and Tokomaru) | 1500kVA | 1964 |
| Tatapouri (between Kaiti and Tolaga) | 1500kVA | 1985 |
| Ngatapa | 1500kVA | 1965 |
| Matawai | 1500kVA | 1964 |
| Waingake | 1500kVA | 1964 |
| Muriwai | 1500kVA | 2002. |
| Waihua (west of Wairoa) | 1500kVA | 1964 |
| Mahia | 1500kVA | 2001 |

.

### 5.2.10.4 Asset Health

#### Condition

Typical failure modes unrelated

- Third party impact damage.
- Land slips
- Flooding damage

Failures in this category are reasonably low and rely on fault response procedures to minimise outage times. Ground mounted assets are more venerable than the overhead assets.

Failure analysis shows that the predominant causes of in service failure are;

- Tank life being reduced by rust which is generally linked to age. Units situated in costal locations is a secondary factor
- A few transformers fail due to overload typically in rural installations where load changes have occurred and have not been notified.
- Lightning Strikes account for the remainder of in service failure, typically on newer transformers
- Ground-mount multi-fin transformers have been identified through inspections, to have rust issues around the fins and have the potential to develop leaks. The units have been identified and incorporated into replacement programs.
- Bushing damage following cable termination failure

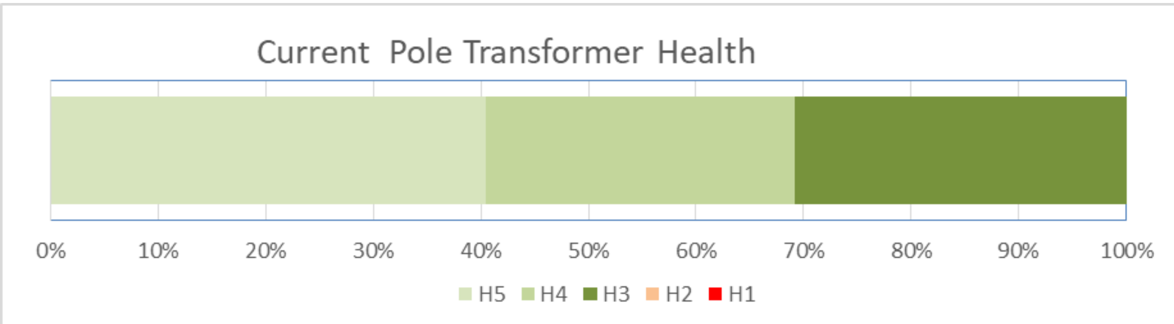
The condition ratings are applied in accordance with 5.3.1 to categorise assets in terms of their expected remaining life where conditional factors were not evident to suggest a different assessment. Assets with more than 23 years remaining life were allocated a good condition score, CI1. Assets with a remaining life between 1 and 23 years were allocated a condition score CI2. Assets with less than 1 years remaining life were allocated a low condition score CI3. The ODV expected life was used to determine remaining life

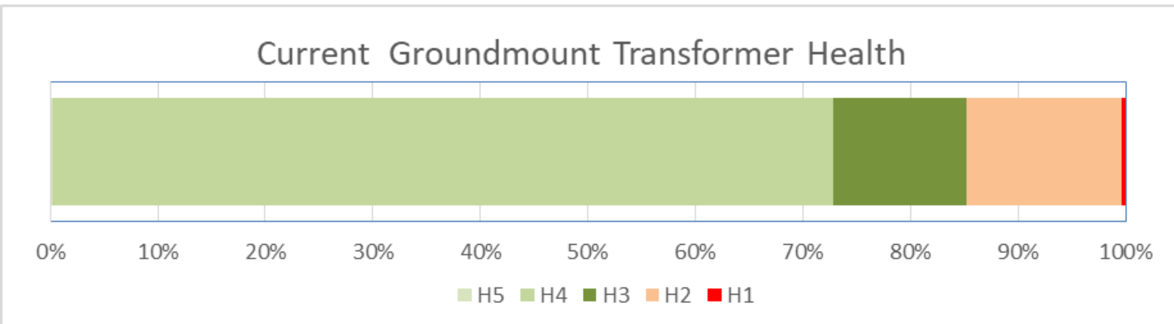
**Criticality**

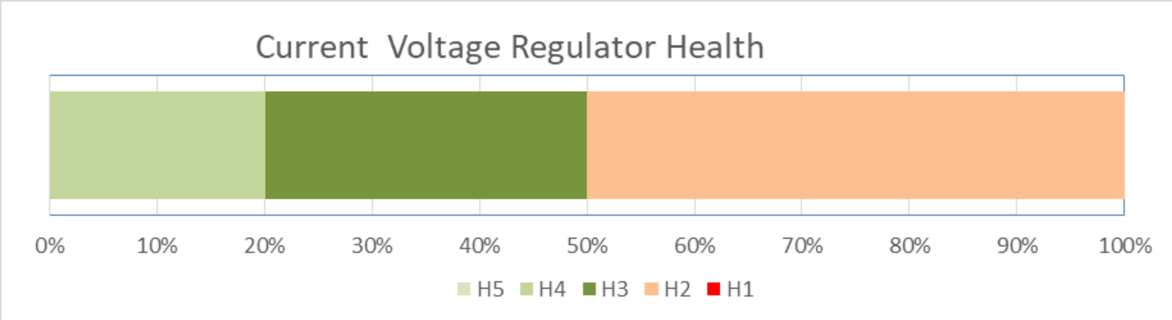
Criticality allocations were made based on the likely impact of a failure on customer numbers. Substations with a rating of up to 100kW are allocated the lowest rating C1, substations rated between 100kVA and 500kVA are allocated a rating of C2, and substations rated above 500kVA are allocated a rating of C3.

In cases where transformers supply schools hospitals and key infrastructure associated with civil defense emergencies the highest criticality C3 is applied regardless of capacity

## Current Health Assessment






### 5.4.10.5 Asset renewal Lifecycle Assessment

| | Small | Large |
|---|---|---|
| ODV Standard Life | 45 years | 45 years |
| Assessed Standard Life | | |
| Population Size | 3041 | 573 |
| Average Age | 30 | 21 |
| Steady state renewal rate p.a. | 68 | 12 |
| Premature failures /Opportunistic renewal | 18 | 4 |
| Start of failure period | 45 years | 45 years |
| Failure period duration | 10 years | 10 years |
| Targeted renewal rate | 50 | Discrete Program |
| Rate of Growth Additions/Upgrades | 20 | 3 |
| Steady state less renewal /upgrade gap | 0 | 0 |

### 5.2.10.6 Expenditure Forecasts

| Planned Maintenance Actions | Quantity @ Unit Cost | Total |
|---|---|---|
| Refurbishment <100kVA | 10 @ $500 | $5,000 |
| Refurbishment >100kVA | 2 @ $4000 | $8,000 |
| Inspection and minor maint | 500 @ $100 | $50,000 |
| Oil Handling /filtering /TX disposal | | $10,000 |
| Earth testing | 800 @ $25 | $60,000 |
| Earthing system repairs | 100 @ $450 | $45,000 |
| | | |
| Unplanned Maintenance Actions | | |
| Defect /Fault repairs | | $15,000 |
| | | |
| Capex Actions | | |
| Transformer Renewal <100kVA | 50 p.a. @ $2,233 | $111,683 |
| Transformer Renewal >100kVA | 7 p.a | 301,544 |
| | | |
| Capex Anticipated growth | | |
| Small Transformers <100kVA | 20 | $87,113 |
| Large Transformers >100kVA | 3 | $167,525 |

While small transformers are only replaced as they fail or on an opportunistic basis, large transformers a programmed based on condition and needs assessments. The program for large transformer replacements and estimated costings is as follows:

| Year | Name | Location | Rating | Total cost | New Type |
|---|---|---|---|---|---|
| 2019/2020 | B430 | Lowe St (Alleyway 89 FM ex masonic) | 500 kVA | $50,000.00 | 500 kVA |
| | W1539 | Corner of Lucknow St and King St, Wairoa | 200 kVA | $35,000.00 | 200 kVA |
| | A286 | Tyndall Road | 300kVA | $35,000.00 | 300kVA |
| | W1525 | Carroll Street, Wairoa | 200kVA | $50,000.00 | 200kVA |
| | W1541 | Mitchell Rd/Churchill Ave | 200kVA | $50,000.00 | 200kVA |
| | A389 | Eastland Port | 500 kVA | $50,000.00 | 500 kVA |
| | | | | **$270,000.00** | |
| 2020/2021 | B375 | Rectory (end of Desmond Road) | 250 kVA | $35,000.00 | 300kVA |
| | B359 | Grey St (Back alley Salvation army) | 300 kVA | $50,000.00 | 300kVA |
| | B361 | Grey St between Childers Rd and Gladstone Rd | 250 kVA | $50,000.00 | 300kVA |
| | W1548 | Rutherford St, Wairoa | 300kVA | $40,000.00 | 300kVA |
| | B440 | 29 Fergusson Drive | 300 kVA | $35,000.00 | 300 kVA |
| | W308 | Western Extension, Tuia | 300 kVA | $40,000.00 | 300 kVA |
| | C637 | Main Road Makaraka - race course by stand | 100 kVA | $25,000.00 | 100 kVA |
| | | | | **$275,000.00** | |
| 2021/2022 | W1570 | Lahore St, Wairoa | 300kVA | $40,000.00 | 300kVA |
| | B358 | Grey St, by Gladstone Rd (T & G) | 100 kVA | $50,000.00 | 100 kVA |
| | F383 | 40 Balfour Rd, Te Karaka | 200kVA | $30,000.00 | 200kVA |
| | W1541 | Mitchell Rd | 200kVA | $70,000.00 | 200kVA |
| | W1562 | Between Marine Parade and Queen Street | 50 kVA | $25,000.00 | 50 kVA |
| | A249 | 89 Kaiti Beach Rd, Yacht Club | 100 kVA | $35,000.00 | 100 kVA |
| | J160 | TUPAROA RD MANUTAHI SCHOOL | 100 kVA | $30,000.00 | 100 kVA |
| | | | | **$280,000.00** | |
| 2022/2023 | W1576 | Colin Street, Wairoa | 200kVA | $35,000.00 | 200kVA |
| | B323 | 235 Awapuni Rd, old Tip Top Factory | 250kVA | $35,000.00 | 300kVA |
| | B6225 | 83 Awapuni Rd | 300 kVA | $35,000.00 | 300 kVA |
| | A289 | 183 Tyndall Road | 250 kVA | $35,000.00 | 300kVA |
| | A323 | Marian Drive | 250 kVA | $35,000.00 | 300 kVA |
| | B936 | Peel St and Lowe St (back alleyway behind Odeon) | 250 kVA | $40,000.00 | 300 kVA |
| | W1534 | 31 River Parade, Wairoa | 200 kVA | $35,000.00 | 200 kVA |
| | B406 | Solander Street | 300 kVA | $35,000.00 | 300 kVA |
| | | | | **$285,000.00** | |
| 2023/2024 | W1559 | Queen Street | 300kVA | $40,000.00 | 300kVA |
| | B947 | 36 Disraeli Street | 100 kVA | $25,000.00 | 100 kVA |
| | B191 | Childers Rd, Rural Bank Sub | 250 kVA | $35,000.00 | 300 kVA |
| | A503 | 233 Harris Street | 250 kVA | $35,000.00 | 300 kVA |
| | A72 | 77 Douglas Street | 250 kVA | $35,000.00 | 200kVA |
| | W1577 | Kabul Street, Wairoa | 200kVA | $40,000.00 | 300kVA |
| | B887 | 15 Albert Streeet | 250 kVA | $35,000.00 | 200kVA |
| | B926 | Atkinson Street | 250 kVA | $35,000.00 | 300kVA |
| | | | | **$280,000.00** | |

| | | | | | |
|---|---|---|---|---|---|
| **2024/2025** | A102 | Makarori Beach | 250 kVA | $35,000.00 | 300 kVA |
| | C670 | Makaraka LayBy | 250 kVA | $35,000.00 | 300 kVA |
| | C559 | Main Road Makaraka | 250 kVA | $35,000.00 | 300 kVA |
| | A532 | 49 Wainui Road | 250 kVA | $35,000.00 | 300 kVA |
| | B257 | Lowe Street inside Building | 500kVA | $50,000.00 | 500kVA |
| | B978 | 5 Innes Street | 250 kVA | $35,000.00 | 300 kVA |
| | W374 | 207 Awamate Road | 300 kVA | $45,000.00 | 300 kVA |
| | | | | **$270,000.00** | |
| **2025/2026** | B892 | Childers Road | 250 kVA | $35,000.00 | 300 kVA |
| | W1568 | Lahore Street | 300kVA | $40,000.00 | 300kVA |
| | C3 | Patemaru Road | 250 kVA | $35,000.00 | 300 kVA |
| | B353 | Childers Road | 250 kVA | $35,000.00 | 300 kVA |
| | D627 | Tuckers Road | 250 kVA | $35,000.00 | 300 kVA |
| | C646 | Jacob Lane | 50kVA | $25,000.00 | 50kVA |
| | B50 | 651 Aberdeen Road | 250 kVA | $35,000.00 | 300 kVA |
| | C404 | TawerA Road | 250 kVA | $45,000.00 | 300 kVA |
| | | | | **$285,000.00** | |
| **2026/2027** | W1557 | 39 Queen St | 500 kVA | $50,000.00 | 500 kVA |
| | C296 | Aerodrome Road | 250kVA | $35,000.00 | 300 kVA |
| | B995 | 679 Gladstone Road | 250 kVA | $35,000.00 | 300 kVA |
| | B936 | Peel St Alley Way | 250 kVA | $35,000.00 | 300 kVA |
| | A399 | BP Kaiti Service Station | 300kVA | $35,000.00 | 300kVA |
| | B738 | 41 Wellington Street | 500kVA | $50,000.00 | 500kVA |
| | B611 | Bright St Post Office | 500kVA | $50,000.00 | 500kVA |
| | | | | **$290,000.00** | |
| **2027/2028** | J486 | 138 Te Araroa SH just north of Ruatoria | 100 kVA | $30,000.00 | 100 kVA |
| | B152 | Disraeli St near Gladstone Rd (sunshine breweries) | 250 kVA | $35,000.00 | 300 kVA |
| | B64 | Roebuck Rd/Anzac St Corner | 250kVA | $35,000.00 | 300kVA |
| | W1569 | 99 Lahore Street | 200kVA | $35,000.00 | 200kVA |
| | B166 | Palmerston Rd Plunket Rm Substation | 500kVA | $55,000.00 | 500kVA |
| | C481 | 119 Papatu Rd | 250kVA | $35,000.00 | 300kVA |
| | B167 | Bright Street Sub | 500kVA | $55,000.00 | 500kVA |
| | | | | **$280,000.00** | |
| **2028/2029** | W384 | Tiniroto Road, Wairoa | 100kVA | $30,000.00 | 100kVA |
| | B368 | Reads Quay Telecom Exchange | 500kVA | $55,000.00 | 500kVA |
| | B947 | Disraeli Street | 100kVA | $30,000.00 | 100kVA |
| | W1036 | ITM Carroll Street | 500kVA | $50,000.00 | 500kVA |
| | B926 | Park Atkinson Street | 250 kVA | $35,000.00 | 300 kVA |
| | W1577 | 56 Kabul Street | 200kVA | $30,000.00 | 200kVA |
| | A39 | 17 Cavendish Crescent | 200kVA | $30,000.00 | 200kVA |
| | A493 | Wheatstone Rd | 50kVA | $20,000.00 | 50kVA |
| | | | | **$280,000.00** | |

#### 5.2.10.7 Design
All transformer installations are designed to allow restoration within 8 hours.

In most cases portable generation is temporarily used to supply load during replacement of larger transformers.

The security standards adopted by Eastland Network Limited do not allow for temporary supply of loads as a result of smaller transformer failure.

Earth resistances step and touch and equal potential bonding standards are in accordance with the electricity act and regulations.

To upgrade earths a maximum of 6 rods (2 banks) are driven before an earth is abandoned as impractical to lower resistance. These situations are reviewed on a case by case basis as the occurrence is rare.

Strength requirements for pole mounted substations are in accordance with the outcomes of the Pole design tool.

Replacement of transformers with ground mount mini sub style units is the standard practice for transformers over 100kVA smaller ground mount transformers are also used for replacements in rural locations where the supply is via underground 11kV cables.

All transformers above 100kVA are ground mounted.

All new urban substations are ground mounted regardless of size.

LV isolation is provided.

All Urban LV connections are cable.

Transformers greater than 500kVA have 3-Phase switching provided for connection and disconnection, on the HV

Standard transformer sizes used are
- 15 kVA for 1 phase supplies
- 30, 50,100, 200, 300, 500, 750, 1000 kVA for 3 phases.

### 5.2.11 Pole Mounted Isolation Equipment
#### 5.2.11.1 Overview and strategy
The configuration of distribution switchgear is described in section 2.2.6

From an asset strategy perspective, the objectives for the transformers are to:

- Focus on strategic location to isolate faults without over populating for convenience
- Achieve a high standard of operational reliability.
- Minimise maintenance costs and rely on fast replacement response to keep costs low.

#### 5.2.11.2 Maintenance
Inspection of air break switches is carried out in conjunction with substation inspections, line patrols and prior to operation. Visual inspection includes checking of the switch contacts and mechanism. Inspection and testing of the earthing is carried out as per earth testing described in the Transformer section.

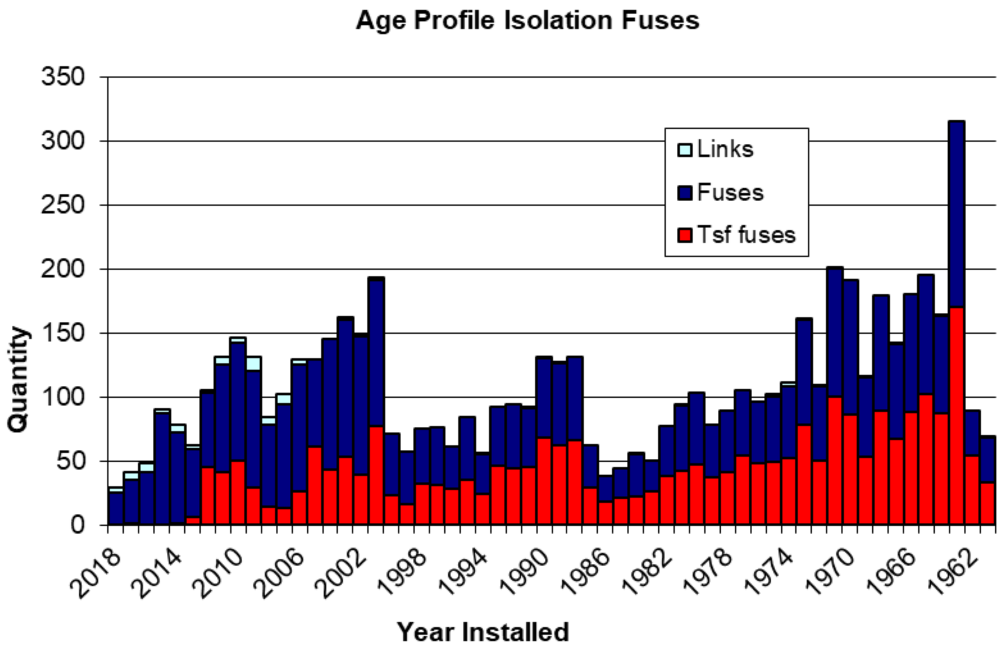
Operational testing of the switches is carried out where this is possible without a shut-down.. Defects are documented as found and corrective action prioritised as necessary to prevent failure in service. This may involve nil operation until the opportunity to coordinate with other work.

The equipment is maintained in accordance with Manufacturers specifications.

Costs associated with maintenance activities are included within the other asset categories. i.e. Zone substations, Rural Automation CB maintenance, line maintenance.

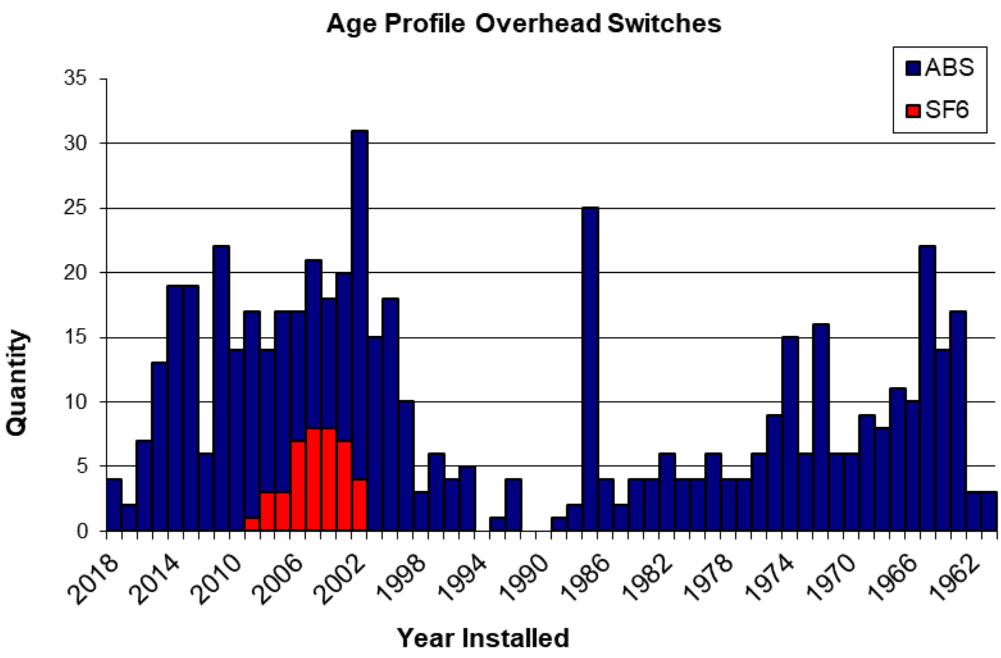
### 5.2.11.3 Age

The age of 11kV fuses is as follows:




The transformer fuses are indicating a pattern which is into a replacement cycle which generally coincides with transformer replacement.

The age of 11kV pole mounted Switches is as follows:



### 5.2.11.4 Asset Health

#### Condition

Typical failure modes for Switches and Fuses are

- Breakdown of Fuse sleeves.
- Contact burning
- Mechanism wear.
- Bearing or pivot stiffness or jamming
- Insulator failure
- Water damage on SF6 SW mechanisms

The ABS units initially were installed during construction with minimal attention or operational use. More recently as pole replacement has commenced the use of switches has increased. Any issues with operation are identified and corrected when found. Condition assessments indicate an expected service life beyond the ODV life of 35 years.

50kV ABS's are well maintained and are relatively new.

Quadrant ABS's with a wire operating system have been identified as potentially problematic should the operating wires break during operation and come into contact with live LV. These switches have a priority for replacement where they are located on poles with LV or at locations where the consequence of failure is high. The characteristics of these ABS's that make them less suitable than the current ABS standard are:

- While it meets the minimum standard the open contact spacing is closer than newer switches. The requirement is a gap of 150mm minimum.
- The switches are not rated to break load (10A maximum). Given the maximum load on most rural feeders and spur lines is well below 10A the switches are adequate for these locations. Switches on higher loaded feeders have systematically been identified and replaced.
- They are wire operated. Should the operating wires break during operation they may come into contact with live LV where it exists on the same structure

Glass type fuses are replaced as identified as the operation requires a high degree of skill and poor operation techniques can cause unnecessary arcing.

The SF6 SW population suffers from mechanism failure of motors and limit switches usually due to water ingress to the enclosures. Since installation drain holes have been added to eliminate the problem. Addition of heater elements in the mechanism enclosures is a consideration should problems persist.

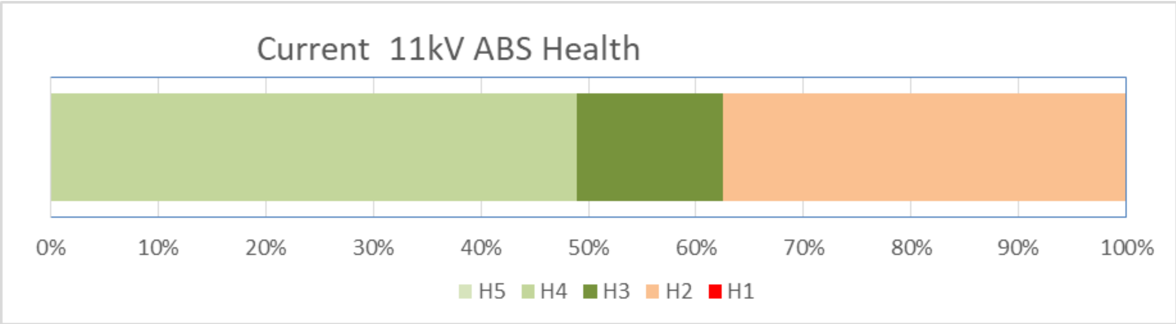
Condition indexes have been applied in line with the criteria in 5.1.3 after consideration of the assessed life and modified by Inspection and operational performance.

#### Criticality

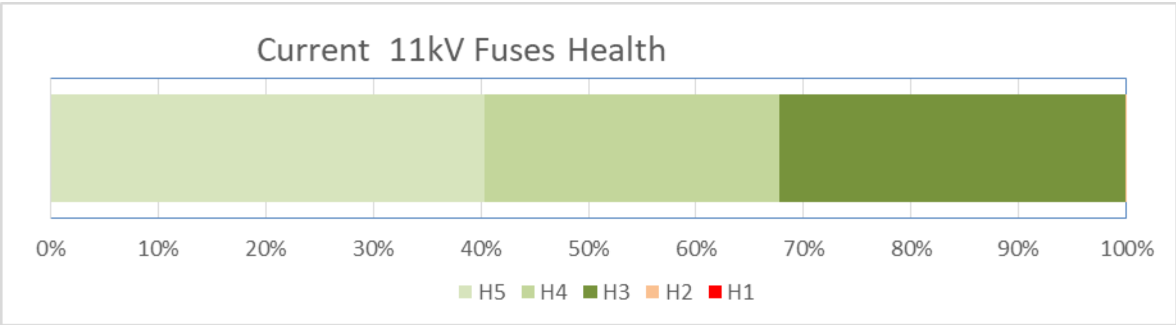
Criticality allocations were made based on a combination of the likely impact of a failure on customer numbers and the normal load.
Typically Transformer fuses have been allocated the lowest rating of C1. The highest criticality C3 is applied to 110kV and 50kV switches along with switches on tie feeders with higher loads.

#### Current Health Assessment

ABS's




Fuses




#### 5.2.11.5 Asset renewal Lifecycle Assessment

(ABS and SF6 SW's)

| | SF6 Switches | ABS | Fuses |
|---|---|---|---|
| Population Size | 30 | 600 | 6680 |
| ODV Standard Life | 35 | 35 years | 35 years |
| Assessed Standard Life | 30 | 60-years | 50 |
| Average Age | 14 | 29 | 33 |
| Steady state renewal rate p.a. | 1 | 12 | 112 |
| Premature failures /Opportunistic renewal | 1 | 6 | 20 |
| Start of failure period | *20 years | 40 years | 40 years |
| Failure period duration | *10-years | 20 years | 20 years |
| Targeted renewal rate | 0 | 15 | 50 |
| Rate of Growth Additions/Upgrades | 1 | 2 | 10 |
| Steady state less renewal /upgrade gap | 0 | 0 | 62 |

#### 5.2.11.6 Expenditure Forecasts

| Planned Actions | | |
|---|---|---|
| SF6 SW and Auto ABS Maint | Refer Rural Automation/CB Avg routine maint | |
| | | |
| Capex | | |

| | | |
|---|---|---|
| Renew ABSs | 15/yr | $111,683 |
| Steady state fuse-set renewal | 50/yr | $44,673 |

#### 5.2.11.7 Design
Standards for Air Break Switches include:

Installations that accommodate live line replacement and maintenance techniques
900mm Phase separation on 11kV
1400mm phase separation on 50kV
Arc suppression fitted if connected capacity >1MVA on 11kV
50kV not used to break load unless fitted with suppression
Load break fault make rating on all new purchases

No transformers greater than 500kVA are installed using Overhead fusing protection in overhead areas.

Where sectionalisers or similar equipment are not present on rural lines air break switches are considered necessary at distances not exceeding 10km with typical connection densities of 20 to 30 per section.

### 5.2.12 Switchgear Ground Mounted

#### 5.2.12.1 Overview and strategy
The configuration of distribution switchgear is described in section 2.2.6
Most of the equipment in use is either ABB Oil filed SD series or ABB SF6 Safelink Switchgear.

From an asset strategy perspective, the objectives are to:

- Apply designs that are standardised to minimise support and maintenance costs.
- Ensure the contingency spares, should a failure occur, are maintained.
- Replace promptly upon operational failure. or reliability issues
- Ensure safety of publicly accessible equipment.
- Ensure designs incorporate consideration of operator safety.

#### 5.2.12.2 Maintenance
Ring main units, oil filled isolators, fuse units and SF6 units are inspected yearly. Items covered in the inspection include inspection of cable entry/protection, operating components, earthing, warning/danger notices and security equipment, (i.e. covers and locks).

General maintenance activities carried out in conjunction with inspections include touchup painting on site, vegetation/rubbish clearing, LV panel cleaning, label upgrading and lubrication of operating components.

Maintenance requiring a shutdown is carried out at increasing intervals as the equipment nears end of life.

At key sites and larger industrial substations switchgear is surveyed bi-annually using thermo-vision equipment. The survey attempts to provide early warning of poor or failing connections to the switchgear and poor contacts. The frequency of monitoring will be increased if testing identifies problems developing at a higher rate.

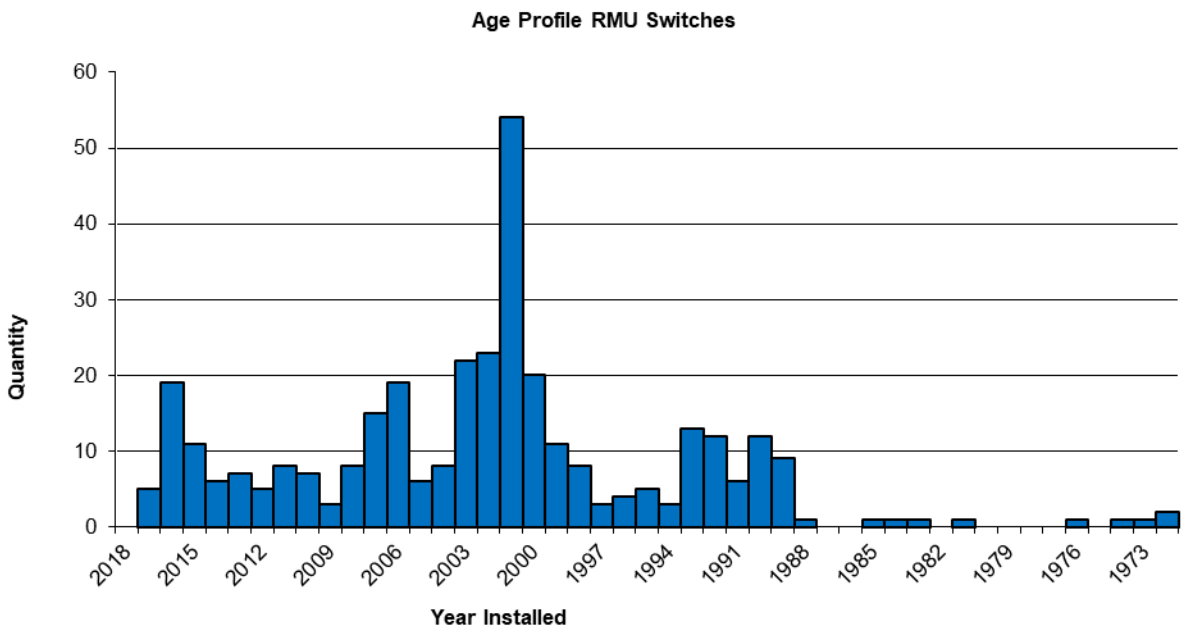
Routine maintenance work requiring shut downs is opportunistic. This is a major constraint on the level of confidence that can be applied to equipment reliability.

Servicing is carried out on the basis of the inspection results and operational performance Activities include:

- Exterior painting on site
- Oil replacement
- Contact replacement
- Termination inspections and cleaning where possible
- Termination replacement
- Mechanism replacement (Defective ABB SF6 Units)

### 5.2.12.3 Age

The age of 11kV Ground Mounted switches is as follows:




The quantities are based on complete assets containing multiple switching units as opposed to individual switching units.

Installation quantities are generally dependent on other work such as under-ground reticulation or installation of new large transformers.

### 5.2.12.4 Asset Health

#### Condition

Typical failure modes for ground mounted switchgear are

- Insulation failure due to oil contamination gas leaks or bushing failure.
- Mechanism wear.
- Mechanism stiffness or jamming
- Tank rust
- Bushing damage from Cable termination failure

The underlying failure mode for distribution switchgear is the degradation of switching mechanisms over time. The degradation is accelerated by factors such as the frequency of operation under normal and fault conditions.
The degradation factors are typically related to changes over time, with age providing the best indicator for potential targeted maintenance.

Post incident analysis has determined that an operational issue exists with ABB SafeLink (SF6) switchgear units A design fault in unit mechanism has been responsible for a number of premature failures. The initial assessment of incorrect grease type for units manufactured between 2000 and 2005 has been revised to a change in a gravity-cam to a driven-cam to prevent the switch from performing slow or soft closing when the spring was not engaged. In addition the mechanism failure allows the unit to transition from closed to earth in a single operation. When power is present the resulting fault current usually destroys the ring main unit. The issue affect units manufactured between 2000 and 2016.

In a few cases insulation failure has occurred on the fuses section of the switch the cause of which has not been determined. Replacement of all mechanisms is underway to correct the issues and a third party fitting is used during operation to prevent the closed to earth operation issue.

The population age profile is relatively young largely due to early replacement due to older designs not meeting the necessary safety, performance and reliability requirements. These types include a small remaining quantity of series 1 Andelect units. In light of the performance and condition assessments of both SF6 and older ABB Oil switches the standard ODV life of 40 years has been re-assessed to 25 years. Alternative switchgear for earlier than anticipated renewal is currently being assessed.

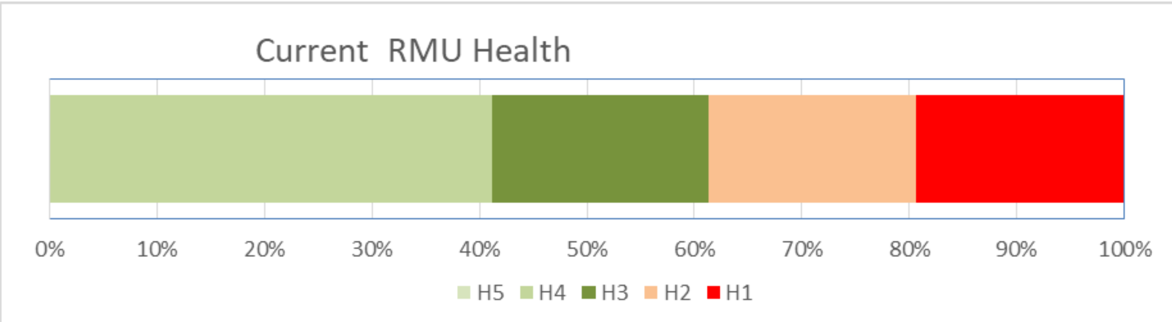
The condition index scale described in section 5.1.3 was used to categorise assets in terms of their assessed remaining life for each type of switchboard. Assets with more than 15 years remaining life were allocated a good condition score, CI1. Assets with an assessed remaining life between 5 and 15 years were allocated an average score, CI2. Assets assessed with less than 5 years remaining life were allocated the lowest condition score, CI3.

**Criticality**

Distribution switchgear criticality across the asset class was allocated in the first instance based on customer density, relative redundancy. Assets on short rural feeders (medium density but low interconnectivity and redundancy) have been allocated to the highest criticality rating (C3), urban assets (high density and medium redundancy) to C2 and CBD (high redundancy) and long rural (low density, low redundancy) assets to the lowest criticality rating.

Where appropriate and based on failure data, criticality level adjustments have been made to reflect the contribution to public and worker safety risk.

**Current Health Assessment**




#### 5.2.12.5 Asset renewal Lifecycle Assessment

Lifecycle Assessment, **(ground mounted individual switches)**

| | |
|---|---|
| Population Size | 344 |
| ODV Standard Life | 40 |
| Assessed Standard life | 25 |
| Average Age | 16 |
| Steady state renewal rate p.a. | 12 |
| Premature failures /Opportunistic renewal | 4 |
| Start of failure period | 20 years |
| Failure period duration | 10 years |
| Targeted renewal rate | 18 |

| | |
|---|---|
| Rate of Growth Additions/Upgrades | 2 |
| Steady state less renewal /upgrade gap | 0 |

#### 5.2.12.6 Expenditure Forecasts

| Planned Maintenance Actions | | Total |
|---|---|---|
| Inspection and minor maint | 15 @ $66 | $1,000 |
| Average Switch maintenance | 200 @ $200 | $40,000 |
| Substation Building Maint/repairs | 5 @ $2,000 | $10,000 |
| | | |
| Unplanned Maintenance Actions | | |
| Defect /Fault repairs | 5 @ $2,000 | $10,000 |
| | | |
| Capex | | |
| Contribution for growth | 2 units or 6-8 switches | $55,842 |
| Planned renewal | 6 units or 18-24 switches | $251,287 |

The following list details the renewal program based on inspection and condition assessments. The costs include associated cabling andalterations.

| Year | Name | Location | Existing | Total cost | New Type |
|---|---|---|---|---|---|
| 2019/2020 | W288 | Apatu St, Wairoa | SDAF3 | $40,000.00 | CFC |
| | A390 | Hirini St, Wainui Rd Cnr | SDAF3 + SD | $40,000.00 | CFCC |
| | B589 | Centennial Crescent | SDAF + SD | $40,000.00 | CFCC |
| | A335 | Parau St, near Wainui Rd | SDAF3 | $40,000.00 | CFCC |
| | W291 | Colin St & Apatu St, Wairoa | SDAF3 | $40,000.00 | CFC |
| | | | | **$200,000.00** | |
| 2020/2021 | A413 | Wainui Rd Weighbridge | SDAF3 + SDAF | $40,000.00 | CFCF |
| | J628 | College Rd South, Ruatoria | SDAF3 + SDAF | $45,000.00 | CFCF |
| | B992 | 19 Solander Street | SDAF3 | $40,000.00 | CFC |
| | A98 | Douglas St | SDAF3 | $35,000.00 | CFC |
| | W1073 | Clyde Rd, Kitchener St, Wairoa | SDAF + SD | $45,000.00 | CFCC |
| | | | | **$205,000.00** | |
| 2021/2022 | A552 | Port Main Office | SDAF3 + SDAF | $40,000.00 | CFCF |
| | A6604 | Porter Street | SDAF3 | $35,000.00 | CFC |
| | B1419 | 17 Abbott Street | SDAF3 | $35,000.00 | CFC |
| | B1071 | Seddon Crescent | SDAF3 | $30,000.00 | CFC |
| | W255 | Queen Street, Wairoa | SDAF3 | $40,000.00 | CFC |
| | B697 | Anzac Street/Carnarvon St | SDAF3 | $35,000.00 | CFC |
| | | | | **$215,000.00** | |

| | | | | | |
|---|---|---|---|---|---|
| **2022/2023** | A331 | Harris St, Wainui Rd Cnr | SDAF3 +SD | $40,000.00 | CFCC |
| | B742 | Salvation Army | Rotary | $45,000.00 | CFC |
| | A403 | Wainui Road | SDAF3 +SD | $40,000.00 | CFCC |
| | W232 | Marine Parade | SDAF3 | $40,000.00 | CFC |
| | B630 | Countdown Car Park | SDAF3 + SDAF | $35,000.00 | CFCF |
| | | | | **$200,000.00** | |
| **2023/2024** | B979 | Childers Rd, Wharehouse | SDAF3 | $35,000.00 | CFC |
| | W261 | Queen St, Wairoa | SDAF3 | $40,000.00 | CFC |
| | A550 | Kaiti Beach | SDAF3 + SDAF | $45,000.00 | CFCC |
| | C376 | 30 Cochrane St | SDAF3 | $30,000.00 | CFC |
| | | Grey St, by Gladstone Rd (T & G) | Back to Back | $65,000.00 | CFC |
| | | | | **$215,000.00** | |
| **2024/2025** | W258 | Queen Street, Wairoa | SDAF3 | $40,000.00 | CFC |
| | B39 | Roebuck Rd by Anzac St | SDAF3 | $35,000.00 | CFC |
| | B747 | Barry Street Sub | SDAF3 + SD + SD | $65,000.00 | CFCC + CCC |
| | B781 | Ormond Rd, Opp Dalrymple St | SD3 | $35,000.00 | CCC |
| | B768 | Stout Street Opp No175 | SDAF3 | $35,000.00 | CFC |
| | | | | **$210,000.00** | |
| **2025/2026** | B785 | YMCA Childers Road | SDAF3 + SDAF | $40,000.00 | CFCF |
| | A540 | Port | SDAF3 | $40,000.00 | CFC |
| | A450 | Huxley Road | SD3 | $40,000.00 | CCC |
| | B879 | Innes St - Cedenco | SDAF3 + SDAF | $40,000.00 | CFCC |
| | A294 | Ida Road | SDAF3 + SDAF | $35,000.00 | CFCF |
| | B811 | Ormond Rd near Fitzherbert St | SD3 | $35,000.00 | CCC |
| | | | | **$230,000.00** | |
| **2026/2027** | A314 | Tyndall Rd | SDAF3 + SDAF | $45,000.00 | CFCF |
| | B846 | Oak Street | SDAF3 | $35,000.00 | CFC |
| | B41 | Scott Street | SDAF3 | $35,000.00 | CFC |
| | B784 | Ormond Rd opposite Atkinson St | SDAF3 | $40,000.00 | CFC |
| | B866 | Grey St - Bright St Service Lane | SDAF3 | $35,000.00 | CFC |
| | J643 | Waiomatatini Road, Ruatoria | SDAF3 | $40,000.00 | CFC |
| | | | | **$230,000.00** | |
| **2027/2028** | W257 | Queen Street Wairoa | SDAF3 | $40,000.00 | CFC |
| | B38 | Cossy Club, Grey Street | SDAF3 | $35,000.00 | CFC |
| | A562 | Rutene Road | SDAF3 + SDAF | $45,000.00 | CFCF |
| | B164 | Desmond Road | SDAF3 | $35,000.00 | CFC |
| | B308 | Palmerston Rd | SDAF3 | $35,000.00 | CFC |
| | A580 | Graham Road | SD3 | $30,000.00 | CCC |
| | | | | **$220,000.00** | |

| | | | | | |
|---|---|---|---|---|---|
| **2028/2029** | W234 | Marine Parade, Wairoa | SDAF3 | $40,000.00 | CFC |
| | W222 | Kiwi Sub | SDAF3 | $40,000.00 | CFC |
| | B853 | Stout St by Popular St | SDAF3 | $40,000.00 | CFC |
| | A578 | Wainui Rd #199 | SDAF3 | $40,000.00 | CFC |
| | A500 | Centennial Crescent near No 1 | SDAF3 | $40,000.00 | CFC |
| | B967 | Cobden St near Midway Service Station | SDAF3 | $40,000.00 | CFC |
| | | | | **$240,000.00** | |

#### 5.2.12.7 Design

Standards for Ground-mount switch installations include:

- No more than 2 transformers supplied from 1 switchboard without bus section
- Not more than 500kVA fed from switchgear supplied from a single cable circuit (excluding industrial situations)
- No more than 2 transformers and associated switchgear cascaded with no back feed
- Not more than 1 cable circuit connected directly to the bus of a switchboard arrangement.
- SF6 or Vacuum type equipment used for replacement to reduce maintenance.

11kV switchgear standards

- Extendable
- Extra height for termination ground clearance
- Independently mounted from transformer.
- 3 phase operation
- Fault make /load break
- 200A fuse tee off rating min.
- 400A Bus bar rating min.
- 12kA short time fault rating min.

### 5.2.13 Control and protection

#### 5.2.13.1 Overview and strategy

The configuration of Transmission and Subtransmission is described in section 2.2.10

From an asset strategy perspective, the objectives for the control and protection assets are to:

- Apply systems that are standardised to minimise support and maintenance costs.
- Ensure the contingency spares, should a failure occur, are maintained.
- Replace promptly upon operational failure. or reliability issues
- Target asset renewal to realise the capabilities and functionality of the equipment being controlled.
- Where appropriate for low value items, e.g. Batteries, replace on a regular basis to avoid excessive testing and maintenance costs.

As protection schemes are required to co-ordinate across both Eastland Network Limited’s network and Transpower’s points of connection, protection equipment must maintain technical and functional compatibility with Eastland Network Limited's and/or Transpower's latest protection operating standards. Generally this results in protection equipment requiring technology upgrading before age or condition replacement.

#### 5.2.13.2 Maintenance

Operation of the equipment is monitored via the SCADA system all operation events are investigated to ensure the operation of devices occurred correctly. Incorrect operation of protection has been found to occur with some equipment types typically in relation to auto-reclose controls. Relay testing and CB trip testing frequencies for relays vary depending on the type and age of devices. The functionality of the tap-changers is monitored via the SCADA system.

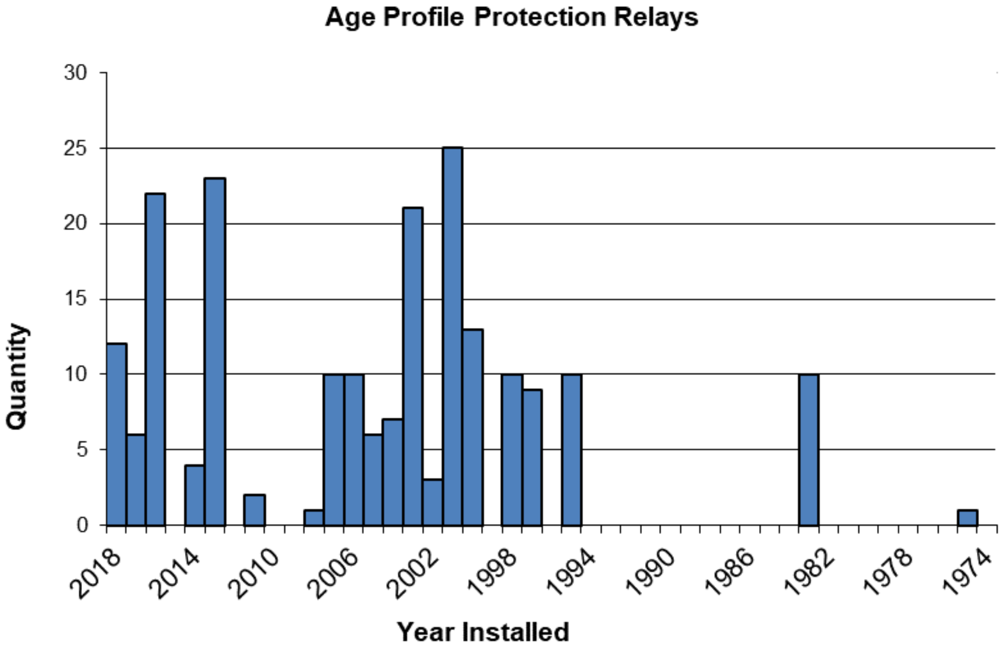
Typical Maintenance frequencies

- Protection Electromechanical – Three yearly secondary tests

- Protection Solid-state – 5 yearly secondary tests
- Protection Microprocessor – 10 yearly tests
- Tap change control – Adjustment and calibration of AVR's not exceeding 4 yearly
- Transducers – calibration 6 yearly
- Battery maintenance costs are minimal tests and maintenance on batteries within zone substations are included in 4 monthly zone substation inspections.
- No battery maintenance is carried out at rural automation sites as the cost to replace the batteries is lower than the cost to undertake tests.
- 24V battery systems – First test 2 years after initial installation, thereafter annual Load test on 24V battery systems
- 110V battery systems – Annual physical inspection and load test (monitoring on line)
- Fire safety and intruder systems not exceeding 6 monthly

#### 5.2.13.3 Age

### Protection Relays




### Voltage control equipment

Tap change control relays provided by IMP with earlier transformer purchases have proved unreliable between 2001 and 2007 the units were replaced with RegD control relays and no further issues have been identified. Older voltage regulators are currently fitted with mercury filled switch mechanisms. Replacement with PLC controls is planned when the existing units fail

DC power supplies

The DC power supplies have been progressively replaced from 1999 as older charges have become noisy and unstable. 24 and 12 volt battery banks are generally less than 5 years old as renewal is more economic than regular testing due to the distances to sites. The condition of batteries installed in pole mounted automation installations deteriorates at a greater rate due to summer temperatures generally achieving a maximum 3 year life. 110V Battery banks are replaced at intervals of 6 to 10 years depending on condition testing hence the age of these installations averages around 8 years.

### 5.2.13.4 Asset Health

#### Condition

Failure analysis shows that the predominant causes of in service failure are;

- Lightning Strikes account for a few in service failures at rural automation sites
- Infestations e.g. ants cause Circuit board and socket interface failures.
- Component aging on circuit boards
- Rodents nesting on equipment and eating wiring
- Equipment cooling fan failure in dusty environments
- Overheating of batteries is outdoor locations.
- LCD screen burn out

The control equipment used predominantly at Zone Substation sites is varied in terms of functionality and performance characteristics for this reason condition and performance are assessed on a case by case basis.

Protection equipment

Protection equipment was traditionally expected to last the life of the device it protected, however newer electronic equipment is unlikely to perform adequately after 10 to 15 years.

Voltage control

Voltage regulators are currently fitted with mercury filled switch mechanisms. Replacement with PLC controls is undertaken when the existing units show signs of mal-operation due to mechanical wear

Zone Substation AVR's are RegD type and have been very reliable. Indication of failure rates for this small population have not been determined at this stage.

The old AVR units at Wairoa Substation have reliability issues and are programmed for replacement.

Battery Systems
Rural Automation sites operate either 12 or 24V DC battery systems

Substation systems include the 110V banks and 24V systems incorporating redundancy with Dual 24V chargers and Batteries.

Early versions of chargers at rural automation sites did not have roll back features for overload and failed when attempting to charge flat batteries after extended outages.

24V Charger Modules used in substations have fans which are the primary cause of charger failure. Note redundancy chargers are installed at each site. Currently alternative products are being assessed with passive cooling options.

Often the condition of electronic components is unknown until real time alarming of a system occurs prompting replacement. For this reason equipment inspection and testing results indicate good operational condition typically beyond its design or standard life.

Other Equipment
The AC panels at a number of substations have aged to the extent that they a below modern standards for switchboard insulation. Renewal with modern Switchboards using MCB's is being considered. Sites identified are Gisborne Substation, Parkinson Substation, Kaiti Substation and TeAraroa substation
Other equipment such as Oil separator Pumps and Air-conditioning systems in substations occasionally need replacing due to failure or condition expenditure covering these items is covered in the forecasts below.

#### Criticality

The criticality of protection relays is taken to be the same as the network element with which it is associated. In other words, the criticality of a protection relay for a transformer circuit breaker is taken to be the same as the transformer. The criticality of protection relays at Major substations older than ten years has been increased to the highest level as the protection is not duplicated.

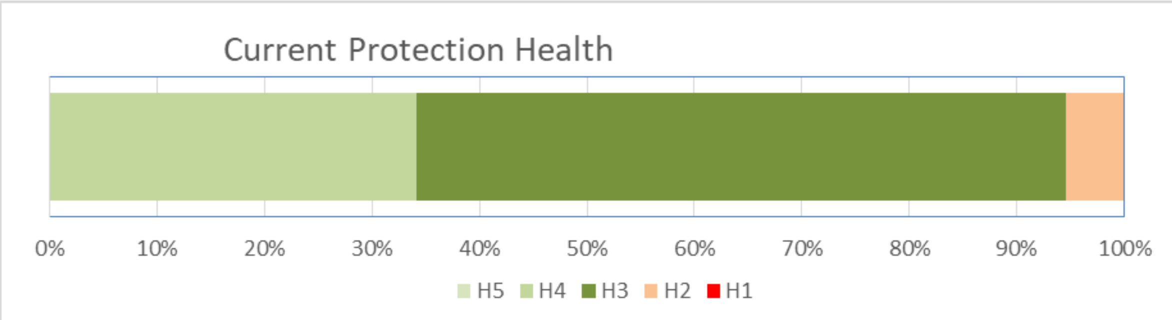
The criticality of a relay reflects its importance to the continued safe operation, reliability, stability and security of the power network.

### Current Health Assessment

The small population and the variety of equipment types, makes and models and function of assets in this category the health assessments are only established only where the analysis is justified.

For most systems used, age analysis provides an adequate indication of the appropriateness of technologies to provide the desired performance rather than condition

An indication of the Protection Relay Health is shown below:




### 5.2.13.5 Asset renewal Lifecycle Assessment

| | Protection | Voltage control | Batteries | Chargers & DC Converters |
|---|---|---|---|---|
| Population Size | 205 | 48 | 206 | 177 |
| Assessed Standard Life | 22 | 20 | 5 | 15 |
| Average Age | 13 | 15 | 3 | 8 |
| Steady state renewal rate p.a. | 9 | 0.8 | 40 | 11 |
| Premature failures /Opportunistic renewal | 0 | 1 | 6 | 4 |
| Start of failure period | 35 | 20 | 3years | 15 |
| Failure period duration | 10 | 10 | 4 years | 10 |
| Targeted renewal rate | 4 | 1 | 40 | 4 |
| Rate of Growth Additions/Upgrades | 0 | 0 | 2 | 2 |
| Steady state less renewal /upgrade gap | 0 | 0 | 0 | 0 |

Remaining Voltage Controls Renewal

| Station | AVR Control Tentative Renewal Date | Cost $ |
|---|---|---|
| Waihua V_Reg | 2020/21 | 5,250 |
| Matawai V_Reg | 2021/22 | 5,250 |
| Waingake V_Reg | 2022/23 | 5,250 |
| Kanakania V_Reg | 2023/24 | 5,250 |
| Tatapouri V_Reg | 2025/26 | 5,250 |
| Wairoa Substation | 2020/21 | |

* Replacement undertaken as items fail

#### 5.2.13.6 Expenditure Forecasts

| Capex | | |
|---|---|---|
| Steady state replacement of Relays | 4 P.a. | $11,168 |
| Steady state Batteries and Charges | | $22,337 |
| Wairoa Substation Tap Changer AVR Replacement | 2020/21 | $26,250 |
| Steady State AVR replacement | 1 P.a. as above | $5250 |
| Allowance for other equipment renewal and upgrade work (includes AVR controls) | | $33,000 |
| Provisional AUFLS protection relay replacement/upgrade | 2020-2022 | $335,000 |

#### 5.2.13.7 Design

All equipment is incorporated into designs that ensure all components of a system are used within manufactures specifications.

New purchases of protection relays include standardisation in terms of flexibility in protection scheme design, communication using standard serial I/O protocols and interchangeable hardware.

Dual 24V Battery systems are to be used where installed CB's operate on 24V and no 110V systems are installed. 24/12-volt DC-DC converters used for Radio equipment power supply.

Battery chargers and batteries where possible rationalise DC supply voltages to a common voltage (i.e. 12 volt, 48 volt supplies standardised at 24volts)

Tap changer controls shall be capable of Master/ Follower or circulating current operation to cope with unbalanced conditions.

Remote manual controls are installed on tap changer controls at Zone Substations and on Voltage Regulators to allow operator intervention when automatic control relays malfunction or when voltage adjustments are necessary when paralleling between to zone substations.

### 5.2.14 Communications

#### 5.2.14.1 Overview and strategy

The configuration of communication assets is described in section 2.2.11 of this plan

From an asset strategy perspective, the objectives for the communications assets are to:

- Minimise operational delays by implementing systems that effectively pass information in an adequate time frame.
- Systems are designed with redundancy or communication options to maintain high communications availably
- Ensure the contingency spares, should a failure occur, are maintained.
- Deal promptly with any known defects.

- Target asset renewal to maintain currency.
- Generally technology upgrade occurs before age or condition replacement; however Eastland Network Limited's strategy has been to defer the renewal until such time as the operational performance and condition of the equipment necessitates the change.

#### 5.2.14.2 Maintenance

A degree of remote monitoring of the radio systems is in place to provide early warning of equipment malfunction. Annual testing and calibration is carried out to ensure the equipment performance is within specification.

#### 5.2.14.3 Age

The age of communications equipment is tabulated as follows:

| Repeater (Multipoint) | Description | Manufacture/Install date |
|---|---|---|
| Whakapunaki | VHF Voice | 2015/2016 |
| Whakapunaki | VHF Abbey | 2000/2000 |
| Kinikini | VHF Voice | 2015/2016 |
| Kinikini | VHF Abbey | 1993/2000 |
| Carnarvon St | VHF Voice | 2014/2014 |
| Umakuri (Tokomaru) | VHF Voice | 2015/2016 |
| Tikitiki | VHF Voice | 2015/2016 |
| Tikitiki | VHF Abbey | 2016/2017 |
| Hicks Bay Hill | UHF Abbey | 2001/2001 |
| Hicks Bay Hill | VHF Voice | 2015/2016 |
| Mata Rd | VHF Voice | 2015/2016 |
| Mata Rd | VHF Abbey | 2015/2016 |
| Makaretu | VHF Abbey | 1993/2000 |
| Makaretu | VHF Voice | 2015/2016 |
| Makaretu | VHF Abbey2 | 2001/2001 |
| Arakihi | VHF Voice | 2015/2016 |
| Arakihi | VHF Abbey | 2001/2001 |
| Waihi Stn on hill | UHF Abbey | 2001/2001 |
| Waihi Power Station- Waihi Hill/W1040 | UHF Data | 2010 |

| Link (point to point) | Type | Manufacture Date |
|---|---|---|
| Gisborne(Matawhero) - Makaretu | 4RF Digital Link /IP | 2003 |
| Makaretu - Arakihi | 4RF Digital Link /IP | 2009 |
| Arakihi – Mata Rd | 4RF Digital Link /IP | 2010 |
| Mata Rd – Umakuri | Cambium IP | 2017 |
| Mata Rd – Tikitiki | 4RF Digital Link /IP | 2011 |
| Tikitiki – Hicks Bay Hill | 4RF Digital Link /IP | 2012 |
| Gisborne - Whakapunaki | 4RF Digital Link /IP | 2007 |
| Whakapunaki – Kini Kini | 4RF Digital Link /IP | 2013 |
| Whakapunaki - Mata | 4RF Digital Link /IP | 2001 |
| Umakuri-Tokomaru Substation | Mikrotik 5G IP | 2017 |

| Communications cable (Note Significant circuits only) | | Installed Date |
|---|---|---|
| Carnarvon St - Gisborne | | 1987 |
| Gisborne - Kaiti | | 1986 |
| Carnarvon St - Makaraka | | 1986 |
| Carnarvon St – Bright St/ Plunket | | 1986 |
| Carnarvon St Reads Quay | | 1986 |
| Carnarvon St – Parkinson St / Birrel St | | 1986 |
| Fibre Optic Circuits | | |
| Makaraka - Parkinson St | | 2005 |
| Parkinson St - JNL | | 2005 |
| Port-Kaiti | | 2006 |
| JNL - Matawhero | | 2005 |
| Carnarvon St – Reads Quay | | 2005 |
| Carnarvon St – Parkinson St | | 2005 |
| Reads Quay – Gladstone Office | | 2013 |
| Port Sub –Port Office | | 2010 |
| Reads Quay - Port | | 2005 |
| RT's | Quantity | Ave purchase date |
| Handheld VHF Narrow band Digital | 45 | 2014-2015 |
| Vehicle VHF Narrow band Digital | 105 | 2014-2015 |
| Substation/Automation sites UHF Analog | 4 | 2001 |
| Substation/Automation sites VHF Narrow Band Analog | 100 | 2005 |

| Pilot Isolation Facilities | No. of Circuits | Service | Installed Year |
|---|---|---|---|
| Carnarvon Street | 9 | Voice(4)/Data(5)/SHSDL (1) | 1995 |
| Valley Rd | 3 | SHSDL | 1990's |
| Gisborne Substation | 4 | SHSDL(2)-Vodafone (2) | 1990's |
| Kaiti | 1 | SHSDL | 1990's |
| Parkinson St | 2 | Not Used | 1990's |
| Makaraka | 1 | Not used | 1990's |
| Wairoa | 3 | Vodafone | 2000 |
| Kiwi | 1 | Vodafone | 1990's |
| Ngatapa | 1 | Vodafone | 1990's |
| Patutahi | 1 | Vodafone | 1990's |
| Pehiri | 1 | Vodafone | 1990's |
| Puha | 1 | Vodafone | 1990's |
| Ruatoria | 1 | Vodafone | 1990's |
| Te Araroa | 1 | Vodafone | 1990's |
| Tokomaru | 3 | Vodafone | 1990's |
| Tolaga | 1 | Vodafone | 1990's |
| Plunket Sub | 1 | Data | 1980's |
| Bright St | 1 | Data | 1980's |
| Reads Quay | 1 | Data | 1980's |
| Birrel St | 1 | Data | 1980's |

### 5.2.14.4 Asset Health

#### Condition

Failure analysis shows that the predominant causes of in service failure are;

- Lightning Strikes account for a few in service failures at rural automation sites
- Infestations e.g. ants cause Circuit board and socket interface failures.
- Component aging on circuit boards
- Ice wind and water damage on antenna systems
- Corroded connections on copper cables
- Increased losses on fibers after external damage

The remaining life of assets is used to develop the condition score. The score identified the assets that are considered to have the highest risk of failure, categorising them in three categories based on whether they have more than 10% of their life remaining, are within the last 10% of their life, or exceeding their expected life.

The standard ODV maximum life assigned to communications equipment is 15 years. Modern equipment with more stable components and self-tuning capability generally perform well during this life. Antennas and cables exposed to weather need more regular replacement (10 years). Usually technology advances make earlier system replacement desirable.

The Vodafone copper circuit phone lines to rural substations where there is no cell phone coverage or fiber fail on a regular basis. Vodafone Surecell devices have been installed and connected via the Radio IP comms network for local cell phone coverage. The isolation equipment associated with these connections will be phased out as fiber-optic or wireless circuits replace the need for copper communications circuits.

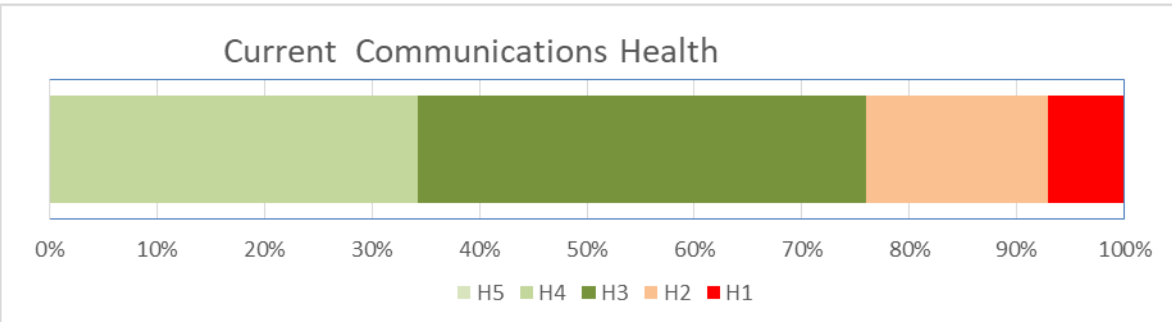
The wireless broadband 2.4G and 5G communications network was installed between 2005 and 2006 with rapid improvement in technologies. The standard life expectations for the equipment is currently around 20 years.

The VHF Scada radio repeaters are aging. While it was anticipated that the Voice Tait DMR system would support IP Scada comms the completion of this development has not occurred at this stage. Currently renewal is deferred while review of digital VHF IP options is undertaken.

#### Criticality

Assets are categorised as critical if they pose a high risk to the network should they fail, and non-critical if they will not have a major impact on the network if they fail. As the Scada assets have manual redundancy they are considered non-critical.

#### Current Health Assessment




### 5.2.14.5 Asset renewal Lifecycle Assessment

The Buildings and Antenna Masts at the radio sites are summarised in the following table

| Location | Age | Condition |
|---|---|---|
| Kinikini | 2016 (Not ENL) | New Container, Mast OK |
| Whakapunaki | 2002 | Good Container ,New Pole 2017 |
| Cricklewood Rd Pump Site | Old Shed (Not ENL) | Pole Ok |
| Makaretu | 2003 | Good Condition |
| Arakihi | Container (ENL) | Good Condition |
| Mata Rd | Old Hut (ENL) Refurbished 2018 – Asbestos removed | Good Condition |
| Umakuri | Old Hut (ENL) Refurbished 2018 - Asbestos removed | Good Condition, |
| Tikitiki | Old Hut (ENL) Refurbished 2018 - Asbestos removed | Good Condition, |
| HicksBay | Portable Building (not ENL) | Good Condition, New sites under investigation due to access issues. |
| TeKuri Hill | Outdoor Solar structure | New Condition 2018 |

As the Radio communications network is predominantly radial in nature benefits of the new technology incorporated into the new equipment can be released sooner if the network is replaced starting at the communications hub spreading outwards to the remote regions. Equipment removed, in some cases, that has some remaining service life is relocated to the remote areas for the short term if necessary until renewal is appropriate.

Fibre Optic circuits installed between 2002/2006 are expected to survive the planning period of this plan before renewal is required.

#### 5.2.14.6 Expenditure Forecasts

| Planned Actions | | Total |
|---|---|---|
| Maintenance/Calibration | | $35,000 |
| Track Maintenance | | $4,000 |
| Hut Maintenance | | $4,000 |
| Radio Licenses | | $13,199 |
| | | |
| Unplanned Actions | | |
| Defect/Fault repairs | | $16,245 |
| | | |
| Capex | | |
| Link renewal and upgrade | | $11,168 |
| Premature failures | | $22,337 |
| Hicks Bay (radio site relocation) | | $22,337 |

#### 5.2.14.7 Design

Construction of new or replacement asset adheres to following standards:

- Compliance with the Radio Spectrum Management Conditions and Radio Communication Regulations.
- Telecom circuits 5kV isolation on all sites.
- Eastland Network pilot communications circuits 5kV isolation at all sites.
- GPS position information on all RT’s
- Equipment at each end of a link to be same make, model and age.
- Power levels standardised on all repeaters and links
- Detachable head RT’s to be used in vehicles.

- Operates within manufacturers specifications.
- Power - repeaters – 25W, RTs – 5W.
- Drift - no more than 2 kHz.

One complete spare link and 2 portable repeaters are maintained for contingency operations.

### 5.2.15 SCADA

#### 5.2.15.1 Overview and strategy

The configuration of Scada system is described in section 2.2.11

From an asset strategy perspective, the objectives for the Scada assets are to:

- Minimise operational delays by implementing systems that effectively pass information in an adequate time frame.
- Provide systems designed with flexibility to support emerging technologies
- Ensure the contingency spares, should a failure occur, are maintained.
- Deal promptly with any known defects.
- Target asset renewal to maintain currency. and performance

#### 5.2.15.2 Maintenance

As the system is progressively upgraded to maintain currency no planned major upgrade or replacement for the Abbey system is programmed.

The RTU input and output functions are tested in conjunction with maintenance of the associated equipment. During protection and switchgear testing the digital indications, analogs, measurement and control functions are verified back to the master station. General indications such as door security and fire alarms are verified during 3 monthly inspections.

Other indications such as DC battery and mains fail alarms are verified during RTU inspections at intervals not exceeding 2 years. This work is generally coordinated with other activities being undertaken at the substations.

#### 5.2.15.3 Age

The Abbey Systems SCADA (Supervisory Control and Data Acquisition) system was purchased in 1999.
Master station
SCADA systems have an ODV life of 15 years as equipment ages support becomes expensive and replacement technology becomes attractive.

Replacement systems generally cost less, are smarter, less proprietary, etc. Like other computer based systems replacement is frequent and continual. The PC's used in the master station are targeted for renewal every 5 years.

## Remote stations

To maintain functionality and compatibility with master station functionality the age of RTU's follows a similar pattern to the master station equipment influenced only by new rural automation sites.

#### 5.2.15.4 Asset Health

**Condition**

Failure analysis shows that the predominant causes of in service failure are;

- Lightning Strikes account for a few in service failures at rural automation sites
- Infestations e.g. ants cause Circuit board and socket interface failures.
- Component aging on circuit boards

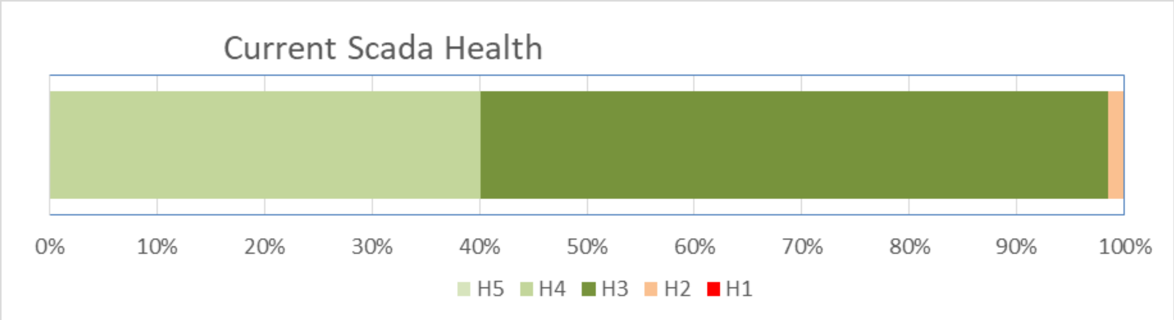
The series 1 Topcat units are being progressively replaced as real time alarming indicates CPU and or main board issues at around the design age of 16 years. Replacement units have IP or Analog communication options and improved signal clarity

All original substation communicators have been replaced to overcome lockup issues following master-station comms restarts and take advantage of new communications options.
The Condition index Score identifies the assets that are considered to have the highest risk of failure, categorising them in three categories based on whether they have more than 10% of their life remaining, are within the last 10% of their life, or exceeding their expected life.

### Criticality

Assets are categorised as critical if they pose a high risk to the network should they fail, and non-critical if they will not have a major impact on the network if they fail. As the Scada assets have manual redundancy they are considered non-critical.

### Current Health Assessment




### 5.2.15.5 Asset renewal Lifecycle Assessment

The current condition assessment indicates the system is in line good operational condition.

### 5.2.15.6 Expenditure Forecasts

Unplanned renewal of failed equipment should assume $11,168 p.a. between major upgrades.

| Planned Actions | | Total |
|---|---|---|
| Support fees | | $10,153 |
| Software Licenses | | $5,077 |
| SCADA maintenance allowance | | $10,153 |
| Configuration file alterations | | $6,092 |
| | | |
| Unplanned Actions | | |
| Defect/Fault repairs | | $10,153 |
| | | |
| Capex | | |
| Ongoing development | | $11,168 |
| Additional sites | 2 p.a. from 2021/22 | $33,000 |
| Massey Road control room | | $44,000 |
| Fault replacement | | $11,168 |

### 5.2.15.7 Design

Correct operation of the SCADA system has a direct impact on the service levels and supply restoration response times. As such the reliability requirements of the system are high.

Dual master stations, remote master connection, sub master and island operating capabilities are directly targeted at robustness of the system to faults.

The poll duration of a single SCADA port increases with the number of RTU's connected to the port. When operating remote equipment from the control room maximum poll durations of 35 seconds are targeted to ensure effective operation and feedback from the equipment being controlled. A maximum of 25 RTU's per port is necessary to achieve the targeted poll duration.

Systems connected with the SCADA system must be selected to consider use of consistent Protocols

DNP3
MODBUS
ABBEY

### 5.2.16 Non Network Assets

The acquisition of non-network assets is managed by Eastland Group Business support services as part of a Business Support operational expense allocation.

The management functions associated with these assets are also carried out by the Eastland Group's Corporate Services Business.

The assets in this category typically have well established condition standards in line with historically adopted practices comparable with all New Zealand business practices. A brief summary of the condition and issues if any, for these assets by category is provided below.

Assets include:

Furniture and Fittings
Plant and Equipment
Safety equipment
Corporate IT infrastructure
Phone systems
Shared corporate software and systems

As needs are identified, business plans and budgets are updated, selection of assets to suit the needs is undertaken and the assets are acquired.

In general asset management and planning activities for these non-network assets are managed by policies and procedures outside the scope of this AMP.

#### 5.2.16.1 IT Infrastructure and Business communications

As the IT and Business communications assets are collectively integrated into a system the degree of utilisation of shared components of the system for Eastland Network Limited verses other Eastland Group businesses is calculated using ratios of personnel and functions performed. In General all assets in this category are owned by Eastland Group and utilised by Eastland Network Limited as appropriate. Costs resulting from allocations are provided in disclosed financial information.

The average age of assets in this category is 3 to 4 years for electronic equipment and 10 years for cabling systems. To maximise business efficiency the systems are designed and maintained to a standard that provides 99% operational availability hence the assets are in very good condition.

#### 5.2.16.2 Land and Buildings

The general condition of Land and building assets identified in section 2.2.12 above is as follows.

North Clyde Wairoa, Land. This property is in good condition with minimal fencing. The grass surface is maintained on a regular basis in accordance with contract specifications. No services are installed on the property hence no renewal plans are required for the site.

Wairoa Depot. While the land is in good condition, the buildings and structures are old and are in a below average state of repair. Roofing on sections to the buildings was replaced in 2010. As the buildings have minimal use there is currently no need to redecorate the interior. Exterior cladding and painting work is undertaken when inspections identify breaches in the integrity of the structures. Fencing is old but intact and the overall exterior condition is in keeping with the standards of general infrastructure in the area. Currently no upgrade plans have been developed pending discussions with potential tenants to determine their requirements.

Tokomaru Bay Depot. The land is in good condition and maintained in line with semi-rural standards applied in the district. The buildings are maintained to above average condition and are of a modern construction. No development or renewal projects have been identified other than routine cosmetic maintenance as a result of inspection and certification activities.

Carnarvon Street Depot and Office facility. The facility is in very good condition due to regular re development projects undertaken over the life of the buildings.

The Garage and Training room facility was built in 2006 and is a modern steel frame skyline garage construction in excellent condition.

The Work shop facility is leased to Contractors and is structurally sound with a concrete/timber construction and steel clad. The workshop roof was renewed in 2016 and some earthquake strength work has been identified and is scheduled to be actioned in 2017/18.

The Store facility is leased to tenants and is in similar condition and of the same construction as the workshop facility.

The Office facility is concrete/wooden construction with Aluminium windows. The building was initially a work shop and was refitted in 2000. The requirement for internal redecoration has been identified and is scheduled for 2017/18.

The former Carpenters workshop houses the test equipment and a small office area used as a meeting room or “over flow”work area. The aged building was refurbished in 2001 and included relining of the interior, replacement of the asbestos roof with steel. In 2017 the building was repaired where necessary and repainted.

The former Garage workshop facility was converted to an office facility and leased to a contractor in 2001. The buildings are maintained inspected and certified to the commercial standards required by regulation. Minor adjustments are made to the buildings as needs arise. The drainage and toilet facilities are in an aged condition and refurbishment of these has been provisionally scheduled for 2017/18.

**5.2.16.3 Generation**

The age of standby generation assets is tabulated as follows:

| Generators | Rating kVA | Manufacture Date | Controller Date/Type |
|---|---|---|---|
| Carnarvon St | 15 | 2017 | 2017 DSE7420 |
| Makaretu | 3 | 1960’s Refurbished 2012 | 2014 DSE7420 |
| Arakihi | 4 | 2011 | 2011 DSE7310 |
| Mata Rd | 4 | 2014 | 2013 DSE7420 |
| Kinikini | 1.5 | 1960’s | 2015 DSE7420 |
| Whakapunaki | 8 | 2015 | 2014 DSE7420 |
| Tikitiki | 4 | 2017 | 2017 DSE 7420 |
| Hicks Bay | NA | NA | NA |
| Gisborne Substation | 12 | 1970’s | 2006 DSE5220 |
| Mobile 65KVA | 65 | 2012 | 2012 Technico Powerwizard |
| Mobile 15KVA | 15 3ph or 1 ph | 2017 | 2017 DSE 7420 |
| Relocatable 1.5KVA | 1.5 | 1960’s | Manual |

Condition is influenced by usage patterns and maintenance undertaken.

As the units are all air cooled maintenance is minimal.
Renewal timing and costs for standby generation assets associated with communication and SCADA assets are as follows:

| Generator Location | Renewal Date | Cost |
|---|---|---|
| Makaretu | 2020/21 | $33,505 |
| Kinikini | 2022/23 | $33,505 |

Further allowance made for an additional 3 condition based radio site generator replacements @ $33,305 ea in period up to 2028.

All fuel and safety systems for the generator installations were updated to align with regulatory changes in 2007.

Note Larger Standby Generation Units are owned by Eastland Generation Limited. Asset Management strategies for these units are outside the scope of this plan.

### 5.2.16.4 Software

The software assets are in a constant state of renewal and upgrade hence age of these systems is generally current. Currently all of the software systems in use are meeting the desired performance requirements and no significant upgrade is planned over the next 3 years. The GIS system is not compatible with 64 bit Windows 7 operating systems. This can be overcome by virtualisation software when necessary.

| Software | Latest Version/Installed Year |
|---|---|
| Gentrack Billing System | 2016 |
| Powerview GIS | 2001 |
| Finance – Accpac | 2015 |
| Fixed Assets - Activa | 2015 |
| Cognos – Financial Reporting | 2012 |
| Abbey Systems Scada | 2018 |
| Microsoft Operating Sys Servers | 2013-2016 |
| Substation Management System Monitor Mikrotik Dude | 2018 |
| Microsoft Exchange | 2018 |
| Microsoft Server (Files) | 2016 |
| GMAIL (redundancy) | 2018 |
| Microsoft Operating Sys PC's | Win10 |
| Microsoft Office | 2013 -2016 |
| PSS Sincal | 2018 |
| Protection software SEL | 2000 and 2018 |
| Protection Software Uniserve | 2018 |
| Battery Charger Software | 2018 Ice / DCtools |
| PLC Software Fanuc | 2010 Proficy 2006 VersaPro |
| PLC Software Cscape | 2016 |
| Metering Software Email | 2014 |
| Loggers Eberle | 2018 |
| PLC Software Rockwell | 2011 |
| Radio Software Aprisa | 2016 |
| Relays Enermet | 2008 |
| Relays Microtrip DOS | 1998 |
| Relays Polarr | 1999 |
| Relays Reg D | 2014 |
| Transducers Weidmuller | 2012 XP only |
| Security Protege | 2016 |
| Config Software Moxa | 2018 |
| Config Software Mikrotik | 2018 |
| Controller PicAxe | 2009 |
| H and S/PSMS Software | 2015 Web Provider |
| Payroll IMS | 2015 |
| Egnyte File Storage | 2015 |
| QNap File Storage | 2018 |

#### 5.2.16.5 Test Equipment
In general the test equipment is between 15 and 30 years old. Key items include:

Protection test set
Baur Cable Fault locator
Variable DC power supply
Ductor
5kV Megger
High Voltage Phasing Equipment
High Voltage Testers
Cable Location Equipment

4 x Voltage recorder loggers were purchased in 2011 to replace aged chart recorders.

Older equipment is built into varnished wood or leather cases and is used infrequently.

While the equipment is old the condition is very good and all items are fit for purpose.

Minimal expenditure is planned in the short term other than an investigation into purchase of a second acoustic detector for cable fault location.

Test attachments for switch gear have an age and condition profile similar to the switchgear as these assets were purchased with the initial purchase of each type of switchgear. There are approximately 15 different test attachments required to cover the switchgear assets used on the network.

#### 5.2.16.6 Safety Equipment
All Eastland Network Limited supplied safety equipment is replaced on an on-going basis generally in accordance with the expiry dates on equipment. Inspection processes and safety tests are undertaken at prescribed intervals. Items that fail tests are replaced as necessary hence the average age of safety equipment is generally 50% of the prescribed life of the equipment.

Equipment Includes:

Hard hats
Switching Suits
Gloves (work gloves and insulated gloves of appropriate Class rating)
Overalls (fire retardant rated)
Safety Boots/Shoes (di-electric as required to comply with ENL's EPZ prcedures)
Climbing Harnesses
Portable Earthing Equipment
High voltage Test attachments

#### 5.2.16.7 Plant and equipment
The nature, range and aging characteristics of plant and equipment vary significantly. Due to the low population size e.g. (1 or 2 of each item) trends and expected useful life is difficult to predict. As issues are identified during use or as a result of workplace inspection programs, equipment is retired or renewed on the basis of case by case. No significant expenditure is programmed for assets in this category.

Equipment Includes:

Safety Ropes
Cones and Area Delineators
Power Tools
Motorised Tools
Hydraulic Equipment
Generators
Pumps
Oil and Fuel Tanks
Crane attachments
Lifting Equipment

#### 5.3.16.8 Furniture and fittings

In general the furniture and fittings including partitioning systems were purchased between 2000 and 2010 as staffing levels increased over time. The assets are maintained in a condition fit for purpose. The Board room table was refurbished in 2000 when it was relocated to the site and is in good condition. The Partition system is due for renewal.

#### 5.2.16.9 Transportation assets

The average age of the transportation assets owned and used by Eastland Network Limited is approximately 4 years. Asset life targets 5 to 9 years or 200,000 km to minimise cost of refitting. Due to the road conditions distances travelled and terrain the average condition is generally below that typically expected from vehicles of the same age. In some cases vehicles can achieve the targeted distance trigger with 3 or 4 years where the role of the user involves significant travel.

#### 5.2.16.10 Expenditure Forecasts

Renewal timing and costs that have been identified for other assets are as follows;

| | | |
|---|---|---|
| Carnarvon Street Toilet facilities and Interior refit | 2018/19 | $350,000 |
| Carnarvon Street Earthquake strengthening | 2018/19 | $100,000 |
| Carnarvon Street Eastech Toilet facilities and Interior refit | 2018/19 | $150,000 |
| Vehicle replacement | | $120,000p.a |
| | | |
| Assets funded through Eastland Group | | |
| Laptop Computers (17) | | $26,000p.a |
| Desktop Computers (36) | | $34000p.a |
| Printers (15) | | $11,000p.a |
| Phones (23) | | $8,000p.a. |
| Tablets (4) | | $2,000p.a. |
| UPS Supplies (12) | | $8,000p.a. |

# 6. Managing the risks to the business

Eastland Network Limited's business is exposed to a wide range of risks. This section examines these risk exposures, describes what Eastland Network Limited has done and will do about these exposures, and what Eastland Network Limited will do when disaster strikes.

## 6.1 Understanding the business risk profile

Arrangements for Eastland Infrastructure to provide all management and support services for all of its companies, which are all owned by the Eastland Community Trust was implemented in 2003. A new management structure was developed with new appointments being made to a number of management positions at this time.

The change in company size and structure altered the business risk profile of Eastland Infrastructure and the companies it manages. A comprehensive risk management review to facilitate the ability to manage risk in accordance with the Risk management Standard AS/NZ 4360:1999 was undertaken in August 2004. The business operations of the three businesses were reviewed against a generic set of risk areas, (Governance, Personal, Financial, Business Development, Environmental, Political, Legal, Operational, Information, Technological and Business Resilience).

Having identified risks and associated existing mitigation practices, analysis was undertaken to determine likelihood (frequency or probability) of the risk occurring and the consequence (impact or magnitude of the effect) should the risk occur. By aggregating the likelihood and consequence, risk significance was assessed both with existing treatments applied and with any additional mitigations/treatments applied. This provided a measure/review of the effectiveness of current and future risk management for each business.

The review identified the following primary exposures:

A number of key staff with specialised business knowledge or skills which is not sufficiently backed up. Mitigation in the form of increased staffing levels has occurred which will be effective over time, however this exposure has yet to be reduced to acceptable levels.

An aged workforce. This exposure was evident for both personnel directly employed by the company and those engaged in contract work for the company. A bursary program to support training in the necessary skill areas has been introduced. In addition financial support of apprenticeship initiatives within the local contractors has been promoted. It is hoped that within this framework, the ability to retain graduates and trades from the local community following training will be bring about a successful succession plan over the next 5 years. Currently the necessary personnel/shill levels within contracting companies at the local level have reached a critical low level to the extent that training apprentices in sufficient quantities is not possible.

A high degree of uncertainty in future/proposed legislative requirements and short response timeframes affecting the ability to prepare policies systems and processes to meet the requirements. Legislative changes include those relating to the Electricity industry safety standards/working practices, use of road corridors, Resource management and consents and Regulatory control and disclosure. Dedicated staff and additional consultants have been engaged to monitor and advise and assist with the development of processes to maintain alignment with the changes. A steady increase in resource levels and their associated costs is anticipated to maintain this exposure within acceptable levels.

## 6.2 Identifying specific risks

The risk management process as it applies to Eastland Network Limited's electricity network business is intended to assess exposure and prioritise mitigating actions. The process is as follows:

Risk issues are identified and recorded.

Minor risk issues are eliminated or controlled.

Potential solutions/actions are developed.

Actions are assessed against outcomes or success factors.

Actions are ranked on the basis of weighted performance against outcomes.

Results are then applied to cost benefit analysis in project viability tests.

### 6.2.1 Guiding principles

Eastland Network Limited's behavior and decision making is guided by the following principles:

Eastland Group endeavors at all times to purchase and provide secure risk managed products and services at the least cost and at the same time if possible secure long term contracts for purchases, services and sales.

Only authorised contractors and personnel may transact business in Eastland Group's name and specified limits shall be maintained for such authorisations.

Eastland Network Limited will only purchase or sell product or services in line with its business expertise.

Eastland Network Limited will only undertake transactions with approved contractors and suppliers. Such transactions shall be maintained within specified limits.

Eastland Network Limited's risk management policy and related procedures and systems are to be reviewed 2 yearly by an independent party.

Annual internal reviews of risk management documentation are undertaken to ensure risks have been assessed correctly and that actions to reduce risks are actually taken.

### 6.2.2 Risk Categories

Eastland Network Limited uses the following tactics to manage and respond to risk issues under the following broad categories:

#### Commercial risks

Competition - assessments of Eastland Network Limited's exposure to bypass or generation are undertaken annually as part of Eastland Network Limited's strategic planning process. As issues arise they are discussed at monthly board meetings.

Customer activity – regular communication is maintained will all Eastland Network Limited's significant consumers. In addition to growth projects Eastland Network Limited has policies in place to provide assistance to local businesses.

Project management & professional liability - regular training and refreshers are carried out. Insurance policies and registrations with professional bodies are kept up to date. Contracts with service providers define provisions required to control associated risks. Maintenance and inspection activities documented in this plan, in addition to condition assessment information, target the identification of hazards and non-compliance issues. Targets for elimination of the risks associated with the hazards and compliance issues are also documented for each asset category in section 8 of this plan.

Financial - contracts with Eastland Network Limited consumers define liability and performance penalties. Contracts with Eastland Network Limited suppliers include requirements for insurance and protection of works.

Emergency Preparedness - Procedures and contact lists for explosion, fire, disease, accident, injury or death incidents, and environmental accidents that may be associated with operation of Eastland Network Limited's main office facilities, network assets and incidents involving contractors working for the company.

Disaster Recovery - Policies, plans and readily accessible documentation are maintained to maximise the effectiveness of Eastland Network Limited's efforts to overcome disaster events. Financial arrangements and insurance policies are in place to control the associated financial impacts resulting from events of this nature. The network is not covered by catastrophe insurance. A borrowing provision is allocated in the annual funding plan for storm and large unplanned events. Events considered in the assessments include flooding, earthquake, tsunami, war, landslips, drought, volcanic eruption, severe storms and bush fire.

#### Legal, statutory & regulatory risks

Financial security - quality system procedures for financial authorities and identification of Eastland Network Limited's representatives are in place and are externally reviewed.

Confidentially- policies and quality system procedures are in place to control access to and dissemination of confidential data.

Legal compliance & statutory liability - quality system procedures and 6 monthly check lists are used to ensure all obligations are met on time and to ensure issues are identified and resolved. Issues are reviewed at 6 monthly board meetings and external parties are used for procedural reviews.

Health & safety - quality system policies, procedures and 6 monthly refresher training are in place. These procedures include hazard identification & control, contractor authorisation, incident reporting and standards for conduct. Self-auditing and independent auditing requirements are included in contractual arrangements and network authorisations.

Public Health & safety

Quality system policies, procedures, and design standards serve as the control measures to minimise residual risk to levels that are as low as reasonably practicable. Both internal and external audits of the systems to ensure compliance with requirements of the regulations are carried out.

### Information security and control risks

Documentation – quality system procedures are in place for storage and duplication of critical documentation. All critical documentation is backed up via the computer systems used to generate the documents. Risk of total loss is controlled by use of multiple storage locations throughout the region.

Information systems – IT procedures are in place to provide 100% redundancy and backup for all systems used. Spares are maintained for critical equipment items. Testing of procedures and auditing of their effectiveness is undertaken on a regular basis.

Communications – alternative communications systems are maintained. Use of external service providers is duplicated by Eastland Network Limited's own communications network. Eastland Network Limited maintains the ability to relay business communications via third parties based outside of the Gisborne and Wairoa regions

Event Management Control - In the event the region is disjoint with respect to access or communications remote centers have been designated to enable decentralized planning and operational facilities to ensure for operations to continue at a localized level. Independent control will be delegated to a person based at each centre to run each area and liaise back to the control centre if communications are available. In the event that no communications are available, then the local centers have the ability to operate independently.

### Physical security of resources

Physical security – Physical security provisions are maintained at all strategic sites through long-term contracts with security providers. Security systems are tested annually.

Land use – legal agreements and easements are maintained for all sites considered strategic or where land use or access is vulnerable to dispute.

### Electricity supply risks

Loss of bulk supply - Transpower does not include cost penalties within contractual arrangements for supply at the Tuai GXP. Hence there is no ability to negotiate cost penalties for loss of supply as was experienced in 2001 and 2003. The purchase of six 1MW diesel generators in 2003, when combined with the Waihi hydro scheme gives us some measure of security for up to 20% of Eastland Network Limited's maximum demand.

Grid Emergency- Procedures are in place so that Eastland Network Limited is able to meet its obligations under the Electricity Governance Rules. These procedures include an approved participant outage plan.

Civil Defense Emergency - Eastland Network Limited is actively involved in and supports preparedness through the involvement with the Hawkes Bay Regional Council and the Gisborne District Council Lifelines groups. If no priorities are identified via the liaison process with Civil Defense, then the sequence of repairs are based on the following priorities:

City areas where large customer numbers are disrupted.

Critical infrastructure, such as water supplies, sewage systems and hospital / medical facilities.
Commercial business appropriate to servicing emergency needs
Rural Townships
Rural areas:
Between townships
Spurs – outlying areas

Liability for loss of supply or fluctuations - contractual arrangements and insurance policies are in place to limit Eastland Network Limited's exposure to the associated outcomes.

Revenue Protection- Procedures are in place to work with Energy retailers where necessary to continually monitor identify and eliminate issues.

### Electricity outage risks

Breakdown and Equipment failure - Network design and material standards are used to control the quality and suitability of product used. Care is taken to align product choice with common industry options to maximise the ability to source shortfalls. Suitability of new products and product use is the responsibility of the Asset Manager and is under continual review. Asset based solutions and standards detailed specifically for each asset. Strategic spares consist of equipment generally purchased for a project ahead of time. This equipment consists of critical items with long delivery times including 50kV/11kV transformers, 50kV switchgear & line hardware, protection, SCADA and communications equipment. Equipment that can be relocated to cover failure of strategic items has also been identified which generally includes 50/11kV transformers, and down-stream 11kV switchgear and protection equipment that can be used to replace failure of primary feeder circuit breakers and protection. In many cases the strategy for failed equipment is to bypass the equipment and operate on reduced functionality or rely on backup systems. Minor breakdown of critical equipment is not uncommon and the processes, which have proven adequate to date, to maintain service levels are similar to those that would apply for catastrophic failure of the critical equipment. The Procedures for documentation of asset & equipment failure are in place to identify problem items or equipment.

Resourcing - Contracts provide for minimum re-sourcing, backup re-sourcing, and response practices. Product suppliers are monitored and audited to ensure specified minimum levels of product spares and replacements are maintained in the region. Procedures and documentation are maintained to ensure product can be sourced from outside the region in a timely manner to cater for catastrophic events. Re-locatable diesel generation is available as a substitute for normal distribution supply. Eastland Network Limited has maintained relationships with companies not normally involved the network and through these relationships assistance and support in past large scale events has been willingly provided.

Access to specialised equipment - Procedures and arrangements to ensure 24 hour access to specialised equipment are maintained and verified on an annual basis.

Competency and capabilities – Skills in helicopter transportation and line reconstruction techniques are maintained to ensure risks associated with road access are controlled via alternative means. This is particularly important in remote areas of the region. To manage additional resource from outside the region, Eastland Network Limited staff qualifications are maintained and skilled local personnel have been identified to supervise activities maintaining work procedures, safety requirements and construction standards.

Processes- Response Plans include pre-prepared switching and contingency plans for all sub-transmission and critical equipment. Testing of processes is undertaken as part of normal operations. In general severe storms occur 1 or 2 times per year causing damage levels beyond the normal resourcing capability. On these occasions the response processes to coordinate priorities and establish additional resource, are put in place to effect repairs. To date the systems have proven adequate. Procedures are in place for review of outages to identify any issues. Corrective actions are incorporated into contractual arrangements design standards and asset management plans as appropriate to control the risks.

### 6.2.3 Asset Management Risk Assessment

Eastland Network Limited considers that a risk component applies to all projects and work undertaken. All network development projects are implemented to mitigate risks to varying degrees.

The results for identified risk issues directly relating to asset management risk assessments and action plan priorities are presented in the following matrix covering specific risk issues,

For each asset management risk currently identified:

The success factors applied are as follows:
The weightings applied
The assessment scores
The resulting priorities

In general there is a strong correlation between risk priorities and current work program's. However it should be noted that risk is not the sole driver of work priorities. Risk priorities influence development plans but timings are also based on the need to co-ordinate projects.

The identified risks are addressed within the current work programs given in the Asset Management Plan. However annual review is necessary due to the rate of change in the network. This process captures new risks and adjusts priorities.

## Action Plan Priorities Ranked by Risk Reduction Outcomes

Success Factor or Outcomes:

- Reduced combined effect with other risks or increased combined provision
- Improved Safety
- Reduced SAIDI (improved service)
- Reduced SAIFI (improved reliability)
- Cost reduced
- Return on investment required achieved or increased
- Economic Impact to Community Reduced
- Compliance and Environmental Responsibility
- Public Acceptance
- Meets Urgent Need

Ranking Criteria (against each Success Factor) : 1 to 10

0: No Impact 2: Low Impact 5: Medium Impact 7: High Impact 10: Crucial

| | AMP | | Criteria Weightings | | | | | | | | | | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Priority | Section | | 20 | 10 | 5 | 10 | 10 | 5 | 10 | 15 | 5 | 10 | 1000 |
| 1 | 5.4 | Red tagged pole replacement high density | 10 | 10 | 10 | 6 | 7 | 8 | 9 | 8 | 10 | 8 | 860 |
| 2 | 5.4 | Red tagged pole replacement rural | 8 | 9 | 10 | 4 | 7 | 8 | 9 | 7 | 9 | 8 | 770 |
| 3 | 5.4 | Red tagged pole replacement remote | 6 | 8 | 10 | 2 | 5 | 9 | 9 | 6 | 8 | 8 | 665 |
| 4 | 5.4.10 | ABS replacement | 7 | 2 | 10 | 3 | 1 | 8 | 9 | 10 | 10 | 8 | 660 |
| 5 | 4.7.1.2 | 33kV line extension Blacks Pad to Mahia | 6 | 10 | 4 | 4 | 4 | 2 | 8 | 8 | 0 | 5 | 580 |
| 6 | 4.7.1.2 | Waihi/Affco/Wairoa 33kV supply Rationalisation | 4 | 10 | 6 | 7 | 4 | 4 | 3 | 8 | 0 | 4 | 530 |
| 8 | 5.3 | Maintaining assets | 10 | 7 | 10 | 0 | 4 | 4 | 0 | 0 | 10 | 3 | 460 |
| 9 | 4.7.1.4 | CBD Security reinforcement due to growth | 6 | 10 | 0 | 6 | 2 | 2 | 2 | 6 | 0 | 1 | 430 |
| 10 | 4.7.1.2 | Matawai Supply security from Ngatapa | 4 | 6 | 0 | 2 | 4 | 3 | 7 | 7 | 0 | 3 | 420 |
| 11 | 5.4.4 | Meter/pillar replacement | 10 | 7 | 9 | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 385 |
| 12 | 5.4.11 | Switchgear Replacement | 6 | 5 | 4 | 0 | 0 | 0 | 4 | 4 | 6 | 3 | 350 |
| 13 | 5.5.2 | Building new assets/upgrades | 5 | 5 | 8 | 2 | 6 | 4 | 0 | 0 | 0 | 4 | 330 |
| 14 | 5.5.1.7 | Circuit Breaker Renewal | 3 | 3 | 5 | 0 | 2 | 3 | 4 | 4 | 3 | 5 | 315 |
| 15 | 5.4 | Conductor renewal | 3 | 3 | 8 | 0 | 2 | 3 | 4 | 4 | 3 | 3 | 310 |
| 16 | 5.4.14/15 | Communications and Scada Renewal | 2 | 3 | 0 | 2 | 0 | 0 | 6 | 7 | 0 | 4 | 295 |
| 17 | 4.7.1.3 | Provisional Embedded Generation | 3 | 3 | 0 | 2 | 2 | 0 | 4 | 4 | 2 | 5 | 290 |
| 18 | 4.7.1.3 | Provisional Connection of Customer Installed Generation | 3 | 3 | 0 | 2 | 2 | 0 | 4 | 4 | 2 | 5 | 290 |
| 19 | 4.7.1.4 | Improved Power Factor Correction | 4 | 3 | 2 | 6 | 5 | 5 | 0 | 0 | 0 | 3 | 285 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 4.7.1.4 | Reduce Network Distribution Losses | 3 | 3 | 2 | 4 | 5 | 5 | 0 | 0 | 0 | 6 | 275 |
| 21 | 5.4.6 | Zone Sub Transformer Renewal | 3 | 3 | 8 | 0 | 2 | 3 | 2 | 2 | 4 | 3 | 265 |
| 22 | 4.7.1.1 | Tuai-Gisborne Line Reconductor | 2 | 5 | 10 | 1 | 0 | 2 | 0 | 0 | 1 | 1 | 175 |
| 23 | 4.7.1.2 | Provisional Mangapapa Zone Substation | 0 | 2 | 0 | 2 | 2 | 3 | 2 | 2 | 4 | 3 | 175 |
| 24 | 4.7.1.2 | Provisional Whangara Zone Substation | 0 | 2 | 0 | 2 | 2 | 3 | 2 | 2 | 4 | 3 | 175 |
| 25 | 4.7.1.1 | Provisional Tuai-Gisborne 3rd Transmission Line | 0 | 2 | 0 | 2 | 2 | 3 | 2 | 2 | 4 | 3 | 175 |
| 26 | 4.7.1.2 | Provisional Patutahi Sub Capacity Increase | 0 | 2 | 0 | 2 | 2 | 3 | 2 | 2 | 4 | 3 | 175 |
| 27 | 5.4.9 | Distribution Transformer Renewal | 2 | 2 | 6 | 3 | 0 | 0 | 0 | 0 | 2 | 4 | 170 |
| 28 | 4.7.1.4 | Uneconomic Rural Lines | 2 | 2 | 7 | 0 | 0 | 1 | 1 | 0 | 6 | 2 | 160 |
| 29 | 4.7.1.5 | Overhead to Underground conversion | 0 | 3 | 4 | 0 | 0 | 0 | 3 | 3 | 5 | 1 | 160 |
| 30 | 4.7.1.5 | Ground fault neutralisers | 0 | 2 | 4 | 0 | 0 | 0 | 3 | 3 | 4 | 1 | 145 |
| 31 | 4.7.1.5 | Portable/Emergency Generation | 2 | 1 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 1 | 125 |
| 32 | 4.7.1.5 | Urban rural Automation | 1 | 1 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 1 | 105 |
| 33 | 4.7.1.4 | Improve Load control capability | 1 | 1 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 90 |

## 6.3 Emergency Response Plans

The nature of Eastland Network Limited's business is such that every unplanned supply outage that occurs invokes an emergency response of some degree. In addition there are also unplanned events or incidents that can threaten the safe and continued supply of electricity which prompt an emergency response

Emergency response at a small scale includes the following types of events:

Part power to one or more premises
No power to one or more premises
Third party damage to network assets.
Property fires
These types of events occur on a daily basis. In any one day 5 to 20 events are typical.

Large scale events that require emergency response to a greater degree include:

Extreme weather e.g. Wind, snow, lightning storms
Earthquake
Tsunami
Major flooding
These types of events are relatively rare and occur 4 or 5 times per year to varying degrees.

In these large scale events the normal emergency response strategies become swamped hence additional resources and prioritization is required for effective management of the events.

### 6.3.1 Minor events

The processes in place for small scale events are as follows:

#### 6.3.1.1 Event Notification

Notification of the event is obtained:
When a member of the public calls the call centre.
When police or emergency services contact the duty control operator.
When the SCADA system automatically detects an issue and notifies the duty control operator.

#### 6.3.1.2 First Response

The duty control operator in some cases will carry out remote operations to either isolate the assets affected by event or minimise the effects on other electricity customers.

The call centre or duty control operator directly dispatch fault contractors to the location of the event.

Where possible the first response fault contractor performs the necessary corrective actions.

Where additional personnel or equipment is required the first response fault contractor carry out actions required to ensure the assets are safe and relays all necessary information via the call centre or duty control operator to obtain additional resources.

#### 6.3.1.3 Restoration

Where correction or restoration of supply following an event is beyond the capability of first response contractor's additional staff or contractors are dispatched and the corrective actions are carried out as quickly as possible.

### 6.3.2 Major events

The processes in place for large scale events are as follows:

#### 6.3.2.1 Event Notification

Notifications of major events are obtained:

When the call centre receives multiple notifications of unrelated events.
When police or emergency services contact the duty control operator via civil defense protocols.
When the SCADA system automatically detects multiple issues and notifies the duty control operator.
When Eastland Network Limited personnel directly experience an event triggering a personal response. e.g. Earthquake, power goes off
When the automatic civil defense notification system advises the General Manager Energy, Asset and Planning Manager or Civil defense liaison directly.
When the Electricity Commission or System Operator declares an event.

#### 6.3.2.2 Event Response

Where the number or magnitude of events exceeds normal levels the call centre or fault contractors notify the duty control operator. The duty operator makes an assessment and invokes the event actions as necessary.

When civil defense protocols are implemented the recipient of the communication in conjunction with the duty control operator invokes the event actions.

For events such as earthquakes Eastland Network Limited personnel and contractors respond without additional notification. In accordance with their personal emergency action priorities personnel ensure that their own needs and needs of immediate family are met. When the issues in their immediate environment have been addressed the personnel respond to the operational centers. Refer 6.3.2.4 .

#### 6.3.2.3 Event Actions

Establish control centre

The duty control operator is conjunction with the civil defense liaison establish the Event management centre. The necessary personnel are notified, normal activities and duties are suspended and emergency roles are activated.

Additional control room staff are activated.

The civil defense liaison attends the civil defense control centre.

A dispatch team is established to group, prioritise and organise the information from the control room staff and call centre. The dispatch team coordinates the contractor resources to the prioritised tasks. The control room staff monitor and record the activities of fault response and repair teams. The General manager Energy oversees activities of the control staff dispatch team and civil defense liaison and provides status information as necessary.

### Determine Priorities

If no priorities are identified via the liaison process with Civil Defense, then the sequence of repair is based on the following criteria:

City areas where large customer numbers are disrupted.
Critical infrastructure, such as water supplies, sewage systems and hospital / medical facilities, communications facilities.
Commercial business appropriate to servicing emergency needs. E.g. fuel, food
Rural Townships
Rural areas: Between townships
Spurs – outlying areas

### Implement Repairs

Following the allocation of resources first response teams patrol and identify damage to the asset. In addition to land based teams, helicopters are used to carry out patrols, switching, jumper cutting and supply restoration.

Damage reports and requirements for corrective action are relayed via control staff to the dispatch team.

First response teams work with the control staff to disconnect, isolate and make safe damaged assets. Where quick repairs are possible e.g. fuse replacement, these tasks are completed.

Once damaged assets are made safe restoration of supply to unaffected areas is carried out.

Information regarding the requirements for repair or restoration of the damaged assets is communicated by the first response teams to the control staff.

Large repair teams are dispatched with equipment for major repair work, to event locations near job sites. Due to the rugged nature of the terrain in general helicopters are used to drop personnel at the job sites and then follow up a various stages of the work to install poles, restring conductor and return personnel to the vehicles near the event locations. Scheduling of the helicopter work is coordinated by control room staff.

Specialised generator teams are used to move and install generators to remote areas where damaged assets have resulted in isolated areas on spur lines.

### Allocate resources

The dispatch team is notified of resource requirements from the field via the control staff

The team prepares recovery plans and implements the dispatch of resources as required to repair damage.

Equipment and stores providers communicate directly with the dispatch team to establish resource requirements.

The civil defense liaison provides feed back to the dispatch team and updates civil defense plans on the status of new priorities as they are determined.

The dispatch team carries out an on-going reassessment of priorities and planning and applies the available resources to the action timetable.

### Arrange external resources

The information relating to corrective action requirements reported by first response teams is assessed by the General Manager Energy and additional material, equipment and personnel requirements are determined. In general external resource form outside the region is notified of potential around 4 hours into an event. Confirmation of requirements is established with 8 hours and resources typically arrive 8 to16 hours later. Helicopters are used to collect equipment and materials from outside the region when the delivery time frames by road are excessive.

### Arrange support services

A Support services team is established to ensure the needs of emergency personnel are established.

Eastland Network Limited maintains a stock of food and medical supplies sufficient to cater for the short term.

Work hours and fatigue are monitored and recorded by the support team with the information being fed back to the dispatch team.

Communication between field staff and families is coordinated by the support team.

Long term needs are coordinated via the civil defense liaison where necessary.

The chief executive officer is responsible for media updates and public liaison.

#### 6.3.2.4 Operational Centres

##### Primary Site

The Eastland Network Control Room is located at the 172 Carnarvon Street, Gisborne Facility.

##### Unavailability of the Control Room

If for any reason the Control Room is unavailable, then the backup Facility will split into the following respective areas as required:

Eastland Network – Wairoa office
Eastland Network – Kaiti Sub Station or Patutahi Sub Station

##### Operational Facilities

In the event the region is disjoint with respect to access or communications the following remote centers have been designated to enable decentralized planning and operational facilities to ensure for operations to continue at a localized level:

Eastland Network Wairoa
Eastland Network Carnarvon St Sub or Kaiti Sub Station
Eastland Network Tolaga Bay Sub Station
Eastland Network Tokomaru Bay Sub Station
Eastland Network Ruatoria Sub Station
Eastland Network Te Araroa Sub Station
Eastland Network Puha –Station (Te Karaka - Matawai)

Independent control will be delegated to a person based at each centre to run each area and liaise back to the control centre if communications are available.

In the event that no communications are available, then the local centers will have the ability to operate independently.

### 6.3.3 Contingency measures

A majority of the necessary contingency measures are incorporated into designs of the asset. These contingencies include:

Redundant or backup protection systems.
Redundant capacity inherent in conductors and transformers.
Pre-arranged connection points for portable generation
Multiple communication methods via Eastland Network Limited’s RT network of Third party service providers.
Paper management systems ready to cover for failure of computer systems.
Manual operating mechanisms for all assets to backup failure of the SCADA system or auxiliary supply systems.
Significant battery storage at key locations.
The general approach to contingencies is:
For failed equipment with a backup inherent in the design, the backup system is used.
For failed equipment affecting supply the equipment is isolated, or removed to restore supply.

Faulty equipment is replaced with spares held at strategic locations. Spare transformers, switches circuit breakers, protection relays, tap-change equipment and battery systems are held which cover the entire range of equipment used.
Faulty equipment is bypassed to allow restoration of supply. At rural substations such as Ruatoria, Ngatapa, TeAraroa, Tokomaru, Tolaga, Pehiri, Puha, Blacks Pad and Tahaenui the entire 11kV switchboard can be bypassed and a single set of 100Amp isolation fuses used to provide a temporary supply. Portable generation is used to bypass faulty sections of line and cable enabling restoration to isolated spur assets.

### 6.3.4 Participant Outage Plan

Eastland Network Limited's participant outage plan was prepared in accordance with The Electricity Commission requirements. The plan covers methodology and processes for managing two types of event.

Class A events - These events evolve over time and occur when a shortfall of energy available for supply is expected. The electricity Commission is responsible for declaring an event. In these events Eastland Network Limited is required to provide a reduction in energy usage based on a comparison with typical/ normal energy usage. This is achieved by operation of the standby diesel generation, shedding of hot-water load via load control for extended periods outside of normal service levels and rolling outages in line with predetermined priorities.

Immediate (Category B) events – Events that occur with little or no warning, usually as a result of a transmission line or major generation failure. These types of event will generally result in a declaration of a Transmission Grid Emergency. In these events Eastland Network Limited is required to provide a reduction in demand at Grid Exit Points. Depending on the available time frame this is achieved by operation of the standby diesel generation, shedding of load via load control and interruption of load in line with predetermined priorities.

In addition to protect the Transmission System from catastrophic failure following a category B event causing instability an Automatic Under-frequency Load Shedding system is installed (AUFLS) to automatically interrupt supply based on pre-configured priorities.

### 6.3.5 Vulnerable Customers

A process is in place to accommodate supply interruptions affecting customers with special medical needs.

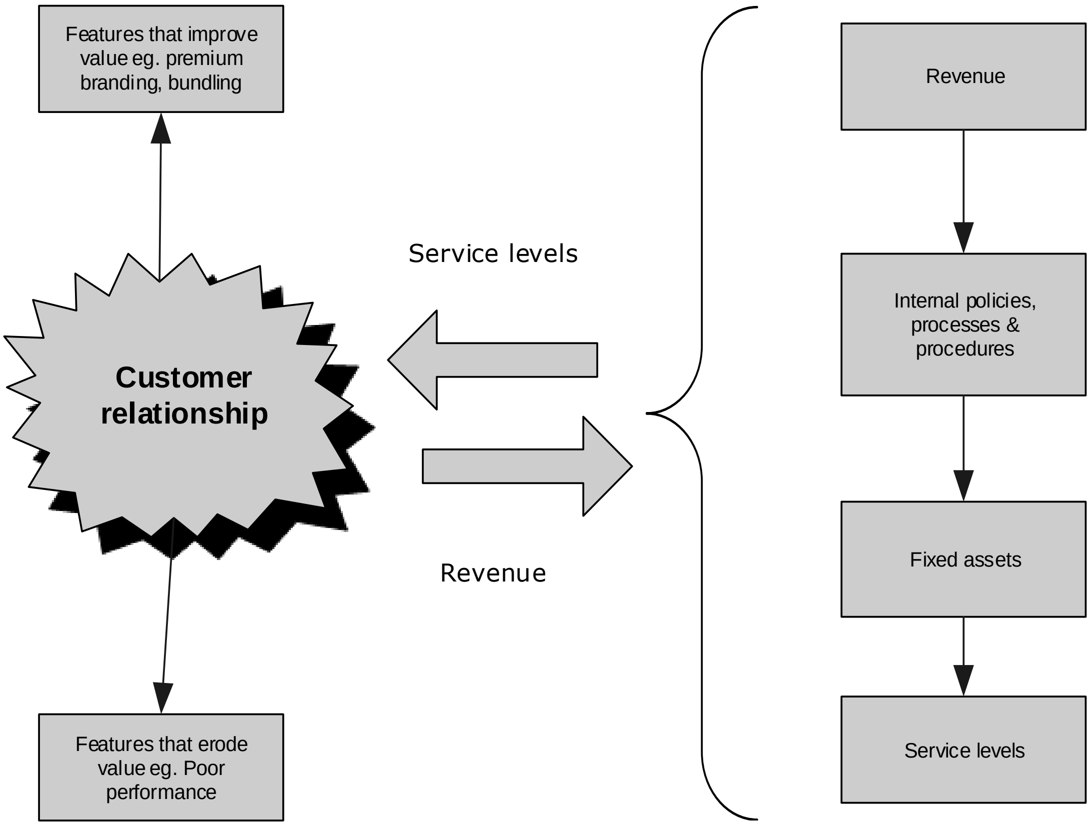
Where Eastland Network Limited is notified of customers with special needs the customers are advised to prepare an individual emergency plan to ensure their needs can be met should there be an interruption to their supply. Action plans covering short term and long term outages are necessary and issues of battery backup systems or emergency transportation are identified and arranged between the customer and their healthcare provider as these individual emergency plans are developed.

# 7. Funding the business

## 7.1 Eastland Network Limited's business model

Eastland Network Limited's business model is based around the right-hand side of Figure 7.1(a) below.

***Figure 7.1(a) – Customer interface model***




This model shows that Eastland Network Limited receives revenue from its consumers (via the energy retailers who operate on the network) and then, through a wide range of internal processes, policies and plans, Eastland Network Limited converts that cash into fixed assets. These fixed assets in turn create the service levels such as capacity, reliability and security that consumers and other stakeholders want.

## 7.2 Financial Income

Eastland Network Limited's income comes primarily from the energy retailers who pay for conveying energy over Eastland Network Limited's lines. Separately identified in Eastland Network Limited's invoicing of charges is the pass through transmission costs associated with Eastland Network Limited's connections to the Transpower Grid and Embedded Generators. The contractual agreement between Eastland Network Limited and the 15 energy retailers who trade over Eastland Network Limited's network is the Use of System Agreement. In 2013/14 Eastland Network Limited commenced negotiating with energy retailers to update Use of System Agreements so that they aligned with the Model Use of System Agreement, (MUoSA) promoted by the Electricity Authority. These negotiations have been completed and all as such energy retailers currently trading on the Eastland network are signed to the MUoSA.

Energy retailers present a bundled charge which incorporates transmission, distribution and energy costs through to end user customers.

When determining the level and constituency of its charges, Eastland Network Limited considers the following pricing principles and influences;

### 7.2.1 Revenue Requirements

Pricing should obtain sufficient revenue for Eastland Network Limited to meet the following requirements;

Meet its contractual obligations for connection to the Transpower Grid.

Meet statutory contractual obligations for Distributed Generation

Meet its contractual obligations for the delivery of energy over its network to the end-consumers.

Comply with statutory requirements on public safety, environmental protection and quality of supply.

Provide for new investment.

Provide a commercially appropriate return on funds to the shareholder.

### 7.2.2 Efficiency

Pricing must be economically efficient in the investment signals it creates. This is achieved by matching the pricing structure to the cost structure as closely as practical.

### 7.2.3 Even-handedness

Pricing must be even-handed across different load groups. Specifically:

The charges to various load groups using the network should vary according to their relative use of different assets.

Where load groups have different service requirements, service at levels above the common denominator should be charged specifically to the load groups demanding higher levels of service.

Average costing will be applied where there is common good usage of assets and services within a load group.

Where new investment is required those users who obtain the benefit should be required to contribute towards the cost.

Pricing must also be even-handed in its treatment of different retailers and provide for equal access as a matter of statutory requirement.

### 7.2.4 Simplicity

Pricing must be kept as simple and as administratively efficient as practical. Specifically:

Transmission charges should be separated from distribution charges.

Eastland Network Limited should endeavor to ensure distribution costs are relatively stable over time.

### 7.2.5 Load Management and Embedded Generation

The pricing methodology should provide signals to encourage customer demand-side participation in load management and investment in embedded generation.

### 7.2.6 Regulation

Electricity lines companies are controlled by the requirements of Part 4 of the Commerce Act 1986 and as set out in Commerce Act (Electricity Distribution Price-Quality Path) Determination 2010. This means that Eastland Network Limited is assessed annually against two thresholds:

A price path threshold, which tests whether a lines companies Notional Revenue for the year is less than its Allowable Notional Revenue for that year; and

A quality threshold, which tests whether a lines companies network quality (SAIDI and SAIFI) for the year is less than its modified long run averages of quality.

The price path threshold criterion limits the amount which lines business may increase prices each year. Under the regime, prices may only be increased such that allowable maximum regulated revenue is not exceeded for each assessment period.

As with the previous price-quality regime, Eastland Network Limited has some concerns over the limits on revenue that are applied under this regime, especially upon a network where consumption and ICP connection growth is static or declining. This is compounded further with an aging network which requires significant levels of on-going maintenance and renewal investment.

However, unlike previous regulation, lines businesses are able to apply to the Commerce Commission for a customized price path which accounts for the specific investment requirements of that business. Eastland Network Limited is keeping a watching brief on its investment requirements and return on investment to determine whether application for a customised price path is required/justified.

# 7.3 Financial Projections

Financial projections are one of the key outputs of this AMP, representing the financial outcome of the management strategies and specific maintenance, renewal and development plans set out herein. They outline Eastland Network Limited's network expenditure over the planning period, separating capital and maintenance related expenditure. The Figures relating to the forecasts of capital expenditure are uplifted by an overhead allocation, (approx. 9.49%) which is allocated to all assets when capitalized, under Eastland Group policy.

Capital expenditure is defined as expenditure that results in increased value of an asset, where the value is defined by service potential (capacity) to derive future benefits, earnings or reduced costs. If extra expenditure, say from an alteration to the original asset, results in extra value after satisfying an independent test on commercial viability, then it is capital expenditure. Overhead to underground conversion, life extension and load driven capacity upgrades fit into this category. Capital expenditure is classified in accordance with the capital expenditure categories as prescribed by the Electricity Distribution Information Disclosure Determination 2012.

Maintenance expenditure is defined as expenditure required to operate an asset or keep it in the minimum acceptable serviceable condition needed to continue its earning until the asset has satisfied the life and earning expectations used to establish the commercial viability of the original investment decision. Commercial viability tests will assume a certain level of operating and maintenance expense. Expenditure beyond this level may threaten commercial viability. Sensitivity to this and other risks are weighted into investment decisions. Maintenance expenditure is classified in accordance with the operational expenditure categories as prescribed by the Electricity Distribution Information Disclosure Determination 2012.

### 7.3.1 Capital Expenditure

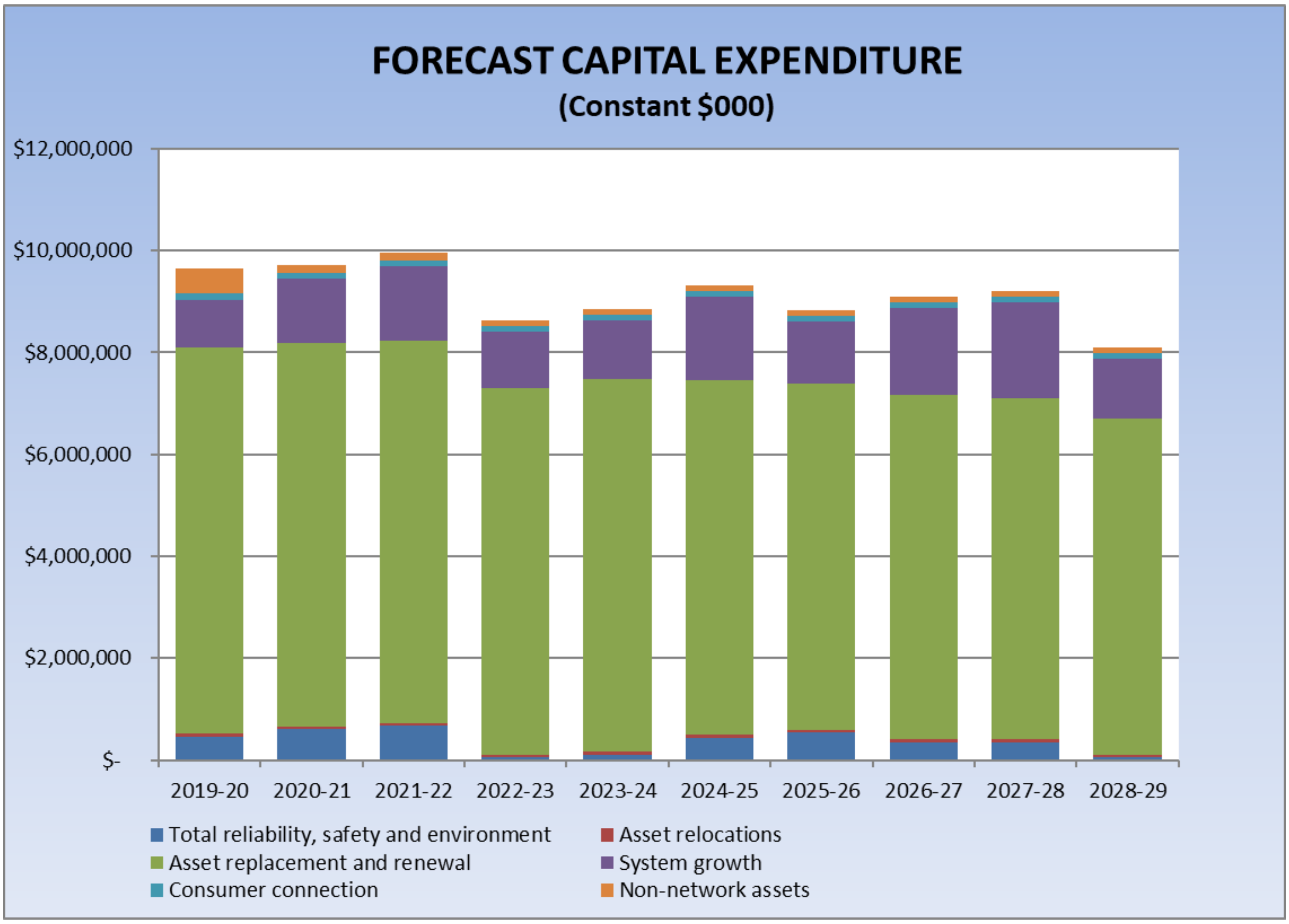
Total network + non-network asset capital expenditure over the planning period, as described in Sections 4.0 and 5.0, is $91.403m. The profile includes a significant 'step up' in expenditure from previous years due to the acquisition of the Eastland transmission spur assets; $10.822m of transmission asset renewal expenditure.

However the underlying distribution asset expenditure profile, (i.e. excluding the Eastland transmission spur assets) is relatively flat with an average expenditure of approximately $7.899m p.a., indicating that steady state assumptions apply. This level of capital expenditure equates to approximately 5.0% of the asset replacement cost.

Capital expenditure forecasts for the planning period are provided by asset type and expenditure category in accordance with the Electricity Distribution Information Disclosure Determination 2012. These forecasts include capitalisation of design and planning costs averaging 8.93% per expenditure category, ($8.165m in total for the period).

The 8.93% capitalisation allowance is an increase on the average 4.7% allowance previously applied. This increase recovers additional costs associated with an increase in the volume of capital work related design and planning being undertaken by “in-house “resources and increased complexity associated with design, planning and project management associated with 110kV transmission assets.

In accordance with Electricity Distribution Information Disclosure Determination 2012 requirements the design, planning and project management allowance is netted off System Operations and Network Support operating costs.




Comments on the categories of capital expenditure are made below.

#### 7.3.1.1 Customer Connection

*Capital expenditure primarily associated with the connection of new consumers to the network or alterations to the connections of existing consumers, where the expenditure relates to connection assets and/or parts of the network for which expenditure is recoverable in total, or in part, by a contribution from those new consumer(s).*

Where assets are required to be installed to facilitate a new, upgraded or altered customer connection it is Eastland Network Limited policy that cost responsibility resides with the customer. Accordingly the majority of Customer Connection expenditure is funded by customers who engage directly with Eastland Network Limited authorised contractors to carry out the required work with the ownership of network type assets being vested to Eastland Network Limited upon completion.

For the planning period the total $1.117m Customer Connection expenditure is 1.2% of the total capital expenditure forecast for the period. None of this unplanned expenditure allowance is related to Eastland transmission spur assets. The allowance is based on historical actual spend associated with the provision of new or upgraded assets which with the exception of $11k p.a. customer contributions to the provision of Load Control Receivers, cannot be reasonably expected to be met by the customer. Customer connection expenditure directly with contractors is not included in the forecast amounts.

#### 7.3.1.2 System Growth

*Capital expenditure primarily associated with a change in demand on the network assets, where the expenditure is not recoverable in total, or in part, through a contribution from the consumer(s) that is (are) responsible for the change in demand.*

For the planning period the total $13.599m System Growth expenditure is 14.88% of the total capital expenditure forecast for the period. System Growth expenditure over the period is dominated by expenditure associated with capacity upgrades forecast to be required within the Gisborne CBD.

This category of expenditure includes provision for the steady state customer driven network extension and capacity upgrades that cannot be avoided. The only major projects included are those where the upgrade triggers are currently exceeded. Trigger levels for growth upgrades predicted are described in Section 5.5.

A key feature of these projections is that while the AMP attempts to predict the impact of growth on network development, probable timings, etc. these issues are excluded from financial planning until more certainty on size and location and optimum response is evident.

#### 7.3.1.3 Asset Replacement and Renewal

*Capital expenditure primarily associated with the progressive physical deterioration of the condition of network assets or their immediate surrounds or expenditure arising as result of the obsolescence of network assets.*

This category of expenditure per asset type is described in Section 5.4.

For the planning period the total Asset Replacement and Renewal expenditure is $70.938m, (distribution assets $60.117m and ex transmission assets $10.821m).

The basis of transmission asset renewal budgeting is provisional forecasting information provided by Transpower. Having gained full operational control of the ex-transmission assets in March 2015 Eastland Network Limited has acquired improved asset performance and condition information that have allowed the reduction/deferral and/or smoothing of the “lumpy” asset renewal expenditure forecast for the transmission assets.

Asset Replacement driven capital expenditure for the planning period related to Eastland Network Limited distribution assets averages $7.094m p.a.

The predominance of this category of capital expenditure in the total expenditure for the period reflects the increasing average age of network assets, (especially poles and conductor) and that many assets are in the age replacement phase of their life cycle. Asset Replacement expenditure is predominantly funded by depreciation.

A previous issue regarding a “gap” between the failure and renewal rate of 11kV poles has been addressed by increasing the pole renewal budget to match the 10 year replacement rate.

A previously identified 8km pa “gap” between the 10 year renewal rate and targeted renewal rate for 11kV conductor has been addressed by increasing the annual renewal rate from 9km to 18km in 2022. Also performance to date indicates that the actual life of conductor is much greater than that forecast. It is not expected that any conductor renewal “gap” will unduly affect the achievement of levels of operational performance required by regulation or expected by customers.

#### 7.3.1.3 Asset Relocation.

*Capital expenditure primarily associated with the need to move assets. This normally results from local authority or Transit road widening projects. Accordingly this category of expenditure is to be used where the cost of moving assets is other than for reasons of routine maintenance, refurbishment and renewal maintenance or fault emergency maintenance.*

Asset Relocation driven capital expenditure for the planning period is an annual unplanned allowance of $50k p.a. based on historical actual spend. Territorial authorities operating in Eastland Network Limited's network coverage area are canvassed annually for information on immediate future and longer term requirements they might have regarding the relocation of Eastland Network Limited assets. Responses received have not identified any specific requirements to relocate Eastland Network Limited assets.

Asset Relocation capital expenditure equates to 0.55% of the total capital expenditure forecast for the period. No allowance has been made over the period for expenditure related to the relocation of transmission assets.

#### 7.3.1.4 Reliability, Safety and Environment

*Capital expenditure primarily associated with maintaining or improving the safety of the network for customers, employees and the public; expenditure primarily associated with the improvement of reliability or service standards; and expenditure primarily associated with meeting new or enhanced environmental requirements.*

Reliability, Safety and Environment driven capital expenditure for the planning period is $3.657m and equates to 4.0% of the total capital expenditure forecast for the period. None of this expenditure forecast relates to Eastland transmission spur assets.

This relatively low level of expenditure in this category is a result of large levels of expenditure that was undertaken between 2000 and 2004 for the purposes of addressing a backlog of safety and environmental issues and improvement of security of supply standards through the development of the sub-transmission network.

It should also be noted that a consequence of Eastland Network Limited's significant asset renewal program is an improvement in reliability, safety and environmental performance hence dedicated expenditure in these areas is not generally required.

#### 7.3.1.5 Non-network Assets

*Assets related to the provision of electricity lines services but are not a network asset.*

Capital expenditure on non-network assets is forecast at $1.591m over the planning period. The expenditure on non-network assets has increased significantly over previous plans with the replacement of the GIS and works management systems being included. These systems are approaching the end of their useful lives with the GIS no longer being supported, and the works management system being a bespoke development, with limited external support available. A new drawing management system is also included in the forecast, along with new software required to support the Eastland transmission spur assets.

#### 7.3.1.6 Overhead to Underground Conversions

For the planning period total of $2.005m is forecast for overhead to underground conversions. This expenditure is included under Asset Replacement and Renewal or Reliability, Safety and Environment-Other.

The following tables and graphs present the forecast expenditure as per the categorisation above, in summary by asset type and in full.

**Eastland Network Limited Capital Expenditure Programme Budget – A|**

| Description | Planned/ Unplanne | Info Disclosure Expenditure Category | Asset Category | Dist/Trans | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 9,653,848 | 9,719,247 | 9,968,162 | 8,639,940 | 8,859,930 | 9,324,394 | 8,824,479 | 9,102,566 | 9,210,091 | 8,099,995 | 91,402,651 |
| **Sub transmission Lines and Cables** | | | | | | | | | | | | | | | |
| GIS-TUI A Interphase Spacers (Transfer from 2015/16) | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | 100,000 | - | - | - | - | - | - | - | - | | 100,000 |
| GIS-TUI A Structure Replacement (pole/wood, 6pa@$38.5k) | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | 231,000 | 231,000 | 231,000 | 231,000 | 231,000 | 231,000 | 231,000 | 231,000 | 231,000 | 231,000 | 2,310,000 |
| GIS-TUI A Insulator Replacement | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | 220,000 | 220,000 | 220,000 | 220,000 | 220,000 | 220,000 | 220,000 | 220,000 | 220,000 | 220,000 | 2,200,000 |
| GIS-TUI A Grillage/Foundation Replacement | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | 275,000 | 275,000 | 275,000 | 275,000 | 275,000 | 275,000 | 275,000 | 275,000 | 275,000 | 275,000 | 2,750,000 |
| TUI-WRA A Foundation/Grillage replacement | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | - | - | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 400,000 |
| GIS-TUI A conductor replacement (span 44 - 45) | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | - | - | - | - | - | - | - | - | - | - | - |
| GIS Sub Underground 50kV | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | | 150,000 | - | - | - | - | - | - | - | - | 150,000 |
| TUI-WRA A Interphase Spacers | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | - | - | - | - | - | - | - | - | - | - | - |
| GIS_TOB A Foundation (Grillage) Refurbishment | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | - | 55,000 | 55,000 | 55,000 | 55,000 | 55,000 | 55,000 | 55,000 | 55,000 | 55,000 | 495,000 |
| GIS_TOB A Tower Refurbishment | Planned | Asset Replacement & Renewal | Subtransmission | Transpower | - | - | - | - | 109,024 | 109,024 | - | - | - | | 218,048 |
| **Subtotal Trans Assets** | | | | | 826,000 | 931,000 | 831,000 | 831,000 | 940,024 | 940,024 | 831,000 | 831,000 | 831,000 | 831,000 | 8,623,048 |
| Replacement 60 (50kV) poles pa (inc Sub Sw Yards) (@ $6k + 10%) | Planned | Asset Replacement & Renewal | Subtransmission | Distribution | 396,000 | 396,000 | 396,000 | 396,000 | 396,000 | 396,000 | 396,000 | 396,000 | 396,000 | 396,000 | 3,960,000 |
| Fault Replacement Line | Unplanned | Asset Replacement & Renewal | Subtransmission | Distribution | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | | 402,058 |
| Mahia 33kV line extension and Substation (defer from 2015) | Planned | System Growth | Subtransmission | Distribution | 55,000 | 550,000 | 550,000 | - | - | - | - | - | - | | 1,155,000 |
| Wairoa Development (GXP to North Clyde) | Planned | System Growth | Subtransmission | Distribution | - | - | - | - | - | 335,049 | 335,049 | 335,049 | 335,049 | | 1,340,196 |
| | | | | | 495,673 | 990,673 | 990,673 | 440,673 | 440,673 | 775,722 | 775,722 | 775,722 | 775,722 | 396,000 | 6,857,254 |
| **11kV Lines and Cables** | | | | | | | | | | | | | | | |
| Conductor replacement Coast; 3km to 2022 then 6km | Planned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 134,020 | 134,020 | 134,020 | 268,039 | 268,039 | 268,039 | 268,039 | 268,039 | 268,039 | 268,039 | 2,278,334 |
| Conductor replacement Gisborne, 3km to 2022 then 6km | Planned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 134,020 | 134,020 | 134,020 | 268,039 | 268,039 | 268,039 | 268,039 | 268,039 | 268,039 | 268,039 | 2,278,334 |
| Conductor replacement Wairoa, 3km to 2022 then 6km | Planned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 134,020 | 134,020 | 134,020 | 268,039 | 268,039 | 268,039 | 268,039 | 268,039 | 268,039 | 268,039 | 2,278,334 |
| Network Line Extention / Upgrade/Fault Replacement (unplan 1km) | Unplanned | System Growth | Distribution and LV lines | Distribution | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | | 990,000 |
| 11kV Replacement 365 poles per year, GIS (@ $4k +10%) | Planned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 1,606,000 | 1,606,000 | 1,606,000 | 1,606,000 | 1,606,000 | 1,606,000 | 1,606,000 | 1,606,000 | 1,606,000 | 1,606,000 | 16,060,000 |
| 11kV Replacement 205 poles per year, WOA (@ $4k + 10%) | Planned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 902,000 | 902,000 | 902,000 | 902,000 | 902,000 | 902,000 | 902,000 | 902,000 | 902,000 | 902,000 | 9,020,000 |
| 11kV Replacement 50 poles (fault & premature failure) | Unplanned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 357,500 | 357,500 | 357,500 | 357,500 | 357,500 | 357,500 | 357,500 | 357,500 | 357,500 | 357,500 | 3,575,000 |
| Network Cable Extention/Upgrade/Replacement (unplanned, 0.5km) | Unplanned | System Growth | Distribution and LV cables | Distribution | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 1,100,000 |
| Cable replacement, (fault, premature failure & rationalisation, 0.5km) | Unplanned | Asset Replacement & Renewal | Distribution and LV cables | Distribution | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 1,100,000 |
| Hirini St to Weigh bridge 370m | Planned | System Growth | Distribution and LV cables | Distribution | - | - | - | 89,346 | - | - | - | - | - | | 89,346 |
| Makaraka - Awapuni 11kV link | Planned | System Growth | Distribution and LV cables | Distribution | 275,000 | - | - | - | - | - | - | - | - | | 275,000 |
| Cable Plunket - Ormond Rd | Planned | System Growth | Distribution and LV cables | Distribution | - | 111,683 | - | - | - | - | - | - | - | | 111,683 |
| Dalton feeder Moana Rd bypass | Planned | System Growth | Distribution and LV cables | Distribution | - | - | - | - | - | - | - | 268,039 | 268,039 | | 536,078 |
| Ngatapa to Otoko Hill 8km (underbuild 50kV) | Planned | System Growth | Distribution and LV lines | Distribution | - | - | - | - | - | - | - | - | - | | - |
| Cable City Feeder (Pak n Save) 0.5km | Planned | System Growth | Distribution and LV cables | Distribution | - | - | - | - | - | 156,356 | - | - | - | | 156,356 |
| Cable Kahutia Street feeder 1.1km | Planned | System Growth | Distribution and LV cables | Distribution | - | - | 307,128 | - | - | - | - | - | - | | 307,128 |
| 11kV cable Port feeder link | Planned | Reliability, Safety & Environment - Quality of Supply | Distribution and LV cables | Distribution | - | - | - | - | - | - | 100,515 | - | - | | 100,515 |
| Wainui Link, Sponge Bay - Llyod George | Planned | System Growth | Distribution and LV cables | Distribution | - | - | - | 150,772 | - | - | - | - | - | | 150,772 |
| Stanley Rd Link, ANZAC/Innes - Awapuni | Planned | System Growth | Distribution and LV cables | Distribution | - | - | - | - | - | - | - | - | 167,525 | 167,525 | 335,050 |
| Wairoa GXP 11kV Feeder Rationalisation/Reinstatement (defer fron 2016/17) | Planned | Reliability, Safety & Environment - Other | Distribution and LV cables | Distribution | | | | | | | | | | | - |
| Asset relocations (for Territorial authorities) | Unplanned | Asset Relocation | Distribution and LV cables | Distribution | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 500,000 |
| | | | | | 3,922,560 | 3,759,243 | 3,954,688 | 4,289,736 | 4,049,618 | 4,205,974 | 4,150,132 | 4,317,656 | 4,485,181 | 4,107,142 | 41,241,929 |
| **LT Lines and Cables** | | | | | | | | | | | | | | | |
| Pole replacement 100 per year (@ $3k + 10%) | Planned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 330,000 | 330,000 | 330,000 | 330,000 | 330,000 | 330,000 | 330,000 | 330,000 | 330,000 | 330,000 | 3,300,000 |
| Chorus Pole replacement 100 per year (3yrs start 2018/19) | Planned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 110,000 | 110,000 | | | | | | | | | 220,000 |
| Line Replacement with Underground 1km (Gis) | Planned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 1,675,247 |
| Line Replacement with Underground 1km (Wairoa) | Planned | Asset Replacement & Renewal | Distribution and LV lines | Distribution | 110,000 | 110,000 | 110,000 | | | | | | | | 330,000 |
| Unplanned Network Extention/Upgrade/Replacement Line 1km | Unplanned | System Growth | Distribution and LV lines | Distribution | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 446,731 |
| Allowance for Growth/Upgrade, Cables 1km | Unplanned | System Growth | Distribution and LV cables | Distribution | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 893,462 |
| Cable replacement, (fault, premature fail & rationalisation, 1km) | Unplanned | Asset Replacement & Renewal | Distribution and LV cables | Distribution | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 89,346 | 893,462 |
| | | | | | 940,891 | 940,891 | 830,891 | 720,891 | 720,891 | 720,891 | 720,890 | 720,890 | 720,890 | 720,890 | 7,758,903 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Service Connections** | | | | | | | | | | | | | | | |
| Service Fuse Boxes & Meter Bds to Replace Galv Meter Box (Asbestos), 100pa from | Planned | Reliability, Safety & Environment - Other | Distribution and LV cables | Distribution | 341,000 | 341,000 | 341,000 | - | - | - | - | - | - | | **1,023,000** |
| Service Pillar Replacement (20pa) | Planned | Asset Replacement & Renewal | Distribution and LV cables | Distribution | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | **223,368** |
| | | | | | **363,337** | **363,337** | **363,337** | **22,337** | **22,337** | **22,337** | **22,337** | **22,337** | **22,337** | **22,337** | **1,246,368** |
| **Load Control** | | | | | | | | | | | | | | | |
| Replace failed ripple relays | Planned | Asset Replacement & Renewal | Other network assets | Distribution | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | **111,682** |
| Provide ripple relays for new connections | Unplanned | Customer Connection | Other network assets | Distribution | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | **111,682** |
| Install second Injection Point Gisborne (11kV) | Planned | System Growth | Other network assets | Distribution | - | - | - | - | 279,208 | 279,208 | - | - | - | | **558,415** |
| | | | | | **22,337** | **22,337** | **22,337** | **22,337** | **301,544** | **301,544** | **22,336** | **22,336** | **22,336** | **22,336** | **781,779** |
| **Zone Substations** | | | | | | | | | | | | | | | |
| Transpower Zone Subs + Spares + SCADA&Comms transfer project Transfer Cost | Planned | System Growth | Zone substations | Transpower | - | - | - | - | - | - | - | - | - | | - |
| GIS 50kV DS Replacement(154 156 174 176 194 196) | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | 313,989 | - | - | - | - | - | - | | **313,989** |
| GIS 110kV DS Replacement (217 227) | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | - | - | - | - | - | 60,000 | - | | **60,000** |
| GIS 110kV DS Replacement (197 207 264 266 294 296)) | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | 58,873 | 300,906 | - | - | - | - | - | | **359,779** |
| GIS 110kV DS Replacement (234 237 247)) | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | 29,436 | 150,453 | - | - | - | - | - | - | | **179,889** |
| GIS 110kV Battery Bank A & Chargers Replacement | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | - | 50,000 | - | - | - | - | - | | **50,000** |
| GIS 110kV Battery Bank B & Charges Replacement | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | 50,000 | - | - | - | - | - | - | - | | **50,000** |
| GIS 110kV C1 2nd Cap Bank | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | - | - | 545,119 | - | - | - | - | | **545,119** |
| GIS Switchyard Metal Replacement | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | - | - | - | - | 110,000 | - | - | | **110,000** |
| GIS 110kV SF6 CB refurbishment | Planned | Asset Replacement & Renewal | Zone substations | Transpower | | | | | | 110,000 | | | | | **110,000** |
| WRA 110kV/11kV TX Tap Changer Controls Replacement | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | 50,000 | | 0 | - | - | - | - | - | | **50,000** |
| WRA 110kV Battery Bank 1 & Chargers Replacement | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | 50,000 | - | - | - | - | - | - | | **50,000** |
| WRA 11kV Feeder Protection Replacement (CB1 & CB11) | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | - | - | - | - | - | - | - | | - |
| WRA T1 & T2 Transformer Protection Replacement | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | - | - | - | - | - | - | - | | - |
| WRA Fence Replacement | Planned | Asset Replacement & Renewal | Zone substations | Transpower | - | - | - | 100,000 | - | - | - | - | - | | **100,000** |
| TUI 110/11 kV Supply Transformer Replacement (defer from 2015/16) | Planned | Asset Replacement & Renewal | Zone substations | Transpower | 220,000 | - | - | - | - | - | - | - | - | | 220,000 |
| | | | | | **220,000** | **129,436** | **573,315** | **450,906** | **545,119** | **110,000** | **110,000** | **60,000** | **-** | **-** | **2,198,776** |
| **Subtotal Trans Assets** | | | | | | | | | | | | | | | |
| New zone Sub Tatapouri/Whangara 2.5MVA | Planned | System Growth | Zone substations | Distribution | - | - | - | - | - | - | - | 502,574 | 502,574 | 502,574 | **1,507,721** |
| New zone Sub Massey Road (split Coast & Kaiti 50kV OH) | Planned | System Growth | Zone substations | Distribution | - | - | - | 275,000 | 275,000 | 275,000 | 275,000 | - | - | | **1,100,000** |
| Kiwi TX bunding & SEPA unit | Planned | Reliability, Safety & Environment - Quality of Supply | Zone substations | Distribution | - | 75,000 | - | - | - | - | - | - | - | | **75,000** |
| Building/Switchyard Security Upgrade (2016/17 defer Kaiti) | Planned | Reliability, Safety & Environment - Quality of Supply | Zone substations | Distribution | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 55,842 | **156,356** |
| Replace roof Te Araroa | Planned | Asset Replacement & Renewal | Zone substations | Distribution | 65,000 | - | - | - | - | - | - | - | - | | **65,000** |
| Replace T1 Patutahi 12MVA (ex-Kaiti) | Planned | Asset Replacement & Renewal | Zone substations | Distribution | | 110,000 | 275,000 | - | - | - | - | - | - | | **385,000** |
| Replace T1 Tolaga 5MVA (ex-Matawhero) | Planned | Asset Replacement & Renewal | Zone substations | Distribution | - | 300,000 | - | - | - | - | - | - | - | | **300,000** |
| Replace T1 & T2 Matawhero (ex Carnarvon T1 & T2) | Planned | Asset Replacement & Renewal | Zone substations | Distribution | 290,000 | - | - | - | - | - | - | - | - | | **290,000** |
| Replace 11kV SWGR Matawhero,Kaiti, Kiwi & Parkinson | Planned | Reliability, Safety & Environment - Other | Zone substations | Distribution | - | - | - | - | - | 330,000 | 330,000 | 330,000 | 330,000 | | **1,320,000** |
| Replace T1 Puha 5MVA (ex-Matawhero) | Planned | Asset Replacement & Renewal | Zone substations | Distribution | - | | 300,000 | - | - | - | - | - | - | | **300,000** |
| Replace T1 Kaiti 12MVA (new) | Planned | Asset Replacement & Renewal | Zone substations | Distribution | | | | | | | | | | | - |
| Replace T1 & T2 Carnarvon 12MVA (new) | Planned | Asset Replacement & Renewal | Zone substations | Distribution | | | | | | | | | | | - |
| Transformer Refurbishment, (@ $110k) | Planned | Asset Replacement & Renewal | Zone substations | Distribution | 110,000 | | | | | | | | | | **110,000** |
| 5MVA 50/11kV TX (spare) | Planned | Asset Replacement & Renewal | Zone substations | Distribution | 300,000 | 300,000 | - | | | | | | | | **600,000** |
| Earthing Upgrades (step potential) | Planned | Asset Replacement & Renewal | Zone substations | Distribution | - | - | - | - | 11,168 | - | - | - | - | 11,168 | **22,336** |
| | | | | | **776,168** | **796,168** | **586,168** | **286,168** | **297,336** | **616,168** | **616,168** | **843,742** | **843,742** | **569,584** | **6,231,413** |
| **50kV CB's** | | | | | | | | | | | | | | | |
| Makaraka Line to Patutahi | Planned | Asset Replacement & Renewal | Zone substations | Distribution | - | - | - | - | - | - | - | - | - | | - |
| Carnarvon T1 & Makarak 29 install | Planned | Asset Replacement & Renewal | Zone substations | Distribution | 110,000 | - | - | - | - | - | - | - | - | | **110,000** |
| | | | | | **110,000** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **110,000** |
| **11kV CB's (Rural Automation)** | | | | | | | | | | | | | | | |
| Field Recloser Automation Plan - replacements | Planned | Asset Replacement & Renewal | Distribution switchgear | Distribution | - | 55,842 | - | 55,842 | - | 55,842 | - | 55,842 | 55,842 | | **279,208** |
| 11kV Field Recloser Automation Plan - additions | Planned | Reliability, Safety & Environment - Quality of Supply | Distribution switchgear | Distribution | 55,842 | - | 55,842 | - | 55,842 | - | 55,842 | - | - | | **223,367** |
| | | | | | **55,842** | **55,842** | **55,842** | **55,842** | **55,842** | **55,842** | **55,842** | **55,842** | **55,842** | **-** | **502,574** |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Distribution Transformers** | | | | | | | | | | | | | | | |
| Replace Transformers <100kVA | Planned | Asset Replacement & Renewal | Distribution substations and tran: | Distribution | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | **1,116,830** |
| Replace Transformers >100kVA | Planned | Asset Replacement & Renewal | Distribution substations and tran: | Distribution | 301,544 | 301,544 | 301,544 | 301,544 | 301,544 | 301,544 | 301,544 | 301,544 | 301,544 | 301,544 | **3,015,441** |
| Transformers Growth <100kVA | Unplanned | System Growth | Distribution substations and tran: | Distribution | 87,113 | 87,113 | 87,113 | 87,113 | 87,113 | 87,113 | 87,113 | 87,113 | 87,113 | 87,113 | **871,128** |
| Transformers Growth >100kVA | Unplanned | System Growth | Distribution substations and tran: | Distribution | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | 167,525 | **1,675,247** |
| | | | | | **667,864** | **667,864** | **667,864** | **667,864** | **667,864** | **667,864** | **667,865** | **667,865** | **667,865** | **667,865** | **6,678,646** |
| **Pole Mounted Isolation Equipment** | | | | | | | | | | | | | | | |
| Age Replacement of 11kV ABS's | Planned | Asset Replacement & Renewal | Distribution switchgear | Distribution | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | **1,116,830** |
| 11kV Fuse replacement 30 sets | Planned | Asset Replacement & Renewal | Distribution switchgear | Distribution | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | **446,731** |
| | | | | | **156,356** | **156,356** | **156,356** | **156,356** | **156,356** | **156,356** | **156,356** | **156,356** | **156,356** | **156,356** | **1,563,561** |
| **11kV Ground Mounted Switchgear** | | | | | | | | | | | | | | | |
| 11kV GM SWGR New Connections | Unplanned | Customer Connection | Distribution switchgear | Distribution | 55,842 | 55,842 | 55,842 | 55,842 | 55,842 | 55,842 | 55,842 | 55,842 | 55,842 | 55,842 | **558,417** |
| Switchgear Replacement plan (2x plan, 2x unplan) | Planned | Asset Replacement & Renewal | Distribution switchgear | Distribution | 251,287 | 251,287 | 251,287 | 251,287 | 251,287 | 251,287 | 251,287 | 251,287 | 251,287 | 251,287 | **2,512,869** |
| (Please leave this row blank) | | | | | | | | | | | | | | | |
| | | | | | **307,128** | **307,128** | **307,128** | **307,128** | **307,128** | **307,128** | **307,129** | **307,129** | **307,129** | **307,129** | **3,071,286** |
| **LV Switchgear** | | | | | | | | | | | | | | | |
| Replace LV Link Pillars (6 boxes p.a.) | Planned | Asset Replacement & Renewal | Distribution switchgear | Distribution | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | **446,731** |
| LV SW/GR Allowance for New Installations | Unplanned | Customer Connection | Distribution switchgear | Distribution | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | 44,673 | **446,731** |
| | | | | | **89,346** | **89,346** | **89,346** | **89,346** | **89,346** | **89,346** | **89,346** | **89,346** | **89,346** | **89,346** | **893,462** |
| **Control and Protection** | | | | | | | | | | | | | | | |
| Replace Batteries / Charges | Unplanned | Asset Replacement & Renewal | Other network assets | Distribution | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | **223,366** |
| Allowance for failure | Unplanned | Asset Replacement & Renewal | Other network assets | Distribution | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | **111,683** |
| AUFLS Relay install | Planned | Reliability, Safety & Environment - Legislative & Reg | Other network assets | Distribution | | 167,525 | 167,525 | - | - | - | - | - | - | | **335,050** |
| Replace 11kV feeder protection Tokomaru Bay | Planned | Asset Replacement & Renewal | Other network assets | Distribution | - | - | - | - | - | - | - | - | - | | - |
| V Reg AVR replace (Waihua, Matawai, Waigake, Kanakania, Tatapouri) | Planned | Asset Replacement & Renewal | Other network assets | Distribution | | 26,250 | | | | | | | | | **26,250** |
| Protection relay age replace | Planned | Asset Replacement & Renewal | Other network assets | Distribution | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | **330,000** |
| | | | | | **66,505** | **260,279** | **234,030** | **66,505** | **66,505** | **66,505** | **66,505** | **66,505** | **66,505** | **66,505** | **1,026,349** |
| **Communications** | | | | | | | | | | | | | | | |
| Replace repeater equipment | Planned | Asset Replacement & Renewal | Other network assets | Distribution | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | **111,682** |
| Replace Radio Site Generator | Planned | Asset Replacement & Renewal | Other network assets | Distribution | - | 33,505 | - | 33,505 | | 33,505 | 33,505 | - | - | | **134,020** |
| Unplanned Comms Equip Replacement (fault & premature fail) | Unplanned | Asset Replacement & Renewal | Other network assets | Distribution | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | 22,337 | **223,368** |
| Relocate/Replace Comms Hut - Hicks Bay | Planned | Asset Replacement & Renewal | Other network assets | Distribution | 33,000 | | | | | | | | | | **33,000** |
| Replace Vehicle RTs | Planned | Reliability, Safety & Environment - Legislative & Reg | Other network assets | Distribution | - | - | - | - | - | - | - | - | - | | - |
| | | | | | **66,505** | **67,010** | **33,505** | **67,010** | **33,505** | **67,010** | **67,010** | **33,505** | **33,505** | **33,505** | **502,069** |
| **SCADA** | | | | | | | | | | | | | | | |
| SCADA Master Station Development | Planned | Reliability, Safety & Environment - Quality of Supply | Other network assets | Distribution | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | | **100,514** |
| Unscheduled RTU Replacement | Unplanned | Asset Replacement & Renewal | Other network assets | Distribution | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | 11,168 | | **100,514** |
| SCADA Rural Automation -development | Planned | Reliability, Safety & Environment - Quality of Supply | Other network assets | Distribution | - | - | 33,505 | 33,505 | 33,505 | 33,505 | 33,505 | - | - | | **167,525** |
| SCADA Long Term Development Additional Sites | Planned | Reliability, Safety & Environment - Quality of Supply | Other network assets | Distribution | - | - | 55,842 | - | - | 55,842 | - | - | - | | **111,683** |
| Alternate Massey Rd Control Room (defer from 2018/19) | Planned | Reliability, Safety & Environment - Quality of Supply | Other network assets | Distribution | 44,000 | | | | | | | | | | **44,000** |
| | | | | | **66,337** | **22,337** | **111,683** | **55,842** | **55,842** | **111,683** | **55,841** | **22,336** | **22,336** | **-** | **524,235** |
| **General** | | | | | | | | | | | | | | | |
| Establish 2x Genset sites (Raupunga & Ruakituri)(defer 2016/17) | Planned | Reliability, Safety & Environment - Quality of Supply | Other network assets | Distribution | - | - | - | - | - | - | - | - | - | | - |
| Trailer mounted 30KVA Generator | Planned | Reliability, Safety & Environment - Quality of Supply | Other network assets | Distribution | | | | | | | | | | | - |
| Capital Contributions | Planned | Customer Connection | Other network assets | Distribution | - | - | - | - | - | - | - | - | - | | - |
| | | | | | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |
| | | | | | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | **Total** |
| **TOTAL NETWORK CAPEX Dist + Trans Assets** | | | | | **9,152,848** | **9,559,247** | **9,808,162** | **8,529,940** | **8,749,930** | **9,214,394** | **8,714,479** | **8,992,566** | **9,100,091** | **7,989,995** | **89,811,651** |

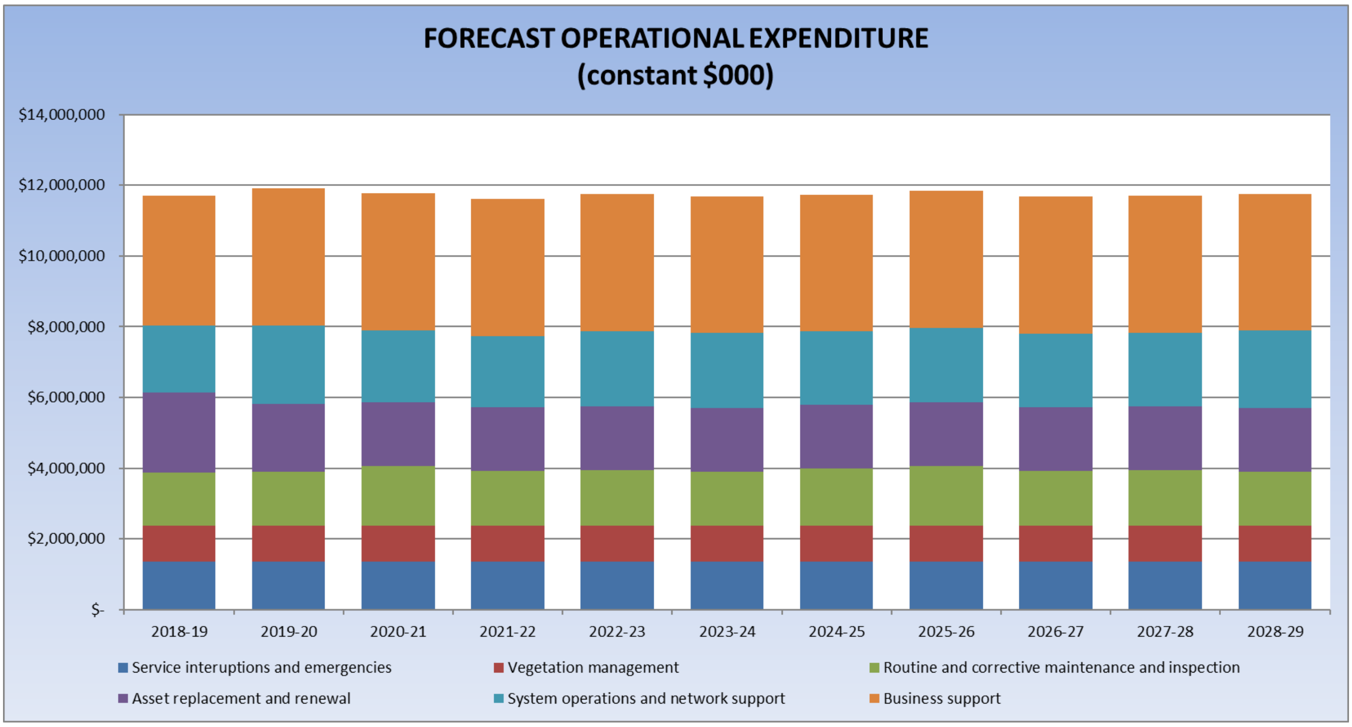
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Network CAPEX Distribution Assets | | | | | 8,106,848 | 8,498,811 | 8,403,848 | 7,248,034 | 7,264,786 | 8,164,370 | 7,773,479 | 8,101,566 | 8,269,091 | 7,158,995 | **78,989,827** |
| Total Network CAPEX Transpower Assets | | | | | 1,046,000 | 1,060,436 | 1,404,315 | 1,281,906 | 1,485,143 | 1,050,024 | 941,000 | 891,000 | 831,000 | 831,000 | **10,821,824** |
| **Routine** | | | | | | | | | | | | | | | - |
| Test Instrument & Safety Equipment,(inc Lone worker 19/20 additional/upgrade) | Planned | Non Network Assets - Routine | Non Network Assets | Distribution | 16,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **106,000** |
| Vehicle Replacement @ $60k each (Ntk) | Planned | Non Network Assets - Routine | Non Network Assets | Distribution | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | **600,000** |
| Vehicle Replacement @ $60k each (Eastech) + 1x Trailers 2018/19 & 2019/20 @ | Planned | Non Network Assets - Routine | Non Network Assets | Distribution | - | - | - | - | - | - | - | - | - | - | - |
| General asset replacement (Eastech) | Planned | Non Network Assets - Routine | Non Network Assets | Distribution | - | - | - | - | - | - | - | - | - | - | - |
| General asset replacement (Ntk) | Planned | Non Network Assets - Routine | Non Network Assets | Distribution | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | **200,000** |
| General building capex (ENL office, Eastech, Wairoa Depot) | Planned | Non Network Assets - Routine | Non Network Assets | Distribution | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | **200,000** |
| **Atypical** | | | | | | | | | | | | | | | - |
| GIS Thin Client Softwaret | Planned | Non Network Assets - Atypical | Non Network Assets | Distribution | 50,000 | - | - | - | - | - | - | - | - | | **50,000** |
| Plan Plotter/Printer replacement | Planned | Non Network Assets - Atypical | Non Network Assets | Distribution | 15,000 | | | | | | | | | | **15,000** |
| Property Capital Projects (ENL Carnarvon St office refurb) | Planned | Non Network Assets - Atypical | Non Network Assets | Distribution | 150,000 | | | | | | | | | | **150,000** |
| Property Capital Projects (Carnarvon St security fence upgrade) | Planned | Non Network Assets - Atypical | Non Network Assets | Distribution | 20,000 | | | | | | | | | | **20,000** |
| Property Capital Projects (Eastech office refurb) | Planned | Non Network Assets - Atypical | Non Network Assets | Distribution | 30,000 | | | | | | | | | | **30,000** |
| Property Capital Projects (Wairoa office & w/shop refurb) | Planned | Non Network Assets - Atypical | Non Network Assets | Distribution | | 50,000 | 50,000 | | | | | | | | **100,000** |
| Solar PV Trial (Carnarvon & 1x Wairoa defer from 2016/17) | Planned | Non Network Assets - Atypical | Non Network Assets | Distribution | 55,000 | | | | | | | | | | **55,000** |
| Home EV Charger trial (half cost with Energy Solutions) | Planned | Non Network Assets - Atypical | Non Network Assets | Distribution | 15,000 | | | | | | | | | | **15,000** |
| Property Capital Projects (ENL Carnarvon St earthquake strengthening) | Planned | Non Network Assets - Atypical | Non Network Assets | Distribution | 50,000 | | | | | | | | | | **50,000** |
| | | | | | | | | | | | | | | | - |
| | | | | | | | | | | | | | | | - |
| | | | | | | | | | | | | | | | - |
| **TOTAL NON-NETWORK ASSETS** | **Total** | **Non Network Assets** | | | **501,000** | **160,000** | **160,000** | **110,000** | **110,000** | **110,000** | **110,000** | **110,000** | **110,000** | **110,000** | **1,591,000** |
| TOTAL CAPEX excl Capcon & Vested | | | | | **9,653,848** | **9,719,247** | **9,968,162** | **8,639,940** | **8,859,930** | **9,324,394** | **8,824,479** | **9,102,566** | **9,210,091** | **8,099,995** | **91,402,651** |
| Vested assets | | | | | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | | **1,800,000** |
| Total Including Capcon and Vested | | | | | **9,853,848** | **9,919,247** | **10,168,162** | **8,839,940** | **9,059,930** | **9,524,394** | **9,024,479** | **9,302,566** | **9,410,091** | **8,099,995** | **93,202,651** |
| **Capital Contributions** | | | | | - | - | - | - | - | - | - | - | - | - | - |
| Customer Connection | | | | | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | | **450,000** |
| **Total Capcon** | | | | | **50,000** | **50,000** | **50,000** | **50,000** | **50,000** | **50,000** | **50,000** | **50,000** | **50,000** | - | **450,000** |
| **Total CAPEX Prior to Vested Assets** | | | | | **9,603,848** | **9,669,247** | **9,918,162** | **8,589,940** | **8,809,930** | **9,274,394** | **8,774,479** | **9,052,566** | **9,160,091** | **8,099,995** | **90,952,651** |
| **Vested Assets** | | | | | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **2,000,000** |
| **Vested Assets Total** | | | | | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **200,000** | **2,000,000** |
| **GRAND TOTAL (Capex incl Non-network assets excl CapCon plus vested assets)** | | | | | **9,803,848** | **9,869,247** | **10,118,162** | **8,789,940** | **9,009,930** | **9,474,394** | **8,974,479** | **9,252,566** | **9,360,091** | **8,299,995** | **92,952,651** |

| Network Asset Capex (+10% On Cost) | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Customer Connection | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | 111,683 | **1,116,830** |
| System Growth | 938,657 | 1,270,340 | 1,465,785 | 1,123,775 | 1,162,864 | 1,654,269 | 1,218,706 | 1,714,319 | 1,881,844 | 1,168,756 | **13,599,314** |
| Asset Replacement & Renewal | 7,589,330 | 7,521,363 | 7,504,645 | 7,188,640 | 7,313,699 | 6,956,758 | 6,791,892 | 6,764,228 | 6,704,228 | 6,603,714 | **70,938,499** |
| Reliability, Safety & Environment - Quality of Supply | 122,178 | 97,337 | 167,525 | 55,842 | 111,683 | 111,683 | 212,198 | 22,336 | 22,336 | 55,842 | **978,959** |
| Reliability, Safety & Environment - Legislative & Reg | - | 167,525 | 167,525 | - | - | - | - | - | - | - | **335,050** |
| Reliability, Safety & Environment - Other | 341,000 | 341,000 | 341,000 | - | - | 330,000 | 330,000 | 330,000 | 330,000 | - | **2,343,000** |
| Asset Relocation | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | **500,000** |
| **Total Asset Capex** | **9,152,848** | **9,559,247** | **9,808,162** | **8,529,940** | **8,749,930** | **9,214,394** | **8,714,479** | **8,992,566** | **9,100,091** | **7,989,995** | **89,811,651** |
| **Non Network Asset Capex (0% On Cost)** | | | | | | | | | | | |
| Routine | 116,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 | 1,106,000 |
| Atypical | 385,000 | 50,000 | 50,000 | - | - | - | - | - | - | - | 485,000 |
| **Total Non-Network Asset Total** | **501,000** | **160,000** | **160,000** | **110,000** | **110,000** | **110,000** | **110,000** | **110,000** | **110,000** | **110,000** | **1,591,000** |
| Total ENL Capex (excl Capcon & Vested) | **9,653,848** | **9,719,247** | **9,968,162** | **8,639,940** | **8,859,930** | **9,324,394** | **8,824,479** | **9,102,566** | **9,210,091** | **8,099,995** | **91,402,651** |

### 7.3.2 Operational Expenditure

Total operational expenditure over the planning period, as described in Section 5.3, is $117.446m. This level of expenditure has increased over the previous plan as a result of the maintenance requirements associated with the Eastland transmission spur assets, and an increase in System Operations and Network Support.

Operational expenditure forecasts for the planning period are provided by asset type and expenditure category in accordance with the Electricity Distribution Information Disclosure Determination 2012.




General comments on the categories of expenditure are made below.

#### 7.3.2.1 Maintenance Expenditure

The total maintenance for the 10 year AMP period is forecast at $57.650m, ($48.876m distribution assets and $8.774m ex-transmission assets).

For current distribution assets maintenance plans have been prepared by asset type and expenditure category. These plans detail the regular on-going work that is necessary to keep assets operating, including the basis for condition monitoring, equipment standards, planned maintenance and provisions for unplanned actions in response to faults or incidents. It has been identified that Eastland Network Limited's current distribution assets are in the age replacement phase of their life cycle. The management tactic is to therefore replace rather than to continue with a heavy maintenance strategy. The expected improvement in average asset condition will lift performance and allows low maintenance expenditure to be sustained.

*7.3.2.1a Service Interruptions and Emergencies*

For the planning period the total $13.644m, ($13.292m distribution assets and $352k ex-transmission assets), Fault and Emergency expenditure is 11.58% of the total maintenance expenditure forecast for the period. As described in section 5.3.1 included in this expenditure category is a standing allowance of $600k p.a. relating to a fault management/response service. This expenditure category has not been materially impacted by the acquisition of the Eastland transmission spur assets due to the very high reliability of those assets.

*7.3.2.1b Vegetation management*

For the planning period the total $10.150m, ($9.000m distribution assets and $1.150m ex-transmission assets), Vegetation Management expenditure is 8.61% of the total maintenance expenditure forecast for the period. The

110kV lines routes have generally been well maintained by Transpower, and vegetation management spend represents an ongoing 'maintenance' programme to address network performance issues.

*7.3.2.1c Routine and Corrective Maintenance and Inspection*

This expenditure that is driven by pre-planned and programmed work schedules and includes routine inspection and testing activities.

For the planning period the total $15.690m, ($9.068m distribution assets and $6.622m ex-transmission assets), Routine and corrective expenditure is 13.31% of the total operational expenditure forecast for the period. The increase in expenditure from 2016 reflects the comprehensive inspection and maintenance regime applied to the Eastland transmission spur assets. A comprehensive inspection and maintenance approach is warranted for these assets given the potential high consequence of the failure. The forecasts reflect the level of expenditure forecast by Transpower, and the programmes and costs will be reviewed as Eastland Network Limited gains operational experience of these assets.

*7.3.2.1d Asset Replacement and Renewal (expensed)*

For the planning period the total $18.166m, ($17.516m distribution assets and $650k ex-transmission assets), Refurbishment and Renewal expenditure is 15.41% of the total maintenance expenditure forecast for the period.

As explained above, incorporated in Asset Replacement and Renewal maintenance expenditure associated with distribution assets, is $1.421m of annual ACOD expenditure, ($14.210m total for the period). The forecast ACOD payment is made to network connected distributed generation in recognition of avoiding investment, (in additional distribution assets and the upgrading of transmission assets), so as to meet required network service and performance standards.

This level of actual maintenance expenditure on the renewal of assets over the period is relatively low for both distribution and ex-transmission assets, and is the result of the large capital asset replacement and renewal program.

### 7.3.2.2 Non-network Operational Expenditure

In accordance with the Electricity Distribution Information Disclosure Determination 2012, information and forecasts relating to two classifications of non-network operational expenditure are as follows;

*7.2.2.2a Business Support*

Business Support expenditure includes expenditure associated with corporate activities such as HR, IT, finance, regulatory compliance, property management, pricing, billing, and revenue collection.

Business Support expenditure includes the provision to Eastland Network Limited of general non-network assets such as office buildings, office furniture, vehicles and PCs, from Eastland Group Limited.

The following Methodology is used to allocate Business support costs from Eastland Group Limited to Eastland Network Limited.

– Any overhead costs directly attributable to an individual business unit are budgeted by the individual business and expensed to the individual business. Examples of which include but are not exclusive to:

- Stationary delivered to the Port would be coded to Port Stationary
- The mobile phone bill of a Linesman would be coded to Eastech Telecommunications
- A team lunch to celebrate success at the Network would be coded to Network Entertainment
- Security
- Rent
- Cleaning
- Expenses relating to Vehicles would be coded to the relevant business unit
- Computer Expenses – Licences for business unit specific software
- Legal/Consulting Costs specific to a business unit

- Payroll costs

- Any costs that are incurred at a Group/Corporate level are expensed into shared services and form part of a management fee. Examples of which include but are not exclusive to:

- Any costs directly attributable to Shared Services/Corporate
- All Group staff functions
- Tax & Treasury advice
- Legal/Consulting
- Computer Expenses (PC's/Laptops, licences for Group-wide software, Servers)
- HR & Recruitment costs for the Group
- Superannuation costs
- Sponsorship

Management Fee Allocation

The management fee as allocated to business units using the following methodology.

- By using the latest available forecast balance sheet position, to determine the % of assets held per business unit.
- By using the latest available payroll information to determine the % of headcount per business unit.
- By using the latest available information from IT to determine the % of headcount with computers per business unit.

The following table shows the management fee percentage allocations determined by Eastland Group Limited for the 2019/20 financial year

| | |
|---|---|
| Energy Solutions | |
| Business Development | 8.33% |
| Gisborne Airport | 1.69% |
| Eastech | 0.89% |
| Network | 36.19% |
| Eastland Generation (waihi/gen) | 3.49% |
| Eastland Generation (admin) | 1.01% |
| TAOM | 5.27% |
| Geothermal Developments | 1.15% |
| Northland Debarking | 1.23% |
| Port Operations | 35.80% |
| Cookstores | 1.07% |
| Electric Village | 0.77% |
| Commercial Property | 3.11% |

For the planning period the total $38.725m Business Support expenditure is 33.04% of the total operational expenditure forecast for the period.

Business Support costs have been forecast 'steady state' for this plan. These business support costs include charges in relation to the 'backbone' IT platform and financial system (which are supplied by Eastland Group to Eastland Network Limited). Eastland Group have recently commenced work on investigating the replacement of their legacy financial system to obtain efficiencies in the services provided.

*7.3.2.2b System Operations and Network Support*

System Operations and Network Support expenditure includes expenditure where the primary driver is the management of the network.

For the planning period the total $21.071m System Operations and Network Support expenditure is 18.06% of the total operational expenditure forecast for the period. Total System Operations and Network Support expenditure is reduced by capitalised design, planning and project management costs totalling $8.164.

Increases in System Operations and Network Support expenditure on previous years has been driven in part by an increase in engineering and associated support staff as a result of the increase in regulatory compliance and additional transmission assets. Eastland Network Limited is embarking on a strategy to increase its resourcing to improve its asset management practices (in conjunction with the replacement of its core asset management systems). It is expected that this investment will improve future AMMAT scores.

The following tables and graphs present the forecast expenditure as per the categorisation above, in summary by asset type and in full.

**Eastland Network Limited, Maintenance Budget, Budget - April 2019 to April 2029**

| | | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Planned / Unplanned | Info Disclosure Expenditure Category | Asset Category | Distribution Custor Transpower | Planned Cost | Unplanned Cost | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | Total |
| **Sub-transmission Lines** | | | | | | | | | | | | | | | | | | |
| GIS-TOK A 110kV - Condition Assesment 6yrs | Planned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | 100,000 | - | | - | - | - | - | - | 100,000 | - | - | - | | **100,000** |
| GIS-TOK A 110kV - Patrols | Planned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | 137,086 | - | 15,232 | 15,232 | 15,232 | 15,232 | 15,232 | 15,232 | - | 15,232 | 15,232 | 15,232 | 15,232 | **137,086** |
| GIS-TOK A 110kV - Access Road Maint | Unplanned | utine & Corrective Maint & Inspection | Subtransmission | Transpower | - | 100,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| GIS-TOK A 110kV - Foundations | Unplanned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | - | 49,171 | 4,917 | 4,917 | 4,917 | 4,917 | 4,917 | 4,917 | 4,917 | 4,917 | 4,917 | 4,917 | 4,917 | **49,171** |
| GIS-TOK A 110kV - Structures | Unplanned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | - | 70,158 | 7,016 | 7,016 | 7,016 | 7,016 | 7,016 | 7,016 | 7,016 | 7,016 | 7,016 | 7,016 | 7,016 | **70,158** |
| GIS-TOK A 110kV - Vegetation Control | Planned | Vegetation management | Subtransmission | Transpower | 300,000 | - | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | **300,000** |
| GIS-TUI A 110kV - Condition Assesment 4yrs | Planned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | 320,000 | - | | - | 160,000 | - | - | - | - | 160,000 | - | - | - | **320,000** |
| GIS-TUI A 110kV - Patrols | Planned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | 240,000 | - | 30,000 | 30,000 | | 30,000 | 30,000 | 30,000 | 30,000 | | 30,000 | 30,000 | 30,000 | **240,000** |
| General - Unscheduled Tower/Line Repairs | Unplanned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | - | 1,000,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | **1,000,000** |
| GIS-TUI A 110kV - Insulators | Unplanned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | - | 140,000 | 14,000 | 14,000 | 14,000 | 14,000 | 14,000 | 14,000 | 14,000 | 14,000 | 14,000 | 14,000 | 14,000 | **140,000** |
| GIS-TUI A 110kV - Structures | Unplanned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | - | 120,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | **120,000** |
| GIS-TUI A 110kV - Vegetation Control | Planned | Vegetation management | Subtransmission | Transpower | 650,000 | - | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | **650,000** |
| TUI-WRA A 110kV - Condition Assesment 4yrs | Planned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | 80,000 | - | - | - | 40,000 | - | - | - | - | 40,000 | - | - | - | **80,000** |
| TUI-WRA A 110kV - Patrols | Planned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | 152,000 | - | 19,000 | 19,000 | | 19,000 | 19,000 | 19,000 | 19,000 | | 19,000 | 19,000 | 19,000 | **152,000** |
| TUI-WRA A 110kV - Access Road Maint | Unplanned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | - | 100,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| TUI-WRA A 110kV - Conductors | Unplanned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | - | 180,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | **180,000** |
| TUI-WRA A 110kV - Insulators | Unplanned | Routine & Corrective Maint & Inspection | Subtransmission | Transpower | - | 220,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | 22,000 | **220,000** |
| TUI-WRA A 110kV - Vegetation Control | Planned | Vegetation management | Subtransmission | Transpower | 200,000 | - | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | **200,000** |
| All ex TP Lines - provision for major maint post 2018 | Planned | Asset replacement and renewal | Subtransmission | Transpower | 500,000 | - | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | **500,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| **Sub Total Transmission Lines** | | | | | 2,679,086 | 1,979,329 | **427,164** | **427,164** | **578,164** | **427,164** | **427,164** | **427,164** | **511,933** | **578,165** | **427,165** | **427,165** | **427,165** | **4,658,415** |
| 50kV Patrols (Ground & Helicopter) | Planned | Routine & Corrective Maint & Inspection | Subtransmission | Distribution | 240,000 | - | 24,000 | 24,000 | 24,000 | 24,000 | 24,000 | 24,000 | 24,000 | 24,000 | 24,000 | 24,000 | 24,000 | **240,000** |
| 50kV Inspections (Climbing) | Planned | Routine & Corrective Maint & Inspection | Subtransmission | Distribution | 200,000 | - | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | **200,000** |
| 50kV Testing - Ultrasound scan (Poles) | Planned | Routine & Corrective Maint & Inspection | Subtransmission | Distribution | 100,000 | - | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| 50kV Defect / Fault repairs | Unplanned | Service interruptions and emergencies | Subtransmission | Distribution | - | 120,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | **120,000** |
| 50kV Fault response (incl Helicopter) | Unplanned | Service interruptions and emergencies | Subtransmission | Distribution | - | 200,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | **200,000** |
| 50kV Radio Interference correction | Unplanned | Service interruptions and emergencies | Subtransmission | Distribution | - | 60,918 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | **60,918** |
| 50kV Pole component replacement/maint (inc Waihi 2018/19 | Planned | Asset replacement and renewal | Subtransmission | Distribution | 600,000 | - | 150,000 | 150,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | **600,000** |
| 50kV Faults Management | Planned | Service interruptions and emergencies | Subtransmission | Distribution | 260,000 | - | 26,000 | 26,000 | 26,000 | 26,000 | 26,000 | 26,000 | 26,000 | 26,000 | 26,000 | 26,000 | 26,000 | **260,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 1,400,000 | 380,918 | **268,092** | **268,092** | **168,092** | **168,092** | **168,092** | **168,092** | **168,092** | **168,092** | **168,092** | **168,092** | **168,092** | **1,780,918** |
| **11kV Lines Cables** | | | | | | | | | | | | | | | | | | |
| 11kV Patrols & general maintenance | Planned | Routine & Corrective Maint & Inspection | Distribution and LV lines | Distribution | 2,000,000 | - | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | **2,000,000** |
| 11kV Testing -Ultrasound scan (Poles) | Planned | Routine & Corrective Maint & Inspection | Distribution and LV lines | Distribution | 800,000 | - | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 | **800,000** |
| 11kV Tree Control program Wairoa | Planned | Vegetation management | Distribution and LV lines | Distribution | 1,500,000 | - | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | **1,500,000** |
| 11kV Tree control program Gisborne | Planned | Vegetation management | Distribution and LV lines | Distribution | 4,500,000 | - | 450,000 | 450,000 | 450,000 | 450,000 | 450,000 | 450,000 | 450,000 | 450,000 | 450,000 | 450,000 | 450,000 | **4,500,000** |
| 11kV Forestry Tree Control Program | Planned | Vegetation management | Distribution and LV lines | Distribution | 2,500,000 | - | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | **2,500,000** |
| 11kV Storm Contengency | Unplanned | Service interruptions and emergencies | Distribution and LV lines | Distribution | - | 1,000,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | **1,000,000** |
| 11kV Trees forced cutting | Unplanned | Vegetation management | Distribution and LV lines | Distribution | - | 500,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | **500,000** |
| 11kV Defect / Fault repairs | Unplanned | Service interruptions and emergencies | Distribution and LV lines | Distribution | - | 2,639,780 | 263,978 | 263,978 | 263,978 | 263,978 | 263,978 | 263,978 | 263,978 | 263,978 | 263,978 | 263,978 | 263,978 | **2,639,780** |
| 11kV Fault response | Unplanned | Service interruptions and emergencies | Distribution and LV lines | Distribution | - | 1,300,000 | 130,000 | 130,000 | 130,000 | 130,000 | 130,000 | 130,000 | 130,000 | 130,000 | 130,000 | 130,000 | 130,000 | **1,300,000** |
| 11kVControl and Switching costs | Unplanned | Routine & Corrective Maint & Inspection | Distribution and LV lines | Distribution | - | 200,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | **200,000** |
| 11kV ABS & Redundant Equip Removal/Disposal | Planned | Routine & Corrective Maint & Inspection | Distribution and LV lines | Distribution | 400,000 | - | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | **400,000** |
| 11kV Faults Management | Planned | Service interruptions and emergencies | Distribution and LV lines | Distribution | 5,000,000 | - | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | **5,000,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 16,700,000 | 5,639,780 | **2,233,978** | **2,233,978** | **2,233,978** | **2,233,978** | **2,233,978** | **2,233,978** | **2,233,978** | **2,233,978** | **2,233,978** | **2,233,978** | **2,233,978** | **22,339,780** |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **400V Lines Cables** | | | | | | | | | | | | | | | | | | |
| 400VLine Patrols & minor maintenance | Planned | Routine & Corrective Maint & Inspection | Distribution and LV lines | Distribution | 100,000 | - | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| 400V Testing -Ultrasound scan (Poles) | Planned | Routine & Corrective Maint & Inspection | Distribution and LV lines | Distribution | 150,000 | - | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | **150,000** |
| 400V Defect / Fault repairs | Unplanned | Service interruptions and emergencies | Distribution and LV lines | Distribution | - | 507,650 | 50,765 | 50,765 | 50,765 | 50,765 | 50,765 | 50,765 | 50,765 | 50,765 | 50,765 | 50,765 | 50,765 | **507,650** |
| 400V Fault response | Unplanned | Service interruptions and emergencies | Distribution and LV lines | Distribution | - | 253,825 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | **253,825** |
| 400V General Maint Cables | Planned | Routine & Corrective Maint & Inspection | Distribution and LV cables | Distribution | 100,000 | - | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| 400V Faults Management | Planned | Service interruptions and emergencies | Distribution and LV lines | Distribution | 250,000 | - | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | **250,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 600,000 | 761,475 | **136,148** | **136,148** | **136,148** | **136,148** | **136,148** | **136,148** | **136,148** | **136,148** | **136,148** | **136,148** | **136,148** | **1,361,475** |
| **Service Connections** | | | | | | | | | | | | | | | | | | |
| Service Patrols/inspection & minor maint | Planned | Routine & Corrective Maint & Inspection | Distribution and LV cables | Distribution | 50,767 | - | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | **50,767** |
| Voltage Checks/Complaints | Unplanned | Routine & Corrective Maint & Inspection | Distribution and LV lines | Distribution | - | 203,060 | 20,306 | 20,306 | 20,306 | 20,306 | 20,306 | 20,306 | 20,306 | 20,306 | 20,306 | 20,306 | 20,306 | **203,060** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 50,767 | 203,060 | **25,383** | **25,383** | **25,383** | **25,383** | **25,383** | **25,383** | **25,383** | **25,383** | **25,383** | **25,383** | **25,383** | **253,827** |
| **Load Control** | | | | | | | | | | | | | | | | | | |
| Load Control Injection plant testing & routine maint | Planned | Routine & Corrective Maint & Inspection | Other network assets | Distribution | 81,222 | - | 8,122 | 8,122 | 8,122 | 8,122 | 8,122 | 8,122 | 8,122 | 8,122 | 8,122 | 8,122 | 8,122 | **81,222** |
| Load Control Defect / Fault repairs | Unplanned | Service interruptions and emergencies | Other network assets | Distribution | - | 50,767 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | **50,767** |
| Load Control Fault response | Unplanned | Service interruptions and emergencies | Other network assets | Distribution | - | 50,767 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | **50,767** |
| Load Control Faults Management | Planned | Service interruptions and emergencies | Other network assets | Distribution | 60,000 | - | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | **60,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 141,222 | 101,534 | **24,275** | **24,275** | **24,275** | **24,275** | **24,275** | **24,275** | **24,275** | **24,276** | **24,276** | **24,276** | **24,276** | **242,756** |
| **Zone Substations** | | | | | | | | | | | | | | | | | | |
| GIS - Fault Attendance/Restoration | Unplanned | Service interruptions and emergencies | Zone substations | Transpower | - | 105,540 | 10,554 | 10,554 | 10,554 | 10,554 | 10,554 | 10,554 | 10,554 | 10,554 | 10,554 | 10,554 | 10,554 | **105,540** |
| GIS - Inspections & routine maint | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 1,000,000 | - | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | **1,000,000** |
| GIS - Repairs | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 700,000 | - | 70,000 | 70,000 | 70,000 | 70,000 | 70,000 | 70,000 | 70,000 | 70,000 | 70,000 | 70,000 | 70,000 | **700,000** |
| GIS -5 yr Earth Test | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 19,290 | - | - | - | - | 9,645 | - | - | - | - | 9,645 | - | - | **19,290** |
| TOK - Fault Attendance/Restoration | Unplanned | Service interruptions and emergencies | Zone substations | Transpower | - | 12,872 | 1,287 | 1,287 | 1,287 | 1,287 | 1,287 | 1,287 | 1,287 | 1,287 | 1,287 | 1,287 | 1,287 | **12,872** |
| TOK - Inspections & routine maint | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 200,000 | - | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | **200,000** |
| TOK - Repairs | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 100,000 | - | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| TUI - Fault Attendance/Restoration | Unplanned | Service interruptions and emergencies | Zone substations | Transpower | - | 100,740 | 10,074 | 10,074 | 10,074 | 10,074 | 10,074 | 10,074 | 10,074 | 10,074 | 10,074 | 10,074 | 10,074 | **100,740** |
| TUI - Inspections & routine maint | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 112,517 | - | 11,252 | 11,252 | 11,252 | 11,252 | 11,252 | 11,252 | 11,252 | 11,252 | 11,252 | 11,252 | 11,252 | **112,517** |
| TUI - Repairs | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 465,557 | - | 46,556 | 46,556 | 46,556 | 46,556 | 46,556 | 46,556 | 46,556 | 46,556 | 46,556 | 46,556 | 46,556 | **465,557** |
| TUI - 5 yr Earth Test | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 5,077 | - | - | - | - | 5,077 | - | - | - | - | - | - | - | **5,077** |
| WRA - Fault Attendance/Restoration | Unplanned | Service interruptions and emergencies | Zone substations | Transpower | - | 132,881 | 13,288 | 13,288 | 13,288 | 13,288 | 13,288 | 13,288 | 13,288 | 13,288 | 13,288 | 13,288 | 13,288 | **132,881** |
| WRA - Inspections & routine maint | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 500,000 | - | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | **500,000** |
| WRA - Repairs | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 500,000 | - | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | **500,000** |
| WRA- 5 yr Earth Test | Planned | Routine & Corrective Maint & Inspection | Zone substations | Transpower | 11,168 | - | - | - | - | 5,584 | - | - | - | - | 5,584 | - | - | **11,168** |
| All ex TP Substns - provision for major maint | Planned | Asset replacement and renewal | Zone substations | Transpower | 150,000 | - | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | **150,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| **Sub Total Transmission Zone Substations** | | | | | 3,763,610 | **352,034** | **408,011** | **408,011** | **408,011** | **428,317** | **408,011** | **408,011** | **408,011** | **408,011** | **423,240** | **408,011** | **408,011** | **4115643.87** |
| **Sub Total Trans Lines + Subs Maint** | | | | | 6,442,695 | **2,331,363** | **835,175** | **835,175** | **986,175** | **855,481** | **835,175** | **835,175** | **919,944** | **986,176** | **850,405** | **835,176** | **835,176** | **8774058.45** |
| Zone Sub 4 Monthly Inspections & minor maint | Planned | Routine & Corrective Maint & Inspection | Zone substations | Distribution | 253,827 | - | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | **253,827** |
| Zone Sub Grounds Maintenance | Planned | Routine & Corrective Maint & Inspection | Zone substations | Distribution | **700,000** | **-** | **60,000** | **70,000** | **70,000** | **70,000** | **70,000** | **70,000** | **70,000** | **70,000** | **70,000** | **70,000** | **70,000** | **700,000** |
| Zone Sub Occupational Health and safety Inspect | Planned | Routine & Corrective Maint & Inspection | Zone substations | Distribution | 50,000 | - | 5,077 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | **50,000** |
| Zone Sub Thermovision/Ultrasound Inspections (10 sites x 2 | Planned | Asset replacement and renewal | Zone substations | Distribution | 200,000 | - | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | **200,000** |
| Zone Sub Transformer paint | Planned | Asset replacement and renewal | Zone substations | Distribution | **200,000** | **-** | **20,000** | **20,000** | **20,000** | **20,000** | **20,000** | **20,000** | **20,000** | **20,000** | **20,000** | **20,000** | **20,000** | **200,000** |
| Zone SubAverage Routine Maintenance/major maint | Planned | Routine & Corrective Maint & Inspection | Zone substations | Distribution | 650,000 | - | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | **650,000** |
| Zone Sub DGA furrow tests 2yr | Planned | Routine & Corrective Maint & Inspection | Zone substations | Distribution | 115,743 | - | 11,574 | 11,574 | 11,574 | 11,574 | 11,574 | 11,574 | 11,574 | 11,574 | 11,574 | 11,574 | 11,574 | **115,743** |
| Zone Sub Average tap changer overhauls 2 units p.a. | Planned | Asset replacement and renewal | Zone substations | Distribution | 152,297 | - | 15,230 | 15,230 | 15,230 | 15,230 | 15,230 | 15,230 | 15,230 | 15,230 | 15,230 | 15,230 | 15,230 | **152,297** |
| Zone Sub Average oil processing 2 p.a. | Planned | Asset replacement and renewal | Zone substations | Distribution | 121,838 | - | 12,184 | 12,184 | 12,184 | 12,184 | 12,184 | 12,184 | 12,184 | 12,184 | 12,184 | 12,184 | 12,184 | **121,838** |
| Zone Sub 5yr "Step Touch" earth test (5 yr) | Planned | Routine & Corrective Maint & Inspection | Zone substations | Distribution | 71,072 | - | - | - | - | - | 35,536 | - | - | - | - | 35,536 | - | **71,072** |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone Sub Protection Testing/CB Service/5 yr | Planned | Routine & Corrective Maint & Inspection | Zone substations | Distribution | **350,000** | **-** | **35,000** | **35,000** | **35,000** | **35,000** | **35,000** | **35,000** | **35,000** | **35,000** | **35,000** | **35,000** | **35,000** | **350,000** |
| Zone Sub Building Maint (paint/spouting/doors/windows) | Planned | Routine & Corrective Maint & Inspection | Zone substations | Distribution | **10,000** | **-** | **10,000** | **10,000** | **10,000** | **10,000** | **10,000** | **10,000** | **10,000** | **10,000** | **10,000** | **10,000** | **10,000** | **100,000** |
| Zone Sub Defect / Fault repairs | Unplanned | Service interruptions and emergencies | Zone substations | Distribution | - | 253,827 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | 25,383 | **253,827** |
| Zone Sub Fault response | Unplanned | Service interruptions and emergencies | Zone substations | Distribution | - | 40,611 | 4,061 | 4,061 | 4,061 | 4,061 | 4,061 | 4,061 | 4,061 | 4,061 | 4,061 | 4,061 | 4,061 | **40,611** |
| Zone Sub Faults Management | Planned | Service interruptions and emergencies | Zone substations | Distribution | 100,000 | - | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 2,974,776 | 294,438 | **318,890** | **328,814** | **328,814** | **328,814** | **364,349** | **328,814** | **328,814** | **328,815** | **328,815** | **364,351** | **328,815** | **3,359,214** |
| **Pole Mounted Isolation Equipment** | | | | | | | | | | | | | | | | | | |
| Rural CB Annual Inspections | Planned | Routine & Corrective Maint & Inspection | Distribution switchgear | Distribution | 137,067 | - | 13,707 | 13,707 | 13,707 | 13,707 | 13,707 | 13,707 | 13,707 | 13,707 | 13,707 | 13,707 | 13,707 | **137,067** |
| Rural CB Average Routine Maintenance | Planned | Routine & Corrective Maint & Inspection | Distribution switchgear | Distribution | 180,000 | - | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | **180,000** |
| Rural CB Defect /Fault repairs | Unplanned | Service interruptions and emergencies | Distribution switchgear | Distribution | - | 200,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | **200,000** |
| Rural CB Faults Management | Planned | Service interruptions and emergencies | Distribution switchgear | Distribution | 100,000 | - | 5,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 417,067 | 200,000 | **56,707** | **61,707** | **61,707** | **61,707** | **61,707** | **61,707** | **61,707** | **61,707** | **61,707** | **61,707** | **61,707** | **617,067** |
| **Distribution Transformers** | | | | | | | | | | | | | | | | | | |
| TX Refurbishment <100kVA | Planned | Asset replacement and renewal | Distribution substations and transf | Distribution | 50,000 | - | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | **50,000** |
| TX Refurbishment >100kVA | Planned | Asset replacement and renewal | Distribution substations and transf | Distribution | 80,000 | - | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | **80,000** |
| GM TX Inspection (incl minor maint & MDI's) | Planned | Routine & Corrective Maint & Inspection | Distribution substations and transf | Distribution | 500,000 | - | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | **500,000** |
| TX Oil Analysis/Handling /filtering /TX disposal | Planned | Asset replacement and renewal | Distribution substations and transf | Distribution | 100,000 | - | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| TX Earth testing | Planned | Routine & Corrective Maint & Inspection | Distribution substations and transf | Distribution | 600,000 | - | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | **600,000** |
| TX Earthing system repairs | Planned | Asset replacement and renewal | Distribution substations and transf | Distribution | 450,000 | - | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | **450,000** |
| TX Defect /Fault repairs | Unplanned | Service interruptions and emergencies | Distribution substations and transf | Distribution | - | 150,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | **150,000** |
| TX Faults Management | Planned | Service interruptions and emergencies | Distribution substations and transf | Distribution | 100,000 | - | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 1,880,000 | 150,000 | **203,000** | **203,000** | **203,000** | **203,000** | **203,000** | **203,000** | **203,000** | **203,000** | **203,000** | **203,000** | **203,000** | **2,030,000** |
| **11kV Switchgear Ground Mounted** | | | | | | | | | | | | | | | | | | |
| 11kV SWGR Inspection & Servicing/minor maint | Planned | Routine & Corrective Maint & Inspection | Distribution switchgear | Distribution | 10,000 | - | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | **10,000** |
| 11kV SWGR Ave Switch 5yr maint/mech change 2018/19 | Planned | Asset replacement and renewal | Distribution switchgear | Distribution | **400,000** | **-** | **90,000** | **40,000** | **40,000** | **40,000** | **40,000** | **40,000** | **40,000** | **40,000** | **40,000** | **40,000** | **40,000** | **400,000** |
| 11kV SWGR Defect /Fault repairs | Unplanned | Service interruptions and emergencies | Distribution switchgear | Distribution | - | 100,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| 11kV SWGR General maint consumer/kiosk substns | Planned | Routine & Corrective Maint & Inspection | Distribution switchgear | Distribution | 100,000 | - | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| 11kV SWGR Faults Management | Planned | Service interruptions and emergencies | Distribution switchgear | Distribution | 130,000 | - | 10,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | **130,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 640,000 | 100,000 | **121,000** | **74,000** | **74,000** | **74,000** | **74,000** | **74,000** | **74,000** | **74,000** | **74,000** | **74,000** | **74,000** | **740,000** |
| **LV Switchgear & Pillars** | | | | | | | | | | | | | | | | | | |
| 400V SWGR Inspection & Servicing/minor maint | Planned | Routine & Corrective Maint & Inspection | Distribution switchgear | Distribution | 150,000 | - | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | **150,000** |
| 400V SWGR Defect /Fault repairs | Unplanned | Service interruptions and emergencies | Distribution switchgear | Distribution | - | 100,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | **100,000** |
| Galv Box inspections & maint | Planned | Routine & Corrective Maint & Inspection | Distribution switchgear | Distribution | 50,000 | - | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | **50,000** |
| 400V OH Service Fuse Base & Carrier replacement | Unplanned | Asset replacement and renewal | Distribution switchgear | Distribution | - | 500,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | **500,000** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 200,000 | 600,000 | **80,000** | **80,000** | **80,000** | **80,000** | **80,000** | **80,000** | **80,000** | **80,000** | **80,000** | **80,000** | **80,000** | **800,000** |
| **Communications** | | | | | | | | | | | | | | | | | | |
| Comms Maintenance/Calibration | Planned | Asset replacement and renewal | Other network assets | Distribution | 350,000 | - | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 | **350,000** |
| Comms Track Inspection & Maintenance | Planned | Routine & Corrective Maint & Inspection | Other network assets | Distribution | 40,000 | - | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | **40,000** |
| Comms Hut Inspection & Maintenance | Planned | Routine & Corrective Maint & Inspection | Other network assets | Distribution | 40,000 | - | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | **40,000** |
| Comms Radio Licences | Planned | Routine & Corrective Maint & Inspection | Other network assets | Distribution | 131,989 | - | 13,199 | 13,199 | 13,199 | 13,199 | 13,199 | 13,199 | 13,199 | 13,199 | 13,199 | 13,199 | 13,199 | **131,989** |
| Comms Defect/Fault repairs | Unplanned | Service interruptions and emergencies | Other network assets | Distribution | - | 162,449 | 16,245 | 16,245 | 16,245 | 16,245 | 16,245 | 16,245 | 16,245 | 16,245 | 16,245 | 16,245 | 16,245 | **162,449** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 561,989 | 162,449 | **72,444** | **72,444** | **72,444** | **72,444** | **72,444** | **72,444** | **72,444** | **72,444** | **72,444** | **72,444** | **72,444** | **724,438** |
| **SCADA** | | | | | | | | | | | | | | | | | | |
| SCADA Support fees | Planned | Routine & Corrective Maint & Inspection | Other network assets | Distribution | 101,530 | - | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | **101,530** |
| SCADA Software Licences | Planned | Routine & Corrective Maint & Inspection | Other network assets | Distribution | 50,767 | - | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | 5,077 | **50,767** |
| SCADA maintenance allowance | Planned | Asset replacement and renewal | Other network assets | Distribution | 101,530 | - | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | **101,530** |
| SCADA Configuration and file alterations | Planned | Routine & Corrective Maint & Inspection | Other network assets | Distribution | 60,919 | - | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | 6,092 | **60,919** |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCADA Defect/Fault repairs | Unplanned | Service interruptions and emergencies | Other network assets | Distribution | - | 101,530 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | 10,153 | **101,530** |
| (Please leave this row blank) | | | | | | | | | | | | | | | | | | |
| | | | | | 314,746 | 101,530 | **41,627** | **41,627** | **41,627** | **41,627** | **41,627** | **41,627** | **41,627** | **41,628** | **41,628** | **41,628** | **41,628** | **416,276** |
| **ACOD - EGL** | Planned | Asset replacement and renewal | Other network assets | Distribution | **14,210,000** | - | **1,727,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **14,210,000** |
| | | | | | 14,210,000 | - | **1,727,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **1,421,000** | **14,210,000** |
| **FAULTS MANAGEMENT** | | | | | | | | | | | | | | | | | | - |
| **(Total from above - Fault Mgt $547.5k, MEP, Stby LM)** | | | | | - | - | **592,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **6,000,000** |
| | **Faults MGT** | | | | - | - | **592,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **600,000** | **6,000,000** |
| | Total Maintenance (Ntk) Expenditure Projections | | | Distribution | - | - | 5,308,543 | 4,970,466 | 4,870,466 | 4,870,466 | 4,906,002 | 4,870,466 | 4,870,466 | 4,870,470 | 4,870,470 | 4,906,006 | 4,870,470 | **48,875,752** |
| | Total Maintenance (Trans ) Expenditure Projections | | | Transpower | - | - | 835,175 | 835,175 | 986,175 | 855,481 | 835,175 | 835,175 | 919,944 | 986,176 | 850,405 | 835,176 | 835,176 | **8,774,058** |
| | **Total Maintenance (Trans + Ntk) Expenditure Projections** | | | | - | - | **6,143,718** | **5,805,642** | **5,856,642** | **5,725,948** | **5,741,177** | **5,705,642** | **5,790,410** | **5,856,646** | **5,720,875** | **5,741,182** | **5,705,646** | **57,649,810** |

| **Total Expenditure Summary** | 2018/19 | 0 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Service interruptions and emergencies | 1,270,413 | 1,356,415 | 6,000,000 | 7,644,158 | 1,356,415 | 1,364,415 | 1,364,415 | 1,364,415 | 1,364,415 | 1,364,415 | 1,364,415 | 1,364,416 | 1,364,416 | 1,364,416 | 1,364,416 | **13,644,158** |
| Routine & Corrective Maint & Inspection | 1,613,973 | 1,509,737 | 13,217,598 | 2,382,389 | 1,509,737 | 1,519,660 | 1,670,660 | 1,539,966 | 1,555,196 | 1,519,660 | 1,604,429 | 1,670,663 | 1,534,892 | 1,555,199 | 1,519,663 | **15,689,987** |
| Asset replacement and renewal | 339,711 | 535,566 | 17,665,665 | 500,000 | 2,262,566 | 1,906,566 | 1,806,566 | 1,806,566 | 1,806,566 | 1,806,566 | 1,806,566 | 1,806,567 | 1,806,567 | 1,806,567 | 1,806,567 | **18,165,665** |
| Vegetation management | 1,015,000 | 1,015,000 | 9,650,000 | 500,000 | 1,015,000 | 1,015,000 | 1,015,000 | 1,015,000 | 1,015,000 | 1,015,000 | 1,015,000 | 1,015,000 | 1,015,000 | 1,015,000 | 1,015,000 | **10,150,000** |
| | **4239097.043** | **4416718.13** | **46533262.9** | 11,026,547 | 6,143,718 | **5,805,642** | **5,856,642** | **5,725,948** | **5,741,177** | **5,705,642** | **5,790,410** | **5,856,646** | **5,720,875** | **5,741,182** | **5,705,646** | **57,649,810** |

## 7.4 How is the asset value changing

Ideally Eastland Network Limited's asset value should remain fairly constant given the average position in terms of security and performance and general satisfaction, across the consumer base with the security/performance verses price trade off currently provided. Any decline of service potential associated with the aging asset should be off-set by an equal restoring of service potential. Factors that will influence the asset value are shown in Table 7.4(a) below:

Table 7.4(a) – Factors influencing asset value

| Factors that increase asset value | Factors that decrease asset value |
|---|---|
| Addition of new assets to the network as a result of improvements to Security and Performance levels or new asset in response to growth. | Removal of assets from the network generally associated with moving industrial and commercial load centers. |
| Renewal of existing assets. Note the definition of renewal as being restoration of original functionality – no increase in service potential beyond original functionality. | On-going depreciation of assets. |
| Increase of standard component values implicit in the ODV methodology. | Reduction of standard component values implicit in the ODV methodology. |

At a practical level Eastland Network Limited's asset valuation will vary even in the absence of component revaluations. This is principally because the accounting treatment of depreciation models the decline in service potential as a straight line (when in most cases it is more closely reflected by an inverted bath-tub curve) whilst the restoration of service potential is very "lumpy". However the aggregation of many depreciating assets and many restoration projects tends to smooth short-term variations in asset value.

The asset value ratio across the urban and rural assets is changing. The urban asset value is increasing as the rural asset value is decreasing. This shift is in line with the greater levels of security and higher performance levels provided in the urban centers. The shift is also influenced by economic justification. With controls on the differential between more economic urban and less uneconomic rural tariffs, the matching of expenditure, affecting asset condition and age, to income, ultimately results in a corresponding shift of asset value.

## 7.5 Depreciation and Renewal of the assets

Eastland Network Limited has identified a small gap between required renewal rates for some assets to maintain asset age, primarily limited by available funding and economic returns.

The nature of the existing asset is such that it will physically deteriorate over its life until it reaches a stage where renewal is required to maintain service. In addition the life expectancies of the components making up the asset are varied which affects the accuracy of renewal forecasts. The renewal costs for these asset components need to be provided for over their respective lives.

Depreciation provides the mechanism to fund this renewal.
The ability for renewal to be funded by depreciation is affected by-
The correct value being assigned to the assets
The correct age expectancy being assigned to the assets
Stability of the costs for the new equivalent asset over time.
Selection of the correct asset components to be removed.

The asset value for Eastland Network Limited has been based on the ODV methodology. This methodology values the existing asset assuming no asset exists initially, 'Green fields approach' and lowest standard cost of the minimum required asset over a 10 year planning cycle.

This method of valuation differs from the actual renewal situation in the following areas:

Renewal costs include costs to remove the existing asset and maintain service while the new asset is installed.

The planning period adopted for new assets is generally greater than 10 years to align more closely with asset life hence avoiding frequent upgrade on an in-service asset that is difficult to access.

At the component level it is often appropriate to change assets not at end of life in conjunction with the asset targeted for renewal.

Any short fall between depreciation funding and renewal cost must be provided from some other source.

The justifiable growth component of renewal expenditure can be sourced from growth funding made available from growth revenue or borrowing.

Higher charges or reduction in the Return on Asset provided to the shareholder can also provide the additional funding.

Finally retiring of the asset at the time of failure, with the resulting reduction or total loss of service is a consideration.

Given set requirements for shareholder expectations ,set requirements from regulators for revenue, defined limits and justifications on borrowing levels and the need to allocate funding to growth and performance improvement, Eastland Network Limited has identified a gap developing between forecast required renewal rates and the target rates that can be financially achieved. This will be particularly significant as Eastland Network Limited approaches the "bow wave" of asset renewals that can be seen in the age profiles for asset components.

The renewal section of this plan identifies the forecast and targeted renewal rates Eastland Network Limited has adopted. For 11kV conductor, a gap as described above is currently developing. For the general case while the set limits remain in place the average age of the asset is increasing and the performance may decline. The observable effects of the declining performance are being offset in the medium term by technology innovations that can be implemented at lower cost than the renewal alternative. Also Eastland Network Limited has identified medium term options to minimise this issue for remote or uneconomic lines which focus on improving systems to target the components requiring renewal more precisely and allowing failures while ensuring backup systems are adequate to maintain performance.

Eastland Network Limited's conclusion is that at some point it must be given an opportunity to increase prices which will enable a balance to be achieved between the level of network investment required and return on asset requirements. Otherwise there is increased risk of performance failure in terms of regulation, customer expectation and sustainability of the business.

# 8. Performance & improvement

## 8.1 Performance against financial plans

Eastland Network Limited's financial year operates from 1 April to 31 March. The results for performance against budget are for the previous financial year (2017/18). The capital and maintenance expenditure tables are shown below.

| Capital Expenditure Comparison | 2017/18 | 2017/18 | 2017/18 |
|---|---|---|---|
| Summary by Asset Group | Budget $ | Actual $ | Difference $ |
| Sub transmission Lines and Cables | 1,031,000 | 1,044,968 | (13,968) |
| Subtotal Trans Assets | 882,296 | 352,932 | 529,364 |
| 11kV Lines and Cables | 3,520,639 | 2,474,584 | 1,046,055 |
| LT Lines and Cables | 648,880 | 693,994 | (45,115) |
| Service Connections | 363,337 | 59,658 | 303,678 |
| Load Control | 22,337 | 6,349 | 15,988 |
| Zone Substations | 1,104,511 | 617,450 | 487,061 |
| Subtotal Trans Assets | 1,961,168 | 486,368 | 1,474,800 |
| 50kV CB's | 0 | 0 | 0 |
| 11kV CB's (Rural Automation) | 55,842 | 59,875 | (4,033) |
| Distribution Transformers | 667,864 | 590,574 | 77,290 |
| Pole Mounted Isolation Equipment | 156,356 | 82,913 | 73,444 |
| 11kV Ground Mounted Switchgear | 307,128 | 266,564 | 40,565 |
| LV Switchgear | 89,346 | 44,758 | 44,589 |
| Control and Protection | 183,505 | 204,667 | (21,162) |
| Communications | 67,010 | 195,824 | (128,814) |
| SCADA | 72,337 | 51,032 | 21,304 |
| General | 77,505 | 28,799 | 48,706 |
| Other | 1,400,000 | 765,733 | 634,267 |
| Total | 12,611,060 | 8,027,041 | 4,584,018 |

| Capital Expenditure Comparison | 2017/18 | 2017/18 | 2017/18 |
|---|---|---|---|
| Summary by category | Budget $ | Actual $ | Difference $ |
| Reliability, Safety & Environment | 746,683 | 491,317 | 255,366 |
| System Growth | 1,103,429 | 615,374 | 488,054 |
| Asset Replacement & Renewal | 9,199,265 | 6,076,715 | 3,122,550 |
| Customer Connection | 111,683 | 77,903 | 33,780 |

| | | | |
|---|---|---|---|
| Asset Relocation | 50,000 | 0 | 50,000 |
| Other | 1,400,000 | 765,733 | 634,267 |
| Total | 12,611,060 | 8,027,041 | 4,584,018 |

| Capital Expenditure Comparison | 2017/18 | 2017/18 | 2017/18 |
|---|---|---|---|
| Summary by type | Budget $ | Actual $ | Difference $ |
| Planned | 11,184,009 | 6,582,410 | 4,601,598 |
| Unplanned | 1,427,051 | 1,444,631 | (17,580) |
| Total | 12,611,060 | 8,027,041 | 4,584,018 |

| Maintenance Expenditure Comparison | 2017/18 | 2017/18 | 2017/18 |
|---|---|---|---|
| Summary by Asset Group | Budget $ | Actual $ | Difference $ |
| Sub Transmission Lines | 610,716 | 318,909 | 291,806 |
| 11kV Lines and Cables | 2,147,896 | 2,107,311 | 40,585 |
| LT Lines and Cables | 136,148 | 184,835 | (48,688) |
| Service Connections | 25,383 | 7,714 | 17,668 |
| Load Control | 24,275 | 15,598 | 8,678 |
| Zone Substations | 769,538 | 527,857 | 241,681 |
| Circuit Breakers | 56,306 | 33,547 | 22,759 |
| Distribution Transformers | 203,000 | 78,878 | 124,122 |
| 11kV Ground Mounted Switchgear | 71,000 | 47,294 | 23,706 |
| LV Switchgear | 80,765 | 73,344 | 7,421 |
| Communications | 72,444 | 56,339 | 16,105 |
| SCADA | 41,627 | 8,355 | 33,372 |
| ACOD | 1,670,000 | 1,353,000 | 317,000 |
| TOTAL | 5,909,097 | 4,812,981 | 1,096,116 |

| Maintenance Expenditure Comparison | 2017/18 | 2017/18 | 2017/18 |
|---|---|---|---|
| Summary by Category | Budget $ | Actual $ | Difference $ |
| Routine and corrective maintenance and inspection | 1,613,973 | 918,306 | 695,667 |
| Asset replacement and renewal | 2,009,711 | 1,556,342 | 453,369 |
| Service interruptions and emergencies | 1,270,413 | 1,270,082 | 331 |
| Vegetation Management | 1,015,000 | 1,068,251 | (53,251) |
| TOTAL | 5,909,097 | 4,812,981 | 1,096,116 |

| Maintenance Expenditure Comparison | 2017/18 | 2017/18 | 2017/18 |
|---|---|---|---|

| Summary by Type | Budget $ | Actual $ | Difference $ |
|---|---|---|---|
| Planned | 4,709,374 | 3,797,224 | 912,151 |
| Unplanned | 1,199,723 | 1,015,757 | 183,966 |
| TOTAL | 5,909,097 | 4,812,981 | 1,096,116 |

A total variation of of $5.680m under spend exists between the 2017/18 period. Capital contributed $4.584m under budget and maintenance contributed 1.096m both under budget.

### 8.1.1 Capital Expenditure

A total variance of $4.584m occurred between the 2017/18 budget and actual capital expenditure. Reasons for this variance are provided below in relation to the categories of capital expenditure.

The $3.122m variance in Asset replacement and renewal expenditure is the result of the following;

$1.7m of the variance relates to 3 subtransmission transformer replacement that was only partially completed in the 2017/18 year due to a manufacturer delay in delivery. The remainder of the budget for the project is continued in the 2018/19 year along with the midlife refurbishment of another transformer.

On-going issues regarding the lack of suitable field service resources to carry out projects was responsible for the deferral and or scaling back of a number of Asset Replacement and Renewal projects. This resulted in $989k of actual versus budget variance for this expenditure category.

The field service resources availability issue was exacerbated last year in that Eastland's primary contractor underwent a change of owner and a subsequent organisational restructure. Eastland continues to work closely with this contractor and other contractors who are not based in the area, to address issues relating to the right sizing of field service resources to meet the requirements of identified projects and associated budgets.

The $489k variance in Growth and Security expenditure is the result of the following;

-Regional development is low hence forecast growth has not been met;

The $256k variation in Reliability and Safety expenditure is the resultant of the following;

-Deferral of Projects due to reallocation of Design Resources

### 8.1.2 Maintenance Expenditure

A total variance of $1.096m occurred between the 2017/18 budget and actual maintenance expenditure.

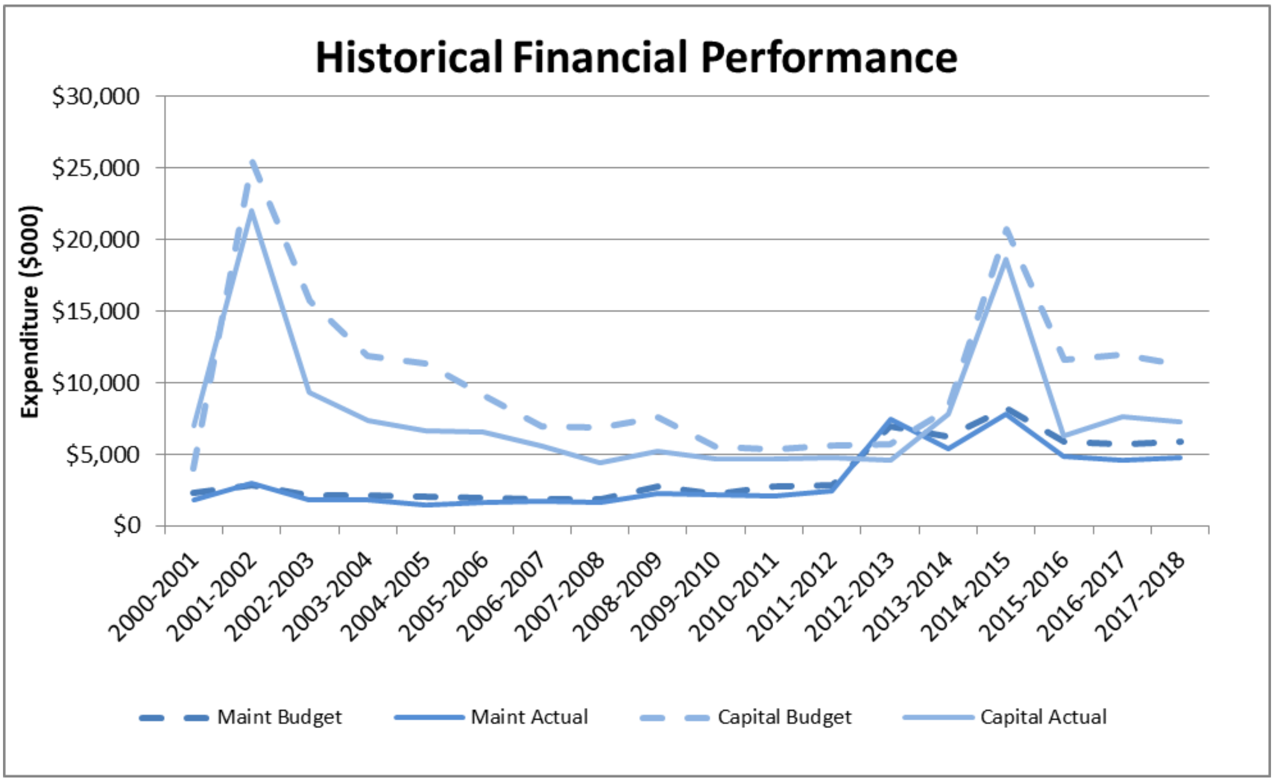
This is primarily due to the short fall of available contractor resources as discussed above .with asset replacement and renewal.

### 8.1.3 Historical performance

The overall past performance to budget is indicated in the following chart. Following the 2001/02 catch up capital expenditure shows a trend declining to 2007/08.

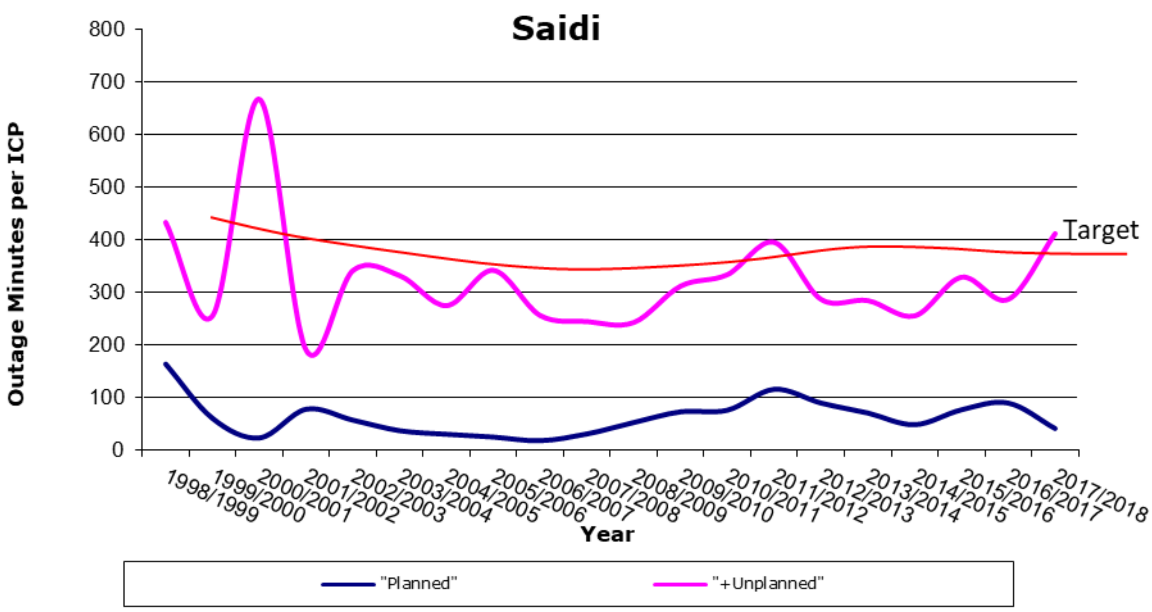
From 2007/08 the trend indicates a steady state pattern with the Transmission acquisition in 2014/2015.

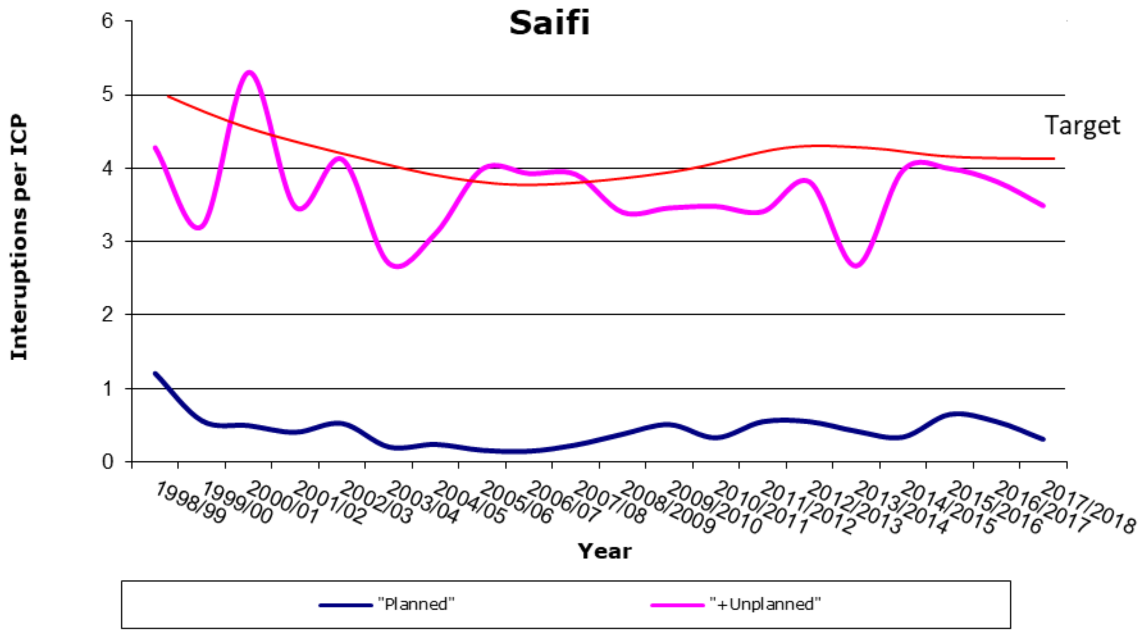
Shortfalls of actual verses budgeted expenditure reflects the gradual increase in asset age forecast over time and potentially indicates the need for future catch up work when the factors governing expenditure change.




## 8.2 Meeting performance targets

### 8.2.1 Primary Service Levels






The primary indicator of reliability performance is the SAIDI index. Besides inherent system security, a wide range of factors impact on observed reliability.

Protection and rural automation is an area where technology delivers large reductions in the impact of outages. Eastland Network Limited has progressively improved the network with this technology between 2000 and 2006.

Optimization of isolation points between 2000 and 2001 has also contributed to improved performance.

Installation of remote diesel generators between 2002 and 2003 has reduced the impact of planned outages. On average over the past 8 years use of generators has avoided 300 SAIDI minutes p.a. The extent of this reduction cannot be seen in the statistics as pole replacement work spur 50kV lines, and substation maintenance work is now carried out without any impact on outage statistics.

Use of Live line technologies has avoided an average of 10 SAIDI minutes p.a. between 2001 and 2008. As a result of skill shortages in 2007 and 2008 and an increase in line renewal work over rugged terrain, the use of Live Line technologies is currently suspended.

While the targeted SAIDI is set at the regulated limit a shift to renewal projects on lines not suited to generator support will increase planned SAIDI figures. This increase will be partially mitigated through the installation of temporary isolation points, (i.e. the cutting of jumpers at shackle points), which results in reduced outage areas affecting less customers.

Significant storm events and environmental factors such as slips after long periods of, generally considered as normal, rainfall have the most significant impact on Eastland Network Limited's ability to achieve its targets. This is evident in the 2000/2001 result where a single 24 hour event contributed to 415.64 SAIDI minutes i.e. 64% of the year's unplanned outages.

The design on the Transmission lines with both circuits on the same tower was exposed to an N-2 event when a Plane impacted both circuits in 2016/2017. The saidi minutes from this single event were 4 times the annual target. This rare event has not been included in the graphs and is normalized out using regulatory reporting requirements.

Other examples of significant events are as follows:

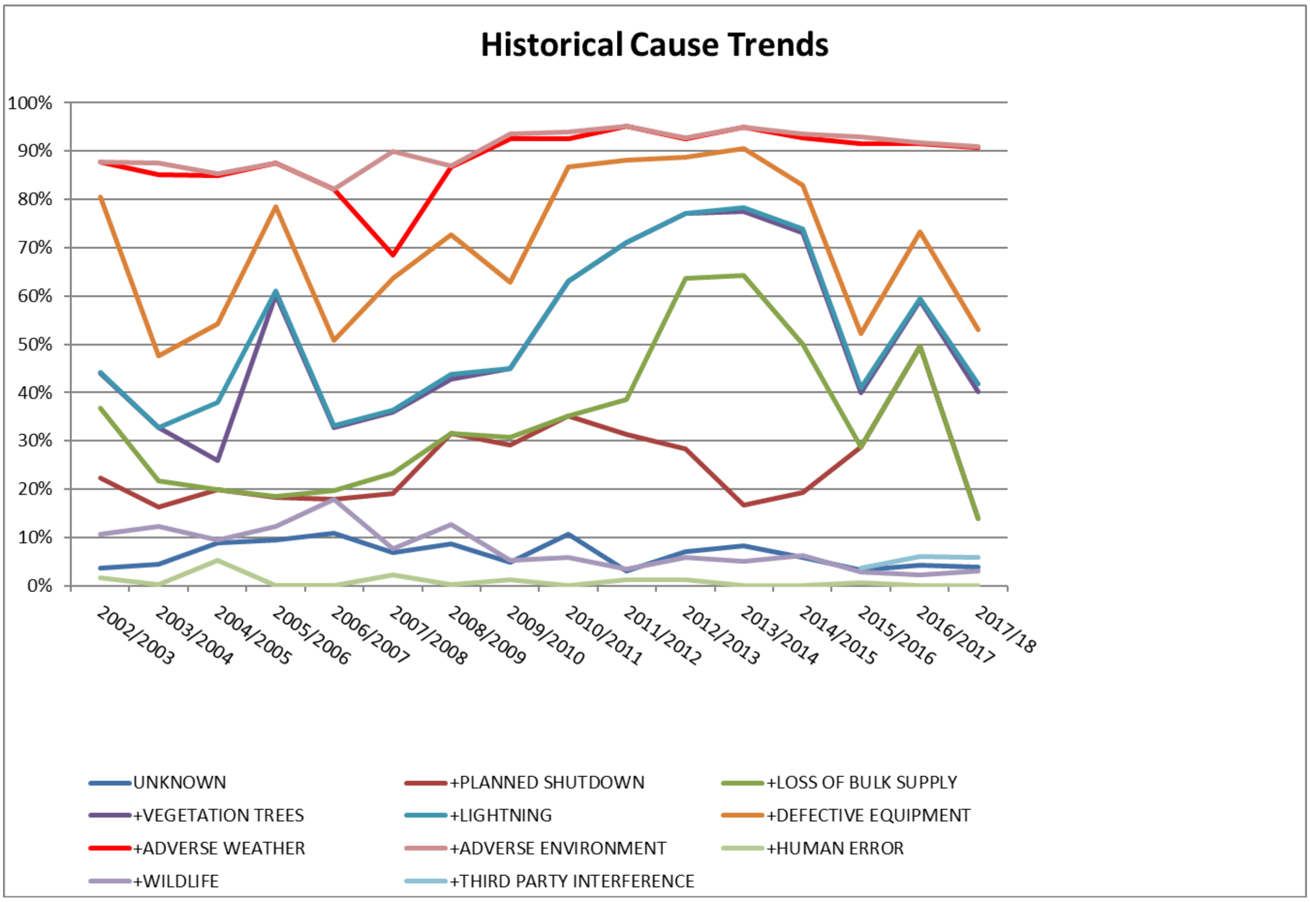
2003/2004, 130.36 Minutes, July storm
2005/2006, 83.83 Minutes, October storm

2006/2007, 99.07 Minutes, June storm
2007/2008, 53.00 Minutes, December Earthquake
2010/2011, 38.80 Minutes, September storm
2011/2012, 41.00 Minutes, March storm.
2012/2013, 40.00 Minutes, October Storm
2016/2017 1672.00 Minutes, Plane Crash (excluded from graph)
Subtraction of these events shows Eastland Network Limited can obtain the target levels through activities it can control.

### 8.2.2 Outage Cause analysis

The historical cause analysis as a percentage of the total customer's affected multiplied by-minutes of interruption time is shown below.

The trend is dominated by variation in adverse weather, tree contacts and defective equipment.

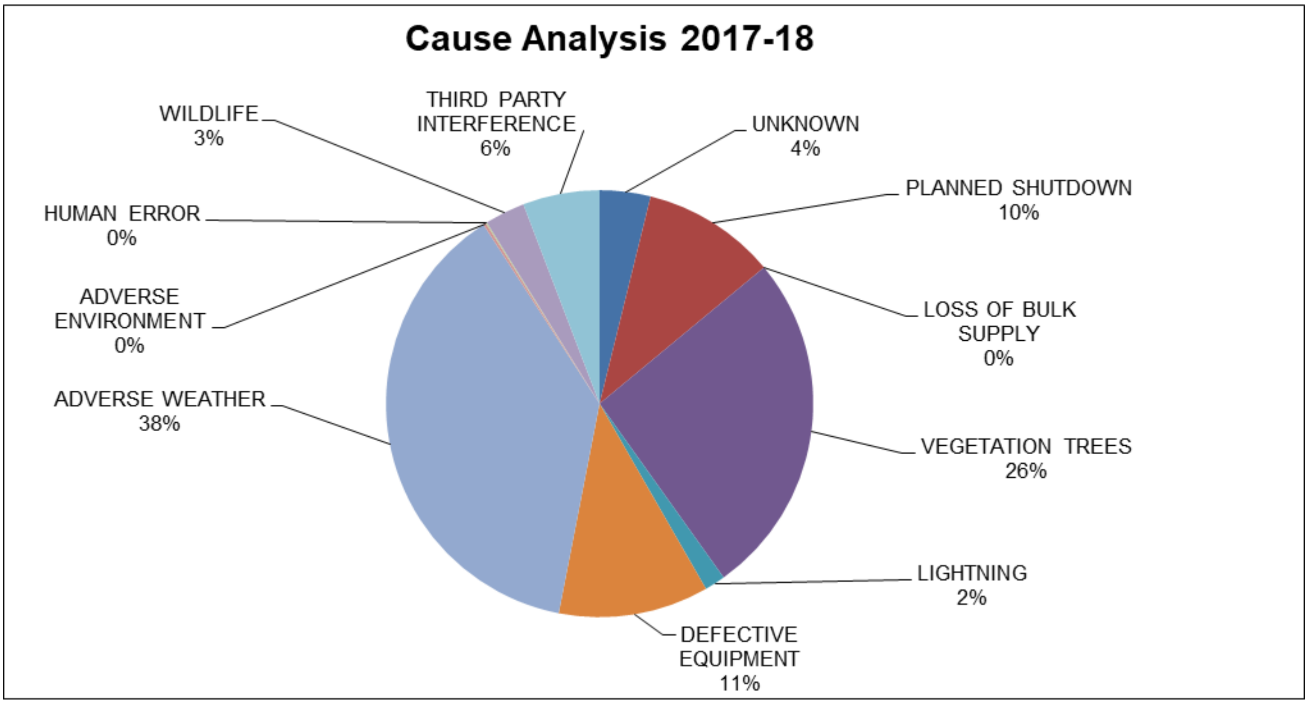



Cause analysis as a percentage of the total customers affected multiplied by-minutes of interruption time during the last year provides the following spread:

- The data excludes a plane crash which would have accounted for 85% of outage causes for the 2016/2017 year.

Loss of Bulk Supply previously peaking at 48% in 2014, has reduced. The transfer of Transmission spur assets to Eastland Network has shifted the risks to other catagories.

Planned shutdowns average 19% p.a. the figure reflects asset renewal on spur assets and activities requiring outages. While the same level of planned outages occurs each year the percentage contribution fluctuates due to higher or lower proportions of unplanned contributions to the total.




The adverse weather component averages 17% p.a. and is in effect reflective of past design, and changing weather trends. Under design is not normally an issue with the exception of extreme wind snow loading events every 2 or 3 years. Designing to these conditions is not considered economic and Eastland Network Limited chooses to manage this risk.

Third Party interference has an average of 8% p.a. This figure is driven by vehicles/pole collisions. Rural automation technology has minimized the impact of these faults however the number of incidents is increasing. The road authorities introduced standards for location of structures alongside roads in 2006. All replacement structures need to conform to set minimum distances from the road edge or be protected by barriers. The costs to upgrade the existing works as part of the renewal will ultimately be borne by Eastland Network Limited's customers rather than the road users, under these requirements.

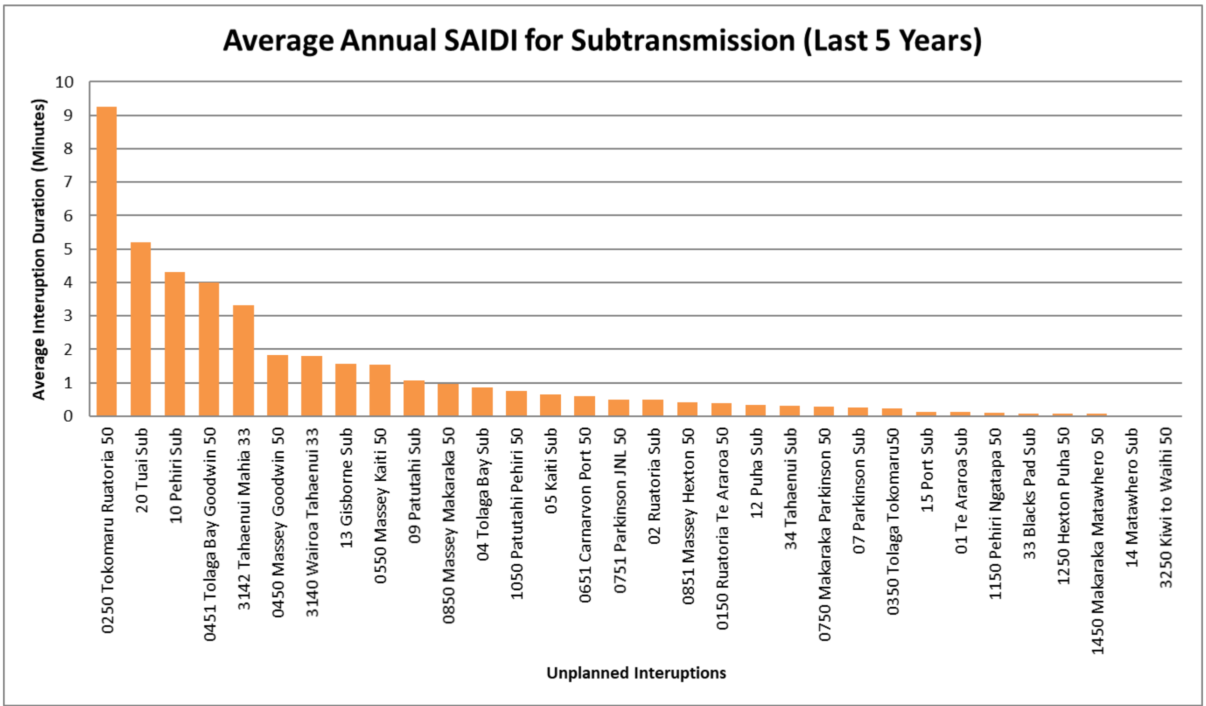
Defective equipment averages 18%. Faults in this category tend to have long repair times/high customer minutes. In most cases causes are related to premature failure of assets In the case of Underground Cables the Heatshrink style terminations on ground mounded switchgear with low bushing clearance are prone to early failure, typically after a period of wet weather followed by high humidity. There is also an increasing trend for newer equipment to fail prior to expectations largely due to reduced quality and workmanship at manufacture. Standardization on proven product, rigid specification and quality control procedures address this issue.

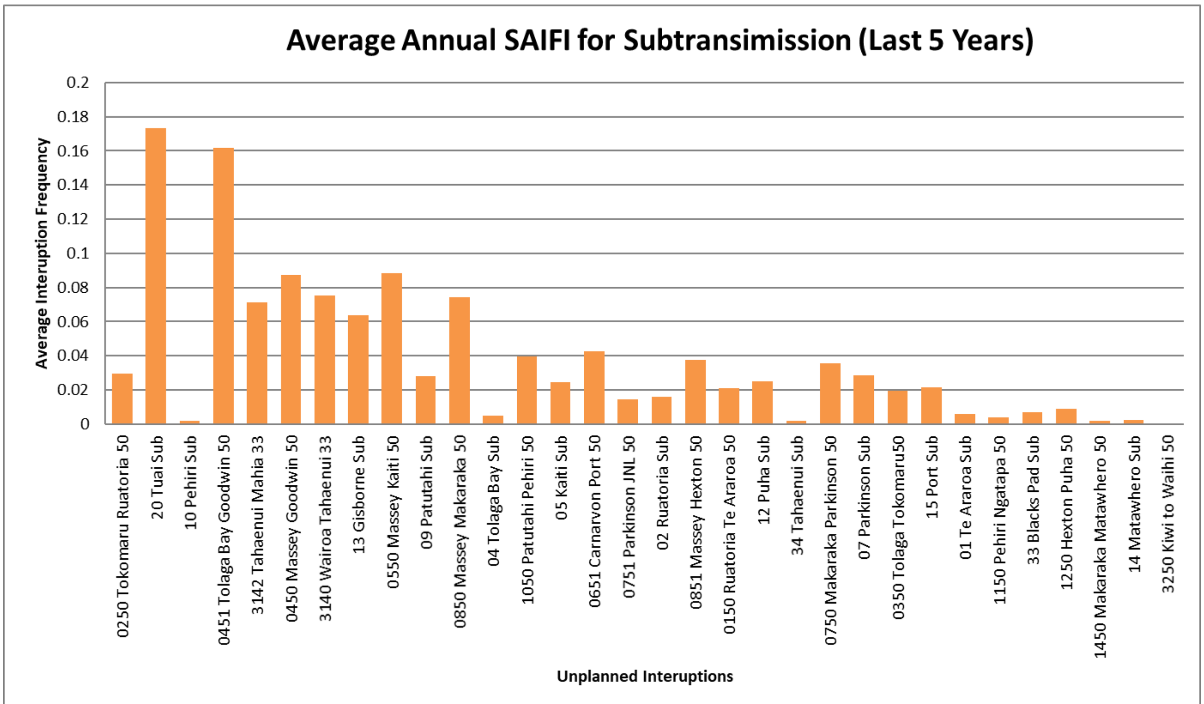
Tree contacts average 17% p.a. The result is influenced by the type and nature of large storms. The figure includes minor tree contacts flying tree debris and falling trees typically outside of the cut zone. The tree regulations and rules governing access to private property have influenced the poor result. As the rules have been implemented the notification processes involved have provided a window in which the trees have encroached safe cut zones. Having grown within the safe cut zone, outages, which are also constrained to ensure regulatory targets are not breached, are now required to remove the trees. The approved resource trained to cut the trees safely is also limited. Over time the tree problems will be reduced as much as practicable, within the requirements of the regulations, which are generally confined to inaccessible rural and remote areas, on privately owned sections of line or forestry blocks. Although the tree regulations provide for cost recovery from tree owners Eastland Network Limited's experience is that faults are likely to occur well before owners can act once the trees have reached the notice zone. Expenditure forecasts for tree control have been increased to compensate.

The Human error figure averaging <1% reflects the quality of safety standards and work practices in place to minimise contractor error.

### 8.2.3 Subtransmission Performance

The performance of Subtransmission feeders is summarised in the following charts showing an average annual performance over the past 7 years. The Gisborne Substation to Goodwin 50kV line appears as the worst performing section of line. As the line is a spur line use of distributed generation is the only method of support. The development work on the 50kV rings described in previous plans has been completed following these events hence performance of urban feeders is improving. The Tolaga Bay Goodwin 50kV line has also had significant pole renewal between 2007 and 2008; hence the line is expected to show improved performance in future.

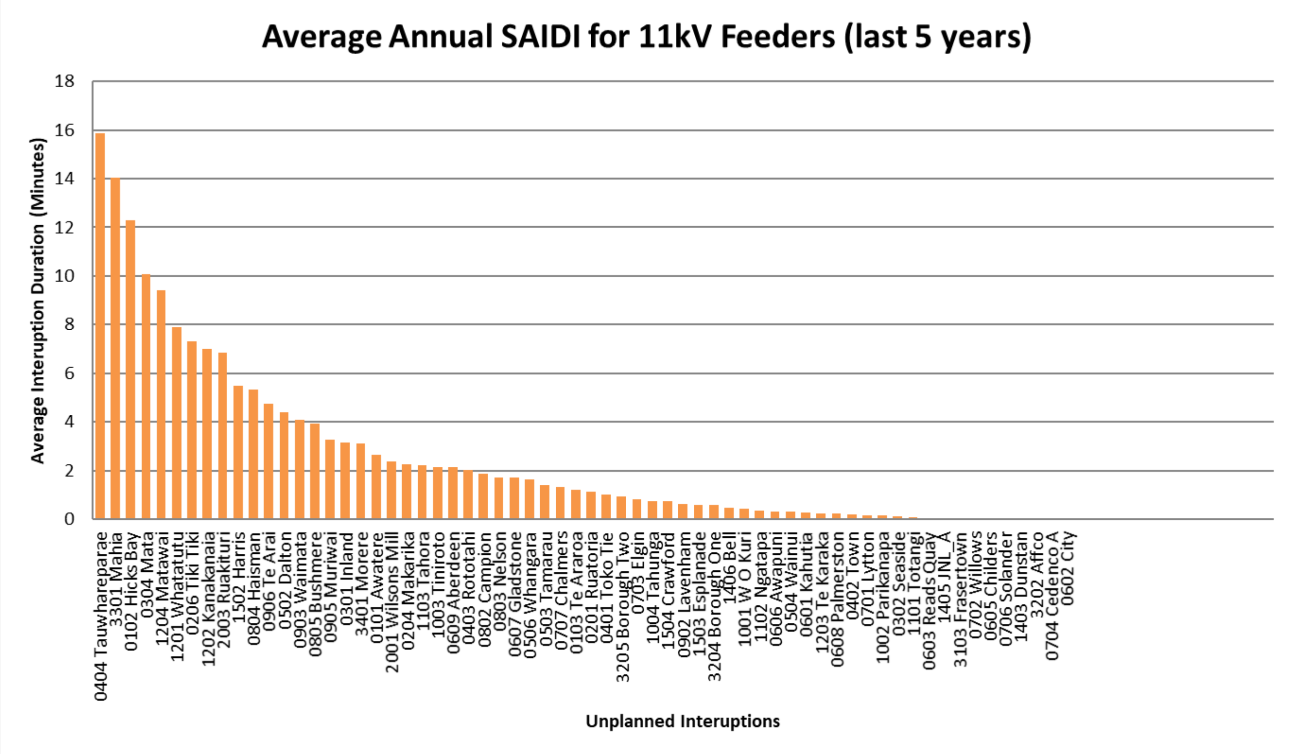


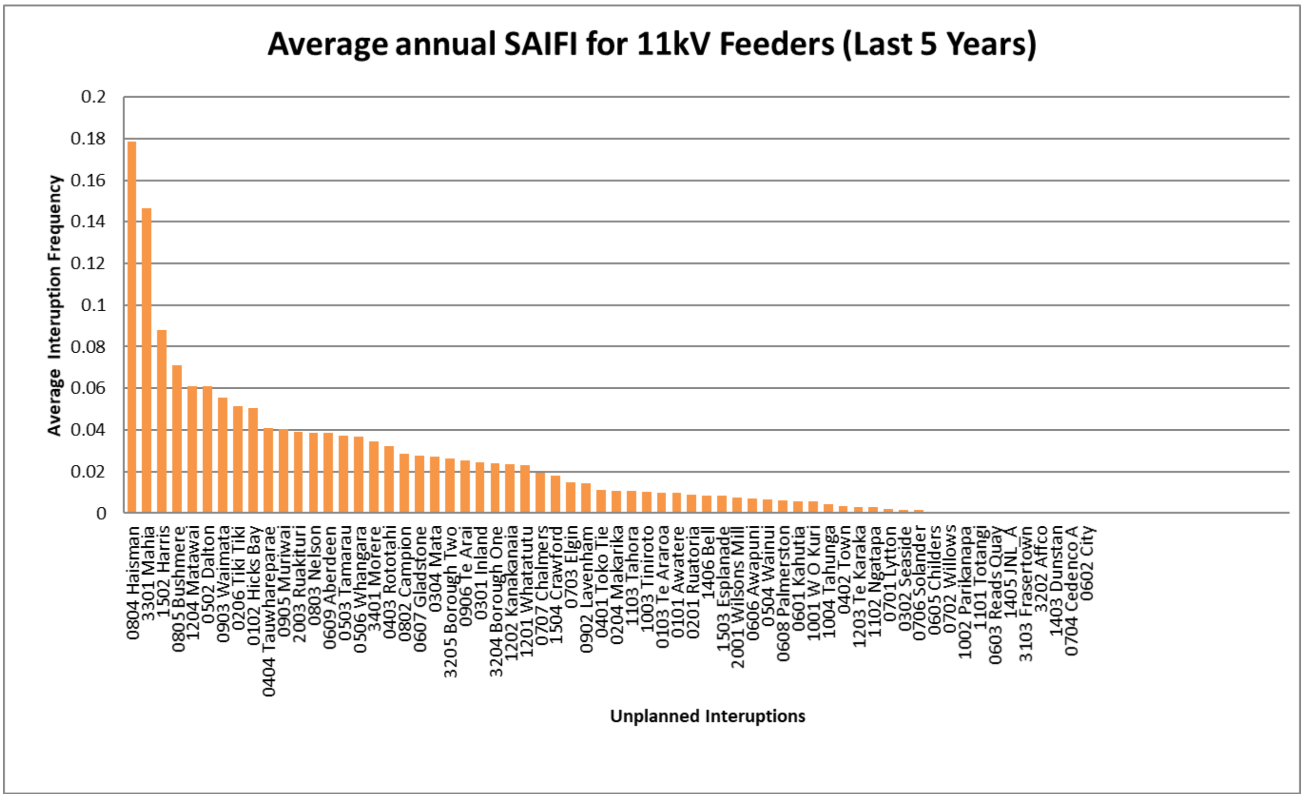



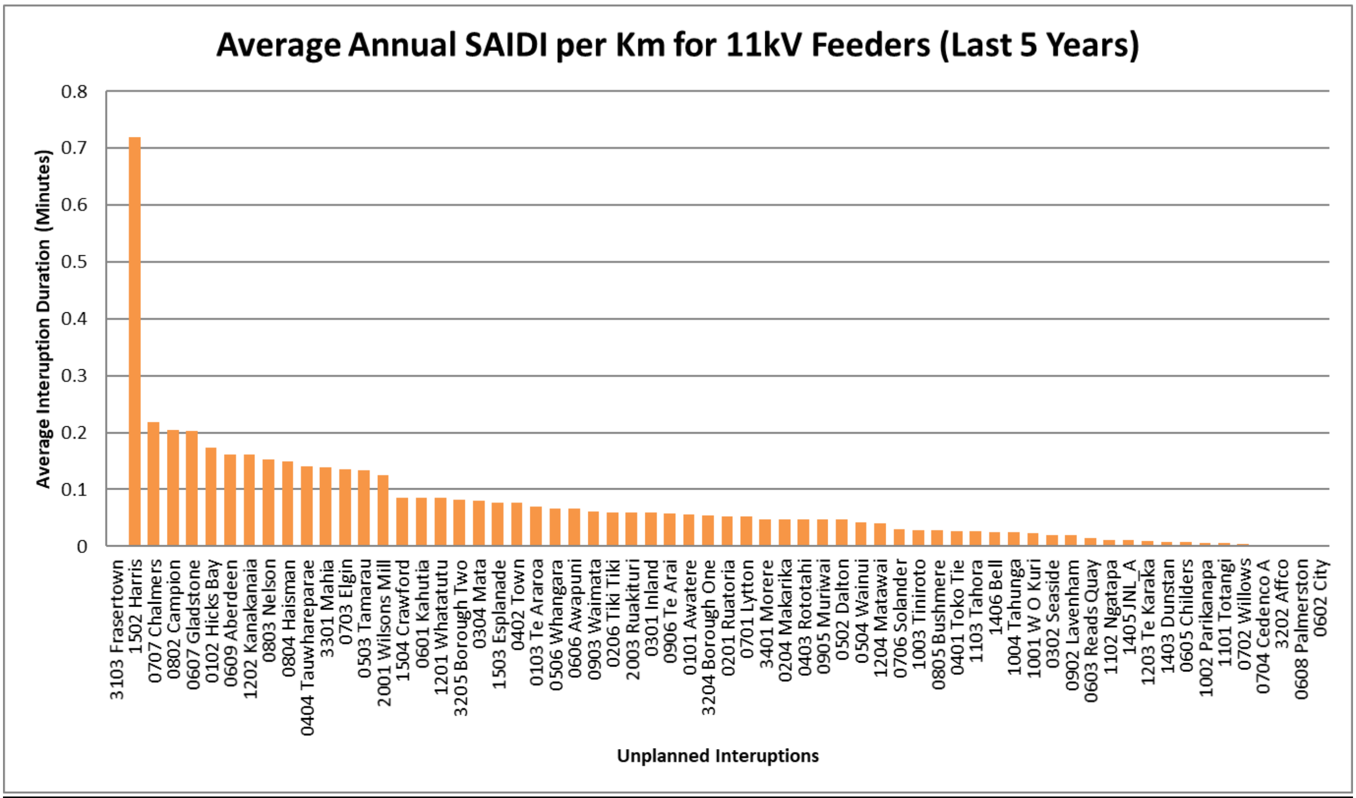

### 8.2.4 Distribution Performance

The performance of distribution feeders is summarised in the following charts showing an average annual performance over the past 5 years.

Based on location, terrain and feeder length comparisons the results indicate a performance in line with expectations. Improvements associated with Matawai and The Wairoa feeders (3201, 3203 and Mahia) have been addressed by projects identified in the development section of this plan.



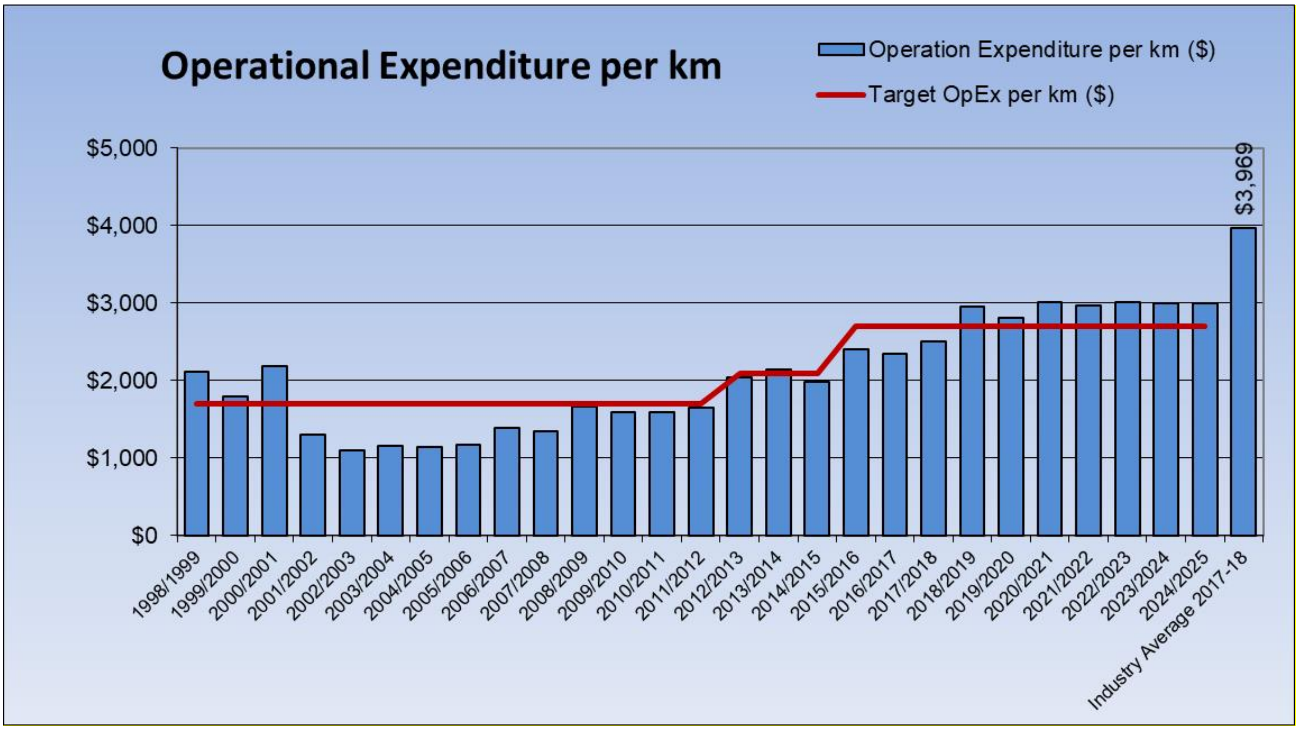


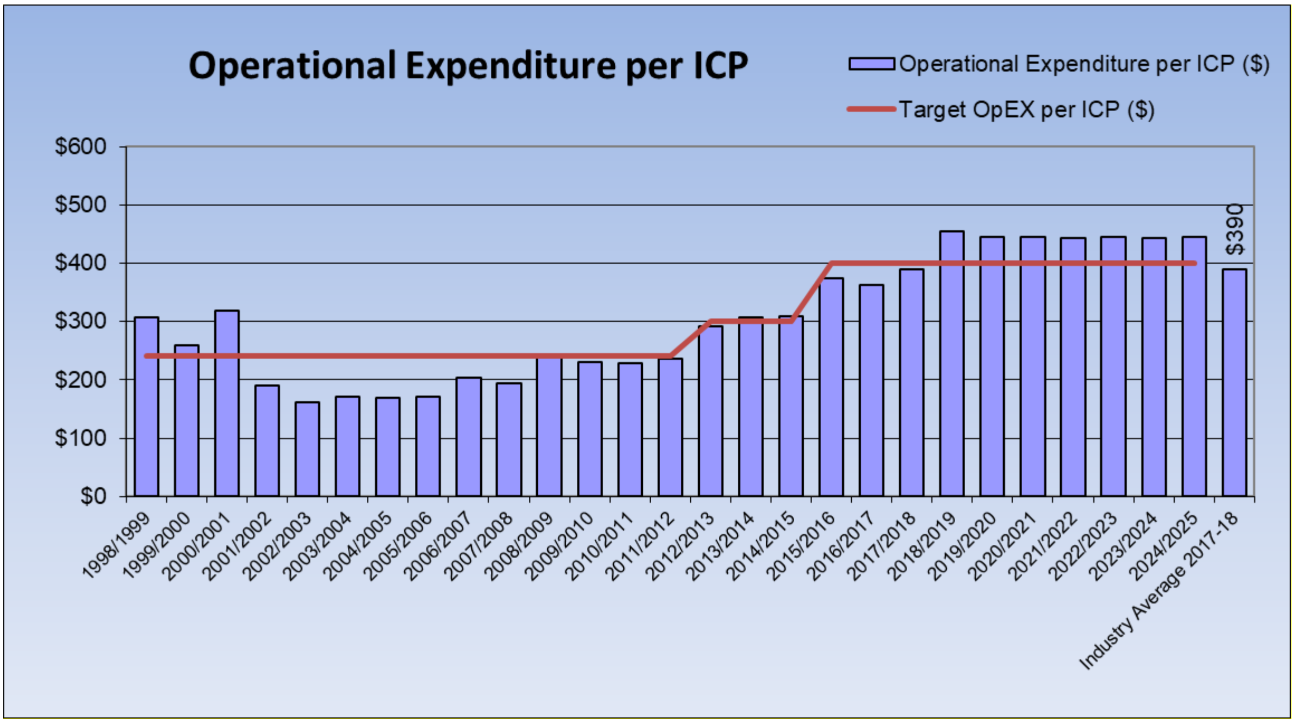

## 8.3 Meeting Delivery Efficiency targets

Cost performance measures that are disclosed each year include:

Operational Expenditure $4770/km
Operational Expenditure $390/connection

The historical trends for Eastland Network Limited's efficiency targets compared with the industry position are as follows:






Changes to targets occur as a result of the analysis of the business results and changes to the business strategic plan. Operational expenditure directly corresponds to strategic changes in the structure of Eastland Group support services, increasing insurance costs, increasing rates, increasing regulatory compliance costs and the acquisition of additional assets such as Eastland transmission spur assets.

## 8.4 Asset Management Systems Review

Eastland Network Limited's quality management system incorporates procedures and processes for review and improvement of all areas of the asset management system. The management systems, processes and plans evolve on an on-going basis.

Targets, Budgets, Project programs, Issues and Forecasts presented in this AMP are typically updated on an annual basis in line with the strategic and business planning process outlined in section 1.2.3 as new or changed Strategies, Requirements, Issues, Developments, Information and Data is obtained.

Legislative compliance reviews are carried out internally on a 6 monthly basis and reported to the Board of Directors.

Executive and Board level assessments of the Eastland Network Limited Asset Management Plans indicate that the nature and level of content in the plan required under regulation exceeds the levels necessary for Eastland Network Limited to efficiently carry out its asset management activities.

Weekly asset management team meetings incorporate review and assessments of the Eastland Network Limited asset management system covering;

- Health and safety
- Public safety
- Systems development
- Design standards
- Quality control
- Resource planning

The balance of risk, efficiency, performance is optimized through this mechanism of team discussion.

An overall assessment of the AMP document, undertaken by the engineering management team indicates that while the description and layout of information may have room for improvement, the additional resource and expenditure to achieve a fully compliant plan is not justified as there would be an insignificant impact on the physical outcomes relating to the assets.

An internal review of Eastland Network Limited's asset management systems is undertaken on an annual basis against NZS7001:2008 which covers, Life cycle Risk, Design, Maintenance and Performance of the Network assets in terms of Public safety management. Non-compliances and corrective actions are incorporated into the improvement initiatives and action plans as necessary.

An internal review consistent with the level of a gap analysis exercise is carried out on Eastland Network Limited's asset management system. This review is conducted on an annual basis. An AMMAT (Asset Management Maturity) assessment is completed in the form of a Questionnaire that has been prepared by the Commerce Commission to conform to extracts/components of the international PAS55 specification for asset management. To ensure the AMMAT is an effective assessment of the maturity of Eastland Network Limited's asset management capability and processes. The most recent completed questionnaire is attached as an Appendix to this AMP.

An external review of the asset management plan and the AMMAT report is undertaken by an independent Engineer bi-annually. The review confirms alignment of the content of the AMP with the Electricity Information Disclosure Requirements for EDB Asset Management Plans. Non-compliances and corrective actions are incorporated into the AMP, improvement initiatives and action plans as necessary.

An external Telarc audit is undertaken to audit the aspects of Asset Management associated with Public Safety Management as required by the Electricity Safety Regulations. As there is a significant overlap between the legislative requirements relating to public safety management of the asset and the mandatory disclosure requirements for asset management determined by the Commerce Commission this audit identifies any gaps that exist in terms of Eastland Network Limited's overall asset management maturity level. Non-compliances and corrective actions are incorporated into improvement initiatives and action plans. On successful completion of each audit a registration certificate is issued by the auditor and forwarded to the Electricity Commission.

## 8.5 Areas for Improvement

In general historical expenditure in any given period has been below the financial targets set. While deferral of costs is valid when forecast triggers do not occur at the time initially predicted, there is an on-going need to minimise the reaction time frame once the expenditure requirement has occurred. The ability to predict the timing for necessary renewal and growth expenditure can also be improved.

The customer oriented service levels currently established rely on representation from government, significant customers and key groups. Refer section 3.1. The survey results to date have identified customers have issues but they are not asking for correction of these issues if the measures are linked to increased costs. Identification of methods to eliminate the issues without increasing costs disproportionately is necessary in order to improve the satisfaction of end users.

The installation profile of the overall asset and historical practices has provided a 'bow wave' effect where at some point the steady state approach for asset renewal adopted by Eastland Network Limited to manage expenditure in line with predictable revenues may not keep up with the asset deterioration. To ensure the correct assets are targeted for renewal at the right time the process for condition assessments and selection need to be optimized and regularly improved.

The uncertainty associated with correct and informed decision making for network development, linked to changing regulatory control, safety and environmental protection requirements requires a high level of understanding of industry direction going forward. Past systems used in a stable environment with a lower rate of change are no longer adequate and increased involvement in the industry policy making arena is becoming increasing necessary.

## 8.6 Improvement Implementation

Eastland Network Limited has identified the following contributors affecting the ability to improve in these areas:

Re-sourcing and maintaining the necessary skills and skill balance for internal staffing, external consulting and local contracting resources
Provision of sufficient and suitable resource to ensure accurate and timely information capture, used as inputs to the prediction and forecasting processes used for management of the assets.
Correct use of appropriate and efficient technologies including tools and equipment to optimise asset construction, condition assessment and maintenance costs.
The level of involvement within the local community and at the policy making level.

With a shortfall in available resources which is more significant in the local region Eastland Network Limited has identified a need to contribute to training and development of new resource from entry level to ensure improvement in the long term.

Eastland Network Limited has a technology focus and is active in identification and development of equipment and systems designed to offset the short term re-sourcing short fall.

Membership, strategic partnership and alliances are being developed in the short to medium term to improve Eastland Network Limited's understanding and input into the direction of the industry.

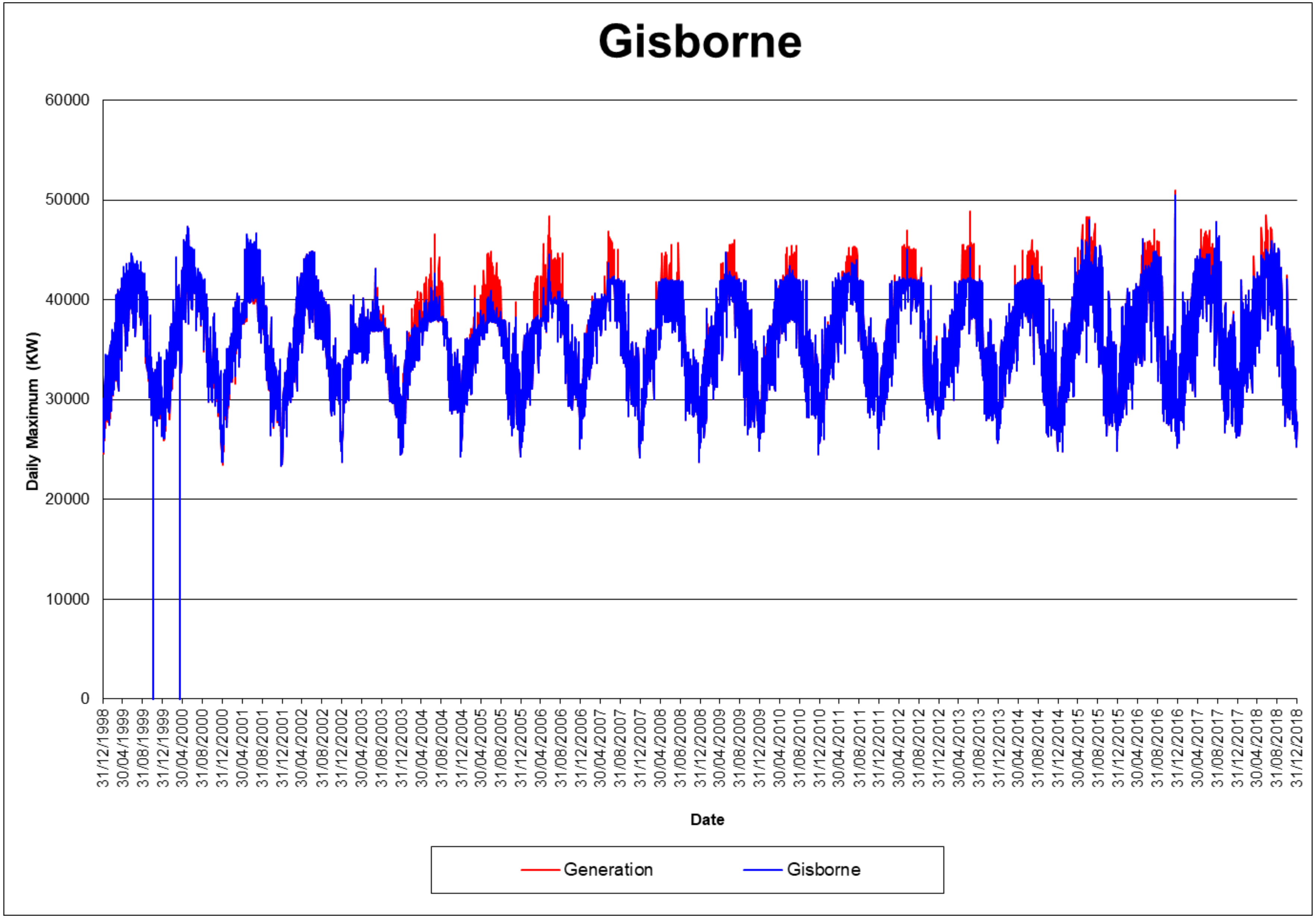
Improvement recommendations following review of the ANNMAT report in Appendix A8 are:

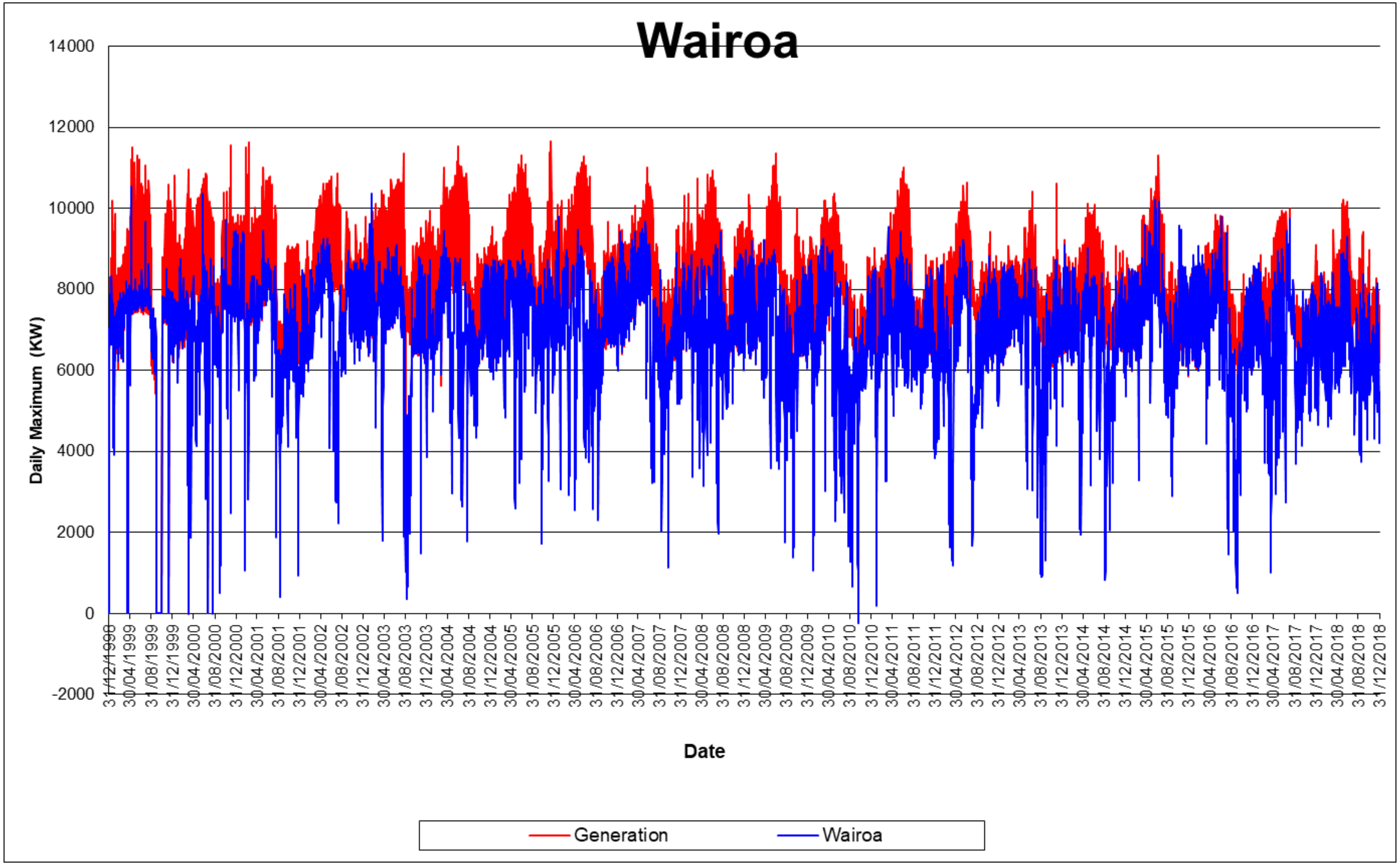
- That the key themes of the AMP be formally communicated to all staff and to senior contractors annually.
- That the duration and detail of work released to contractors be formally coordinated across all managers so that contractors can plan and resource work more efficiently.
- That the performance requirements for each asset class be more visibly linked to the AM Objectives and Business Plan outcomes.
- That more use of leading indicators be made to avoid possible declining performance.
- That the required combination of cost, risk and performance be defined as quantitatively as possible for each asset class based on the AM Strategy and Business Plans.
- That the linkages from AM Strategy to the required combination of cost, risk & performance be formally documented.

# 9. Appendicies

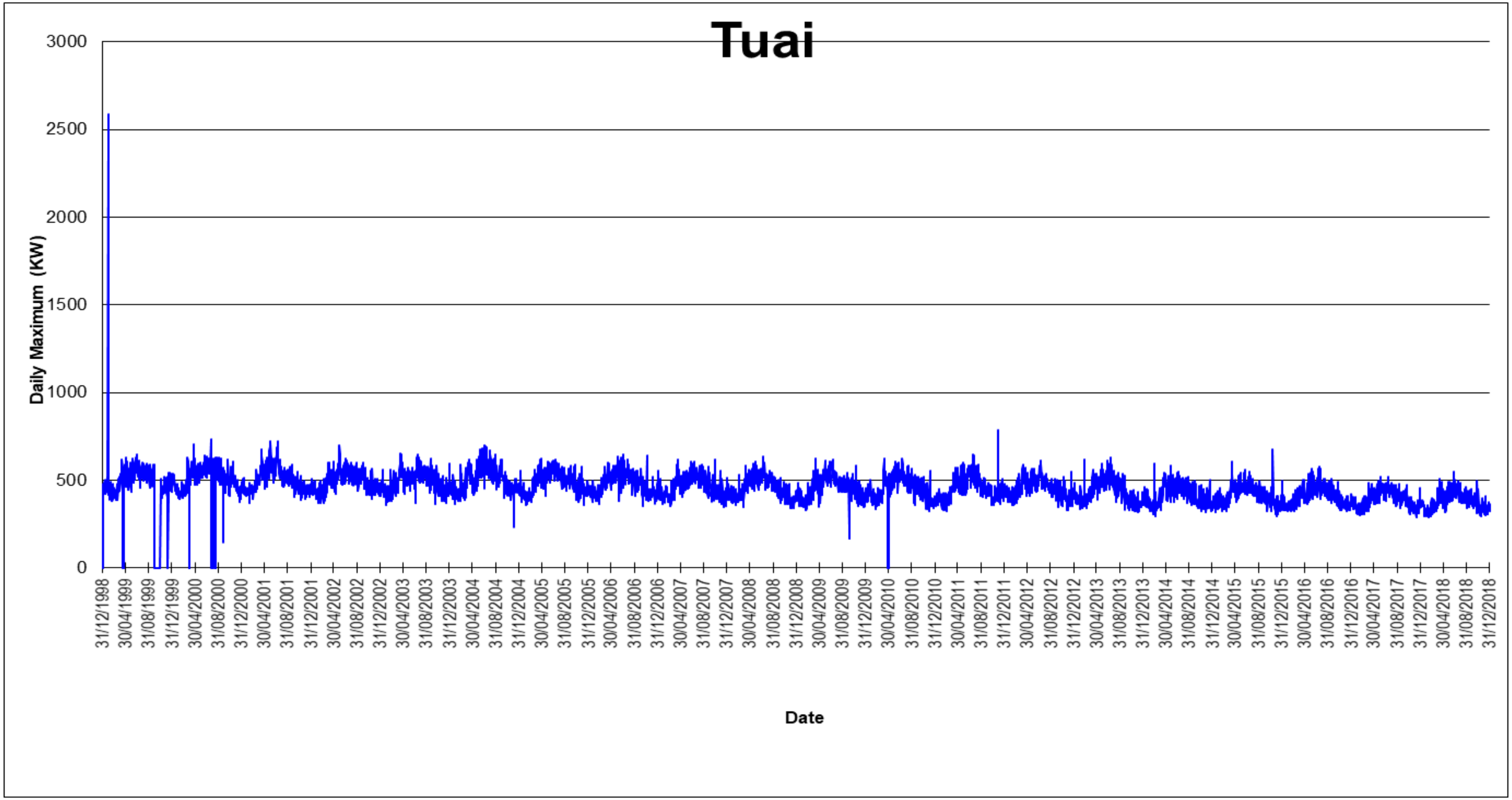
## A1. Feeder loadings

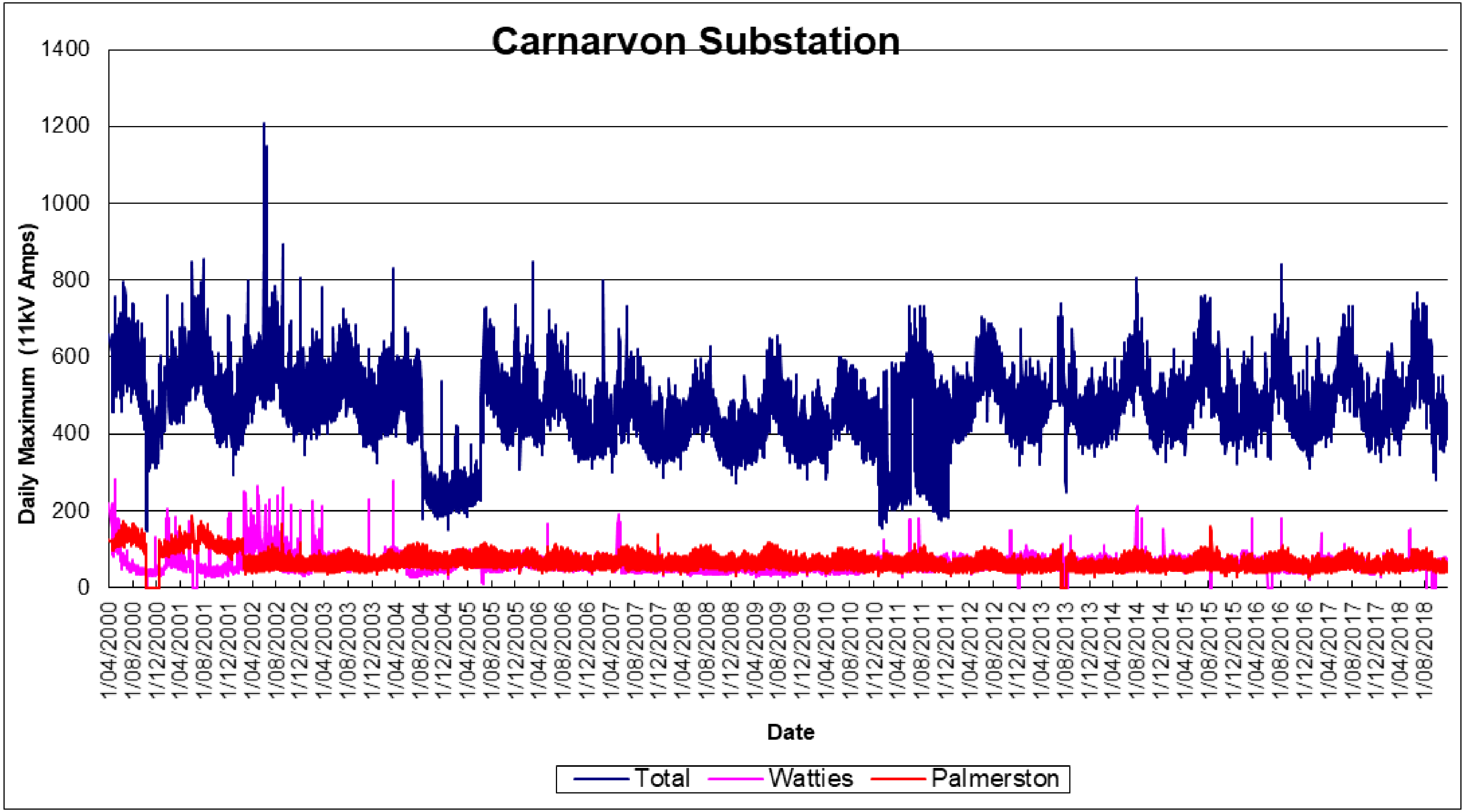
Feeder loadings since 1 December 1998 are shown below. Note some zone substations require more than one chart.

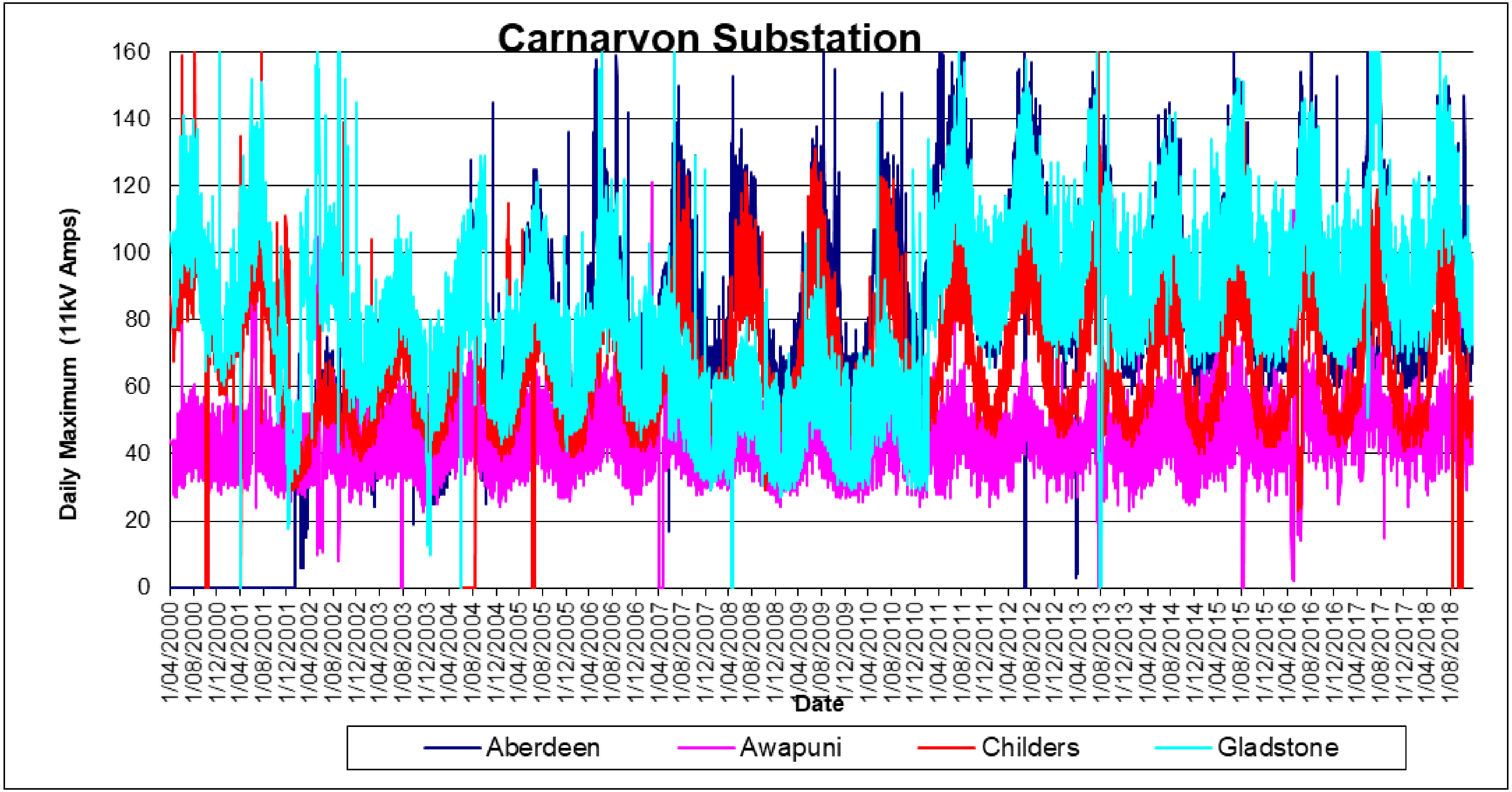

Gisborne
Daily Maximum (KW)
60000
50000
40000
30000
20000
10000
0
Date
Generation
Gisborne

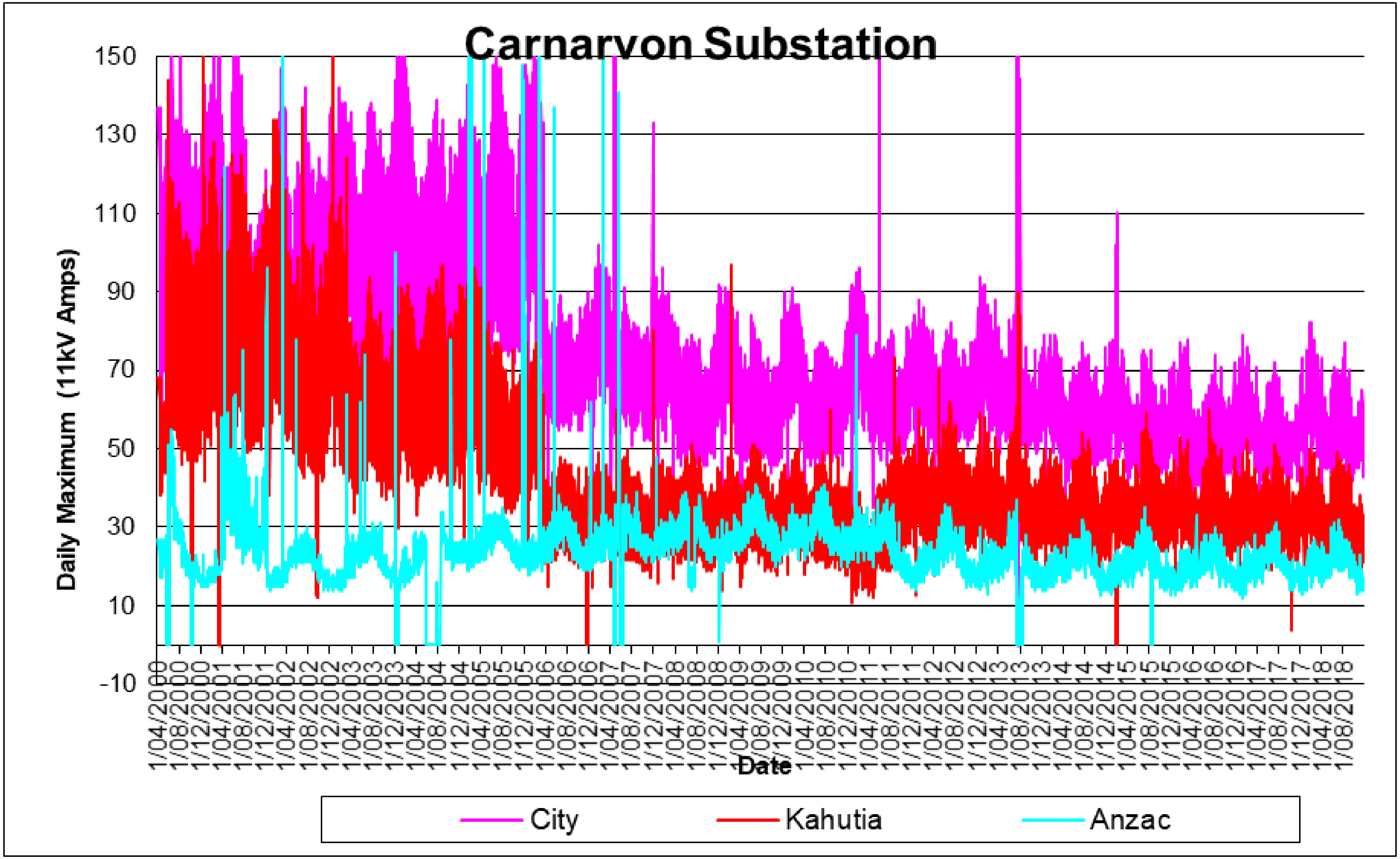


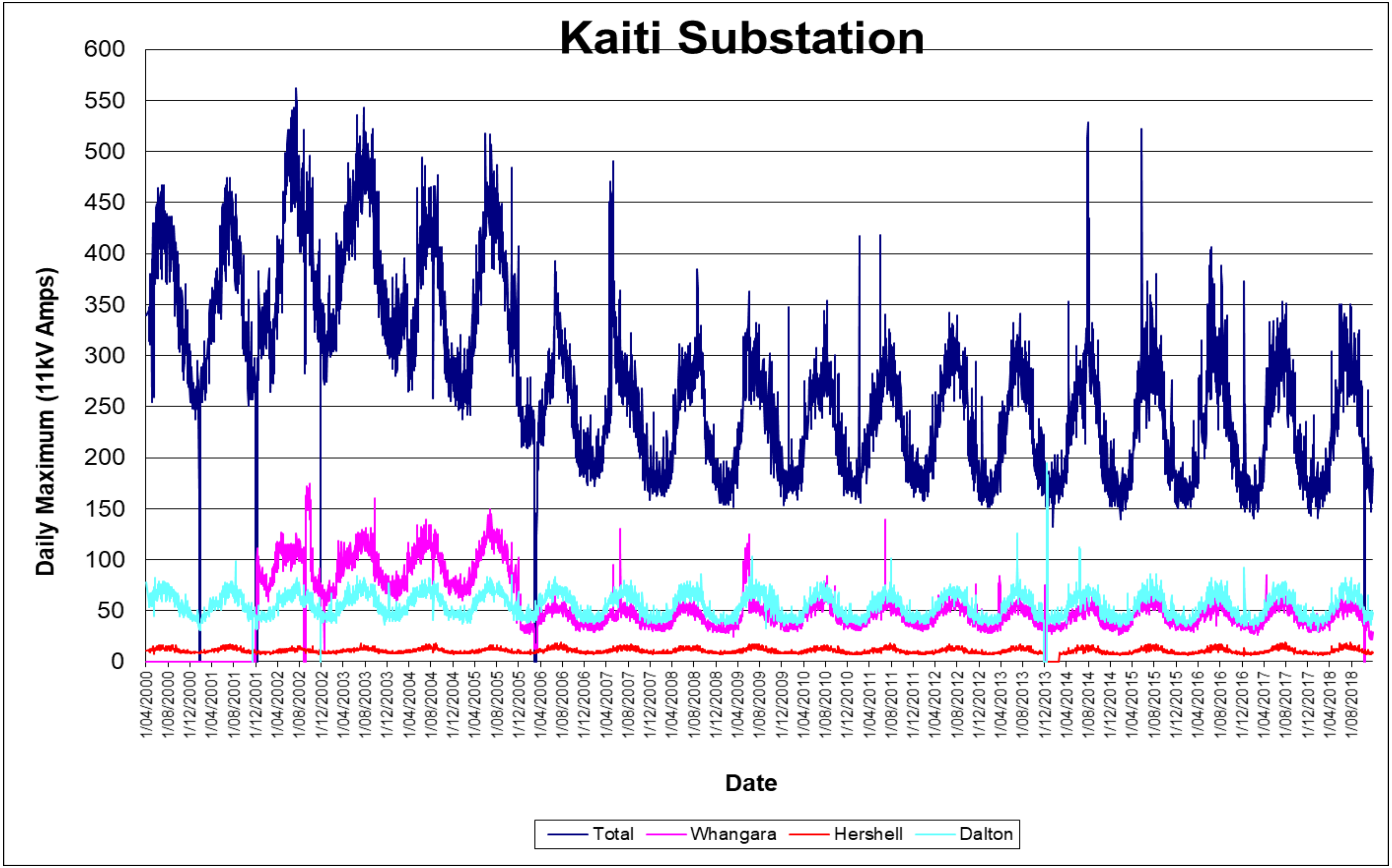
Wairoa
Daily Maximum (KW)
14000
12000
10000
8000
6000
4000
2000
0
-2000
Date
Generation
Wairoa


Tuai
Daily Maximum (KW)
3000
2500
2000
1500
1000
500
0
Date

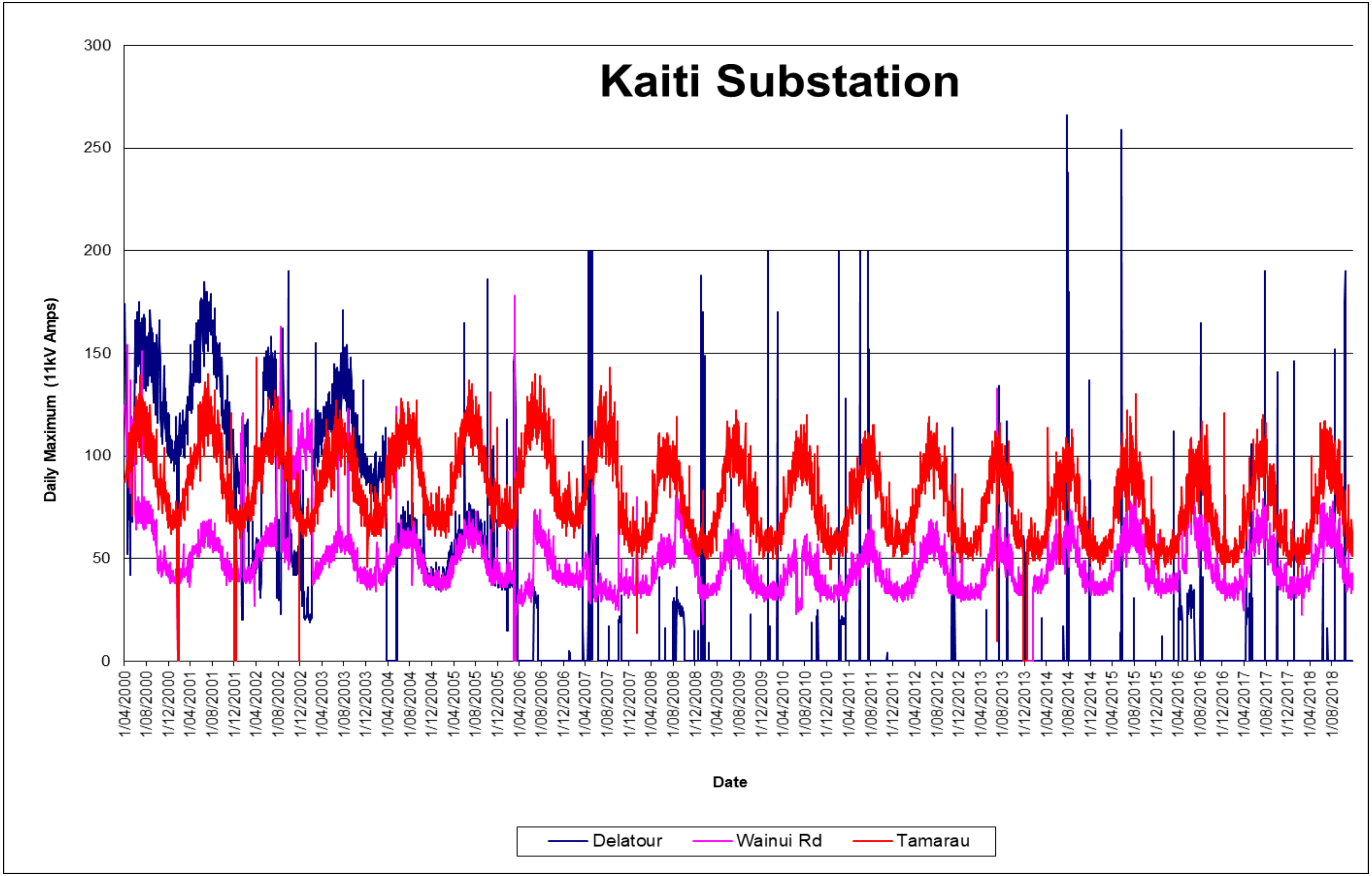

Carnarvon Substation
Daily Maximum (11kV Amps)
1400
1200
1000
800
600
400
200
0
Date
Total
Watties
Palmerston

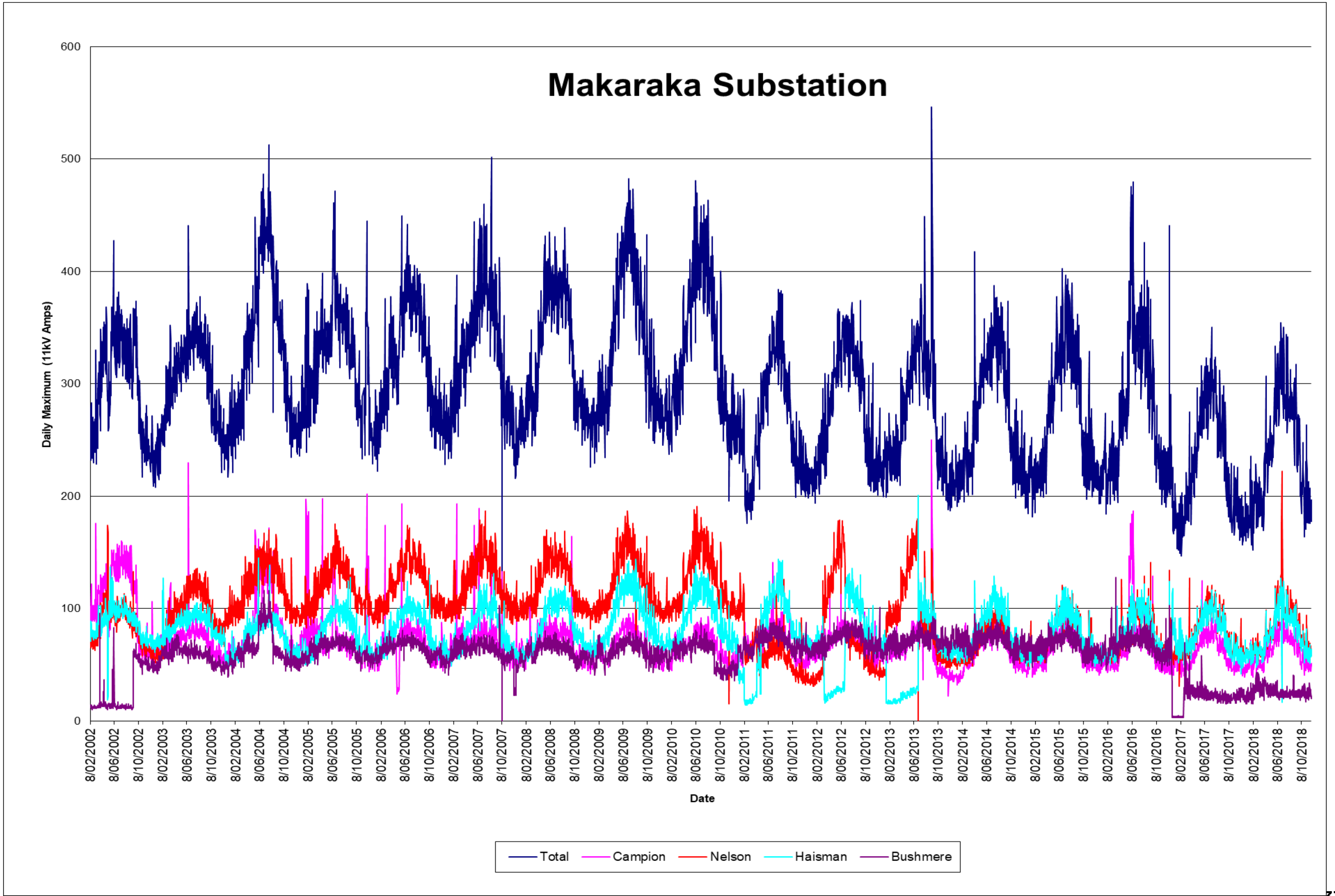

Carnarvon Substation
Daily Maximum (11kV Amps)
160
140
120
100
80
60
40
20
0
Date
Aberdeen
Awapuni
Childers
Gladstone

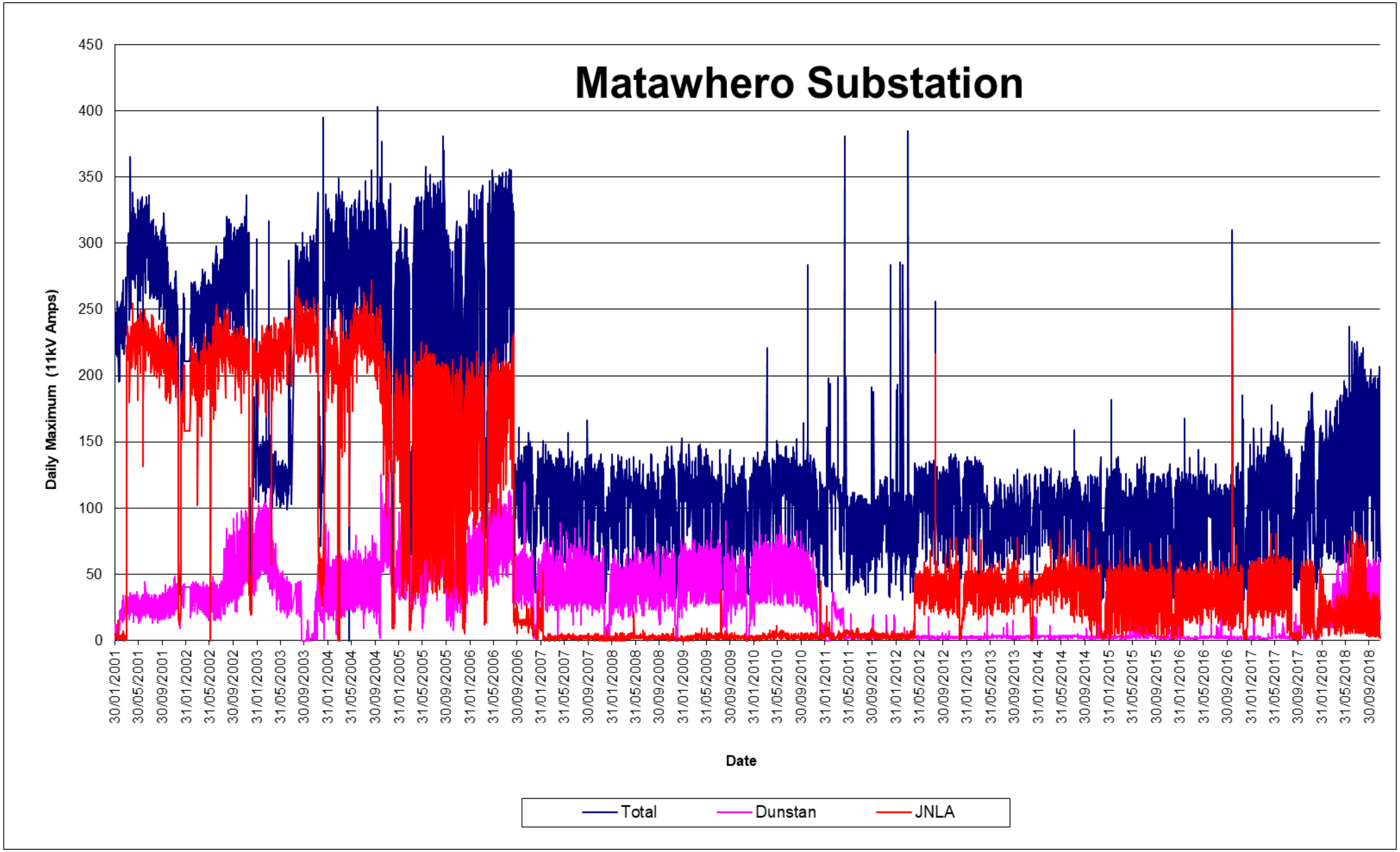

Carnarvon Substation
150
130
110
90
70
50
30
10
-10
Daily Maximum (11kV Amps)
Date
City
Kahutia
Anzac

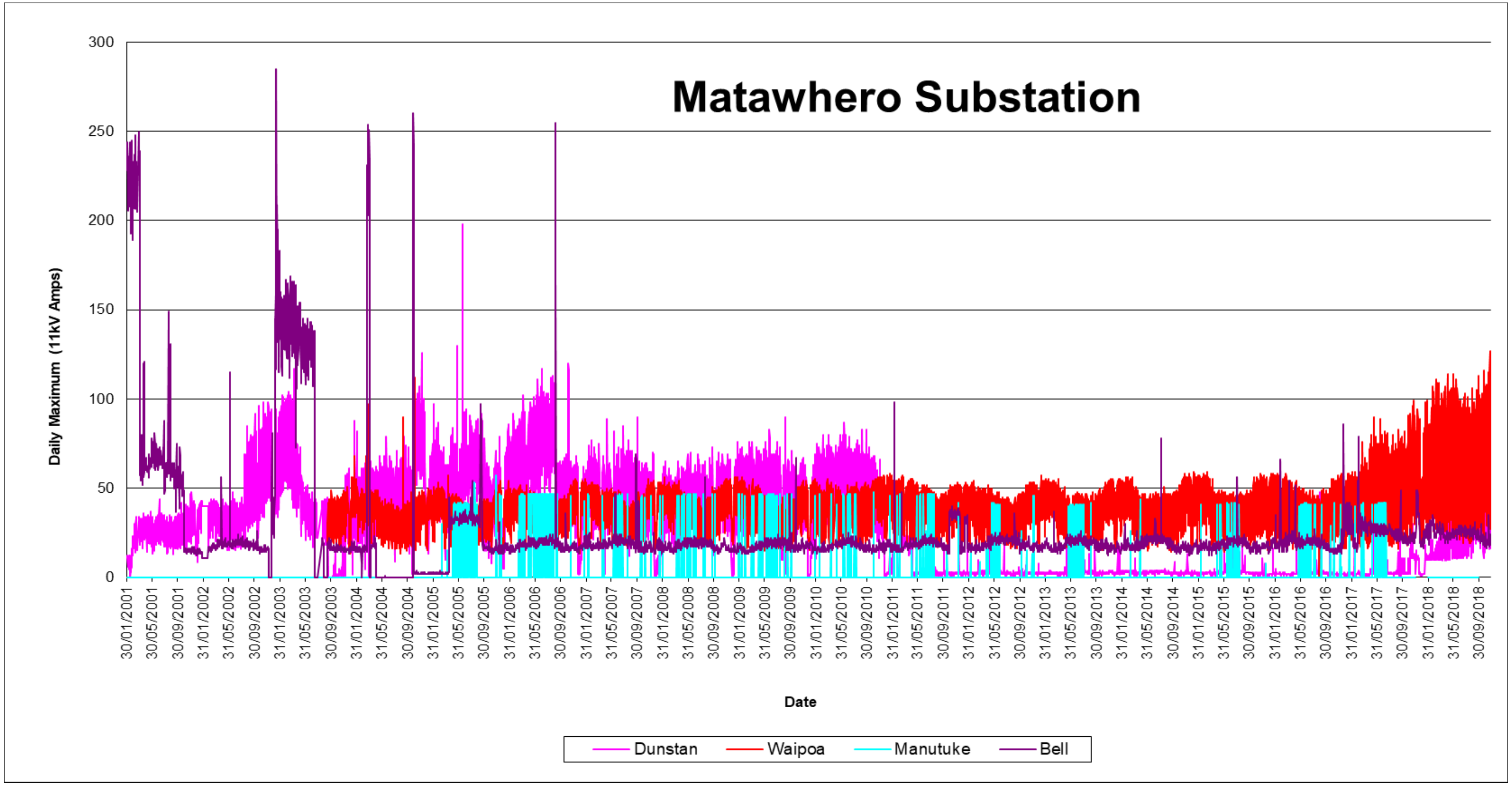


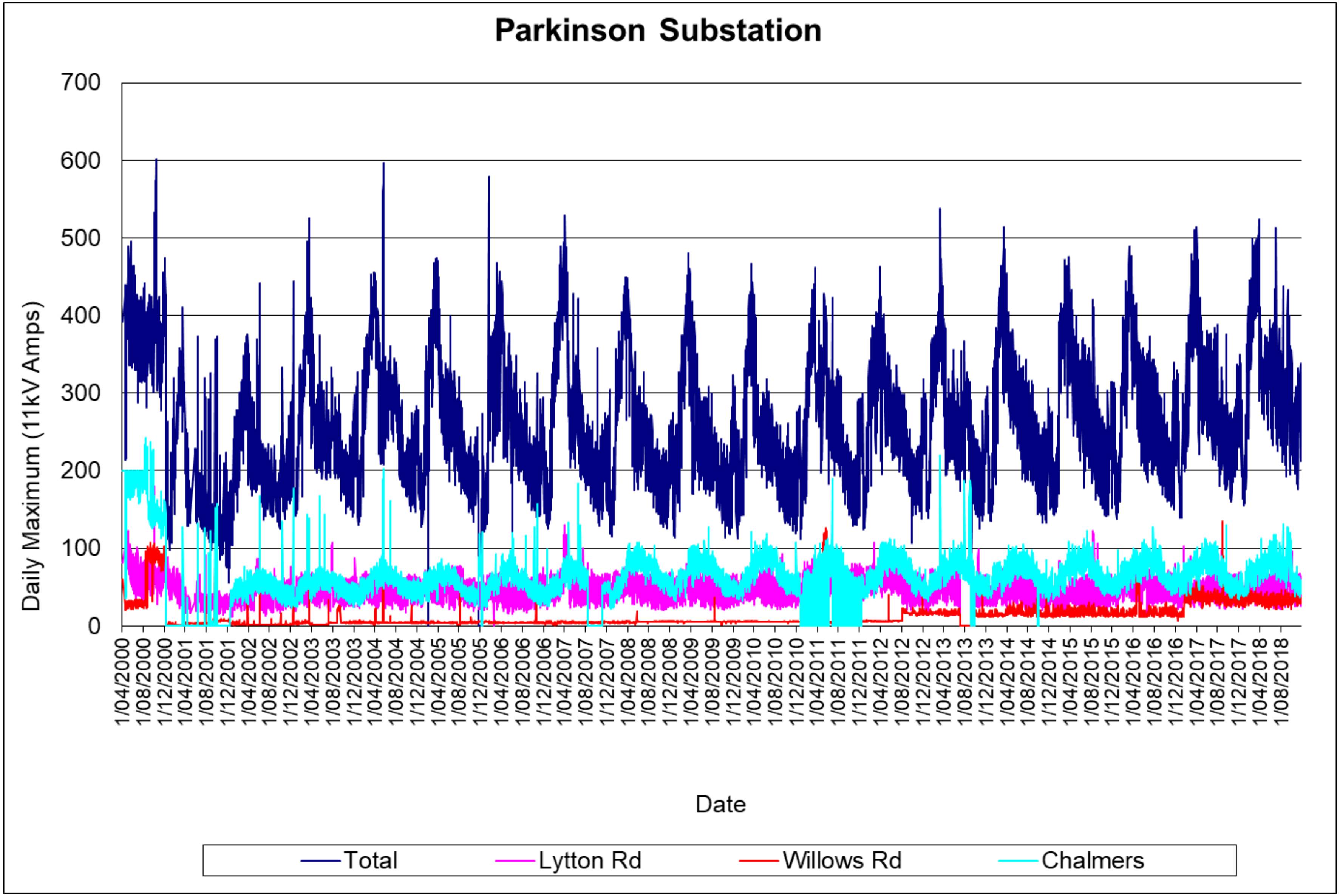
Kaiti Substation
600
550
500
450
400
350
300
250
200
150
100
50
0
Daily Maximum (11kV Amps)
1/04/2000
1/08/2000
1/12/2000
1/04/2001
1/08/2001
1/12/2001
1/04/2002
1/08/2002
1/12/2002
1/04/2003
1/08/2003
1/12/2003
1/04/2004
1/08/2004
1/12/2004
1/04/2005
1/08/2005
1/12/2005
1/04/2006
1/08/2006
1/12/2006
1/04/2007
1/08/2007
1/12/2007
1/04/2008
1/08/2008
1/12/2008
1/04/2009
1/08/2009
1/12/2009
1/04/2010
1/08/2010
1/12/2010
1/04/2011
1/08/2011
1/12/2011
1/04/2012
1/08/2012
1/12/2012
1/04/2013
1/08/2013
1/12/2013
1/04/2014
1/08/2014
1/12/2014
1/04/2015
1/08/2015
1/12/2015
1/04/2016
1/08/2016
1/12/2016
1/04/2017
1/08/2017
1/12/2017
1/04/2018
1/08/2018
Date
Total
Whangara
Hershell
Dalton

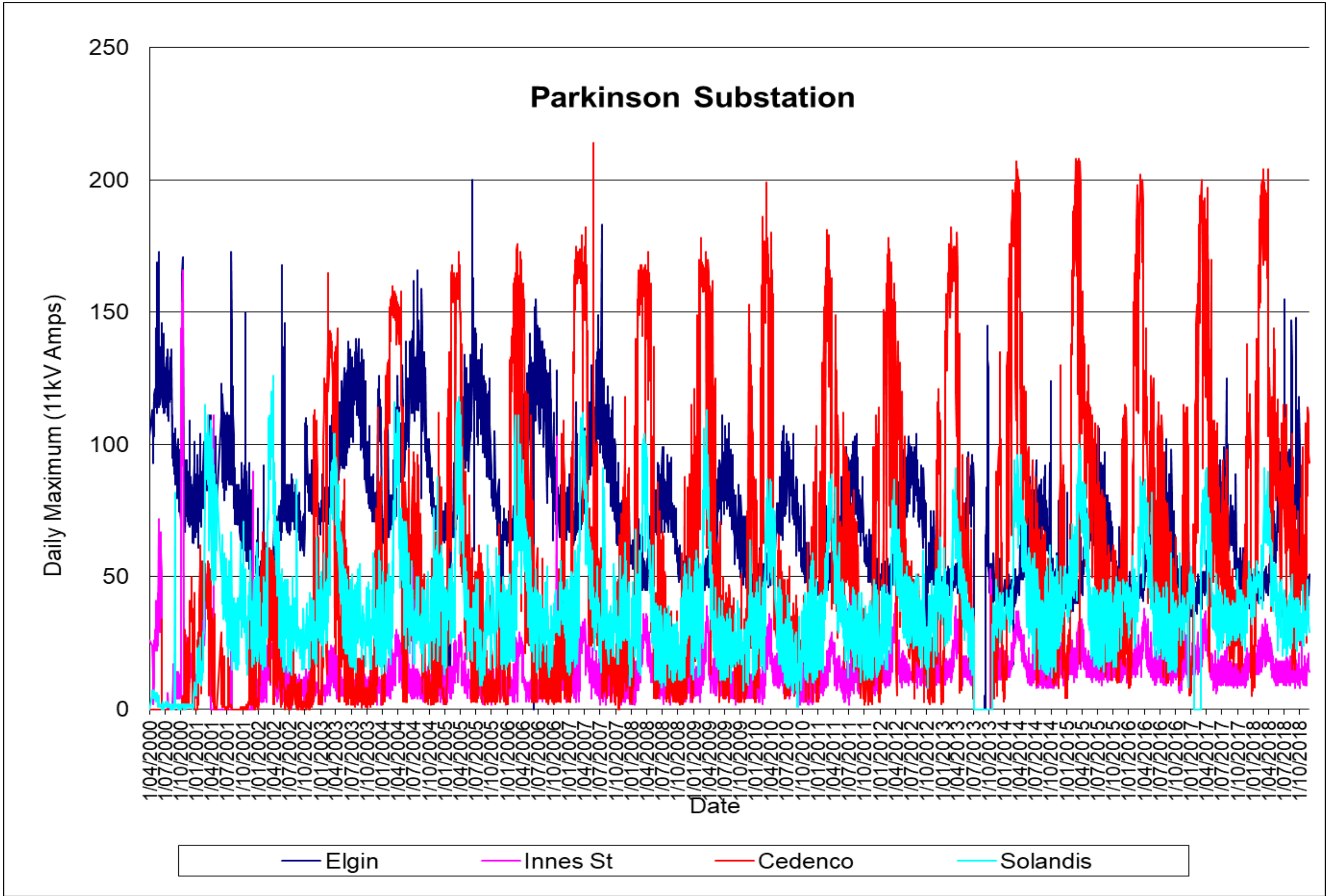

Kaiti Substation
Daily Maximum (11kV Amps)
300
250
200
150
100
50
0
Date
1/04/2000
1/08/2000
1/12/2000
1/04/2001
1/08/2001
1/12/2001
1/04/2002
1/08/2002
1/12/2002
1/04/2003
1/08/2003
1/12/2003
1/04/2004
1/08/2004
1/12/2004
1/04/2005
1/08/2005
1/12/2005
1/04/2006
1/08/2006
1/12/2006
1/04/2007
1/08/2007
1/12/2007
1/04/2008
1/08/2008
1/12/2008
1/04/2009
1/08/2009
1/12/2009
1/04/2010
1/08/2010
1/12/2010
1/04/2011
1/08/2011
1/12/2011
1/04/2012
1/08/2012
1/12/2012
1/04/2013
1/08/2013
1/12/2013
1/04/2014
1/08/2014
1/12/2014
1/04/2015
1/08/2015
1/12/2015
1/04/2016
1/08/2016
1/12/2016
1/04/2017
1/08/2017
1/12/2017
1/04/2018
1/08/2018
Delatour
Wainui Rd
Tamarau

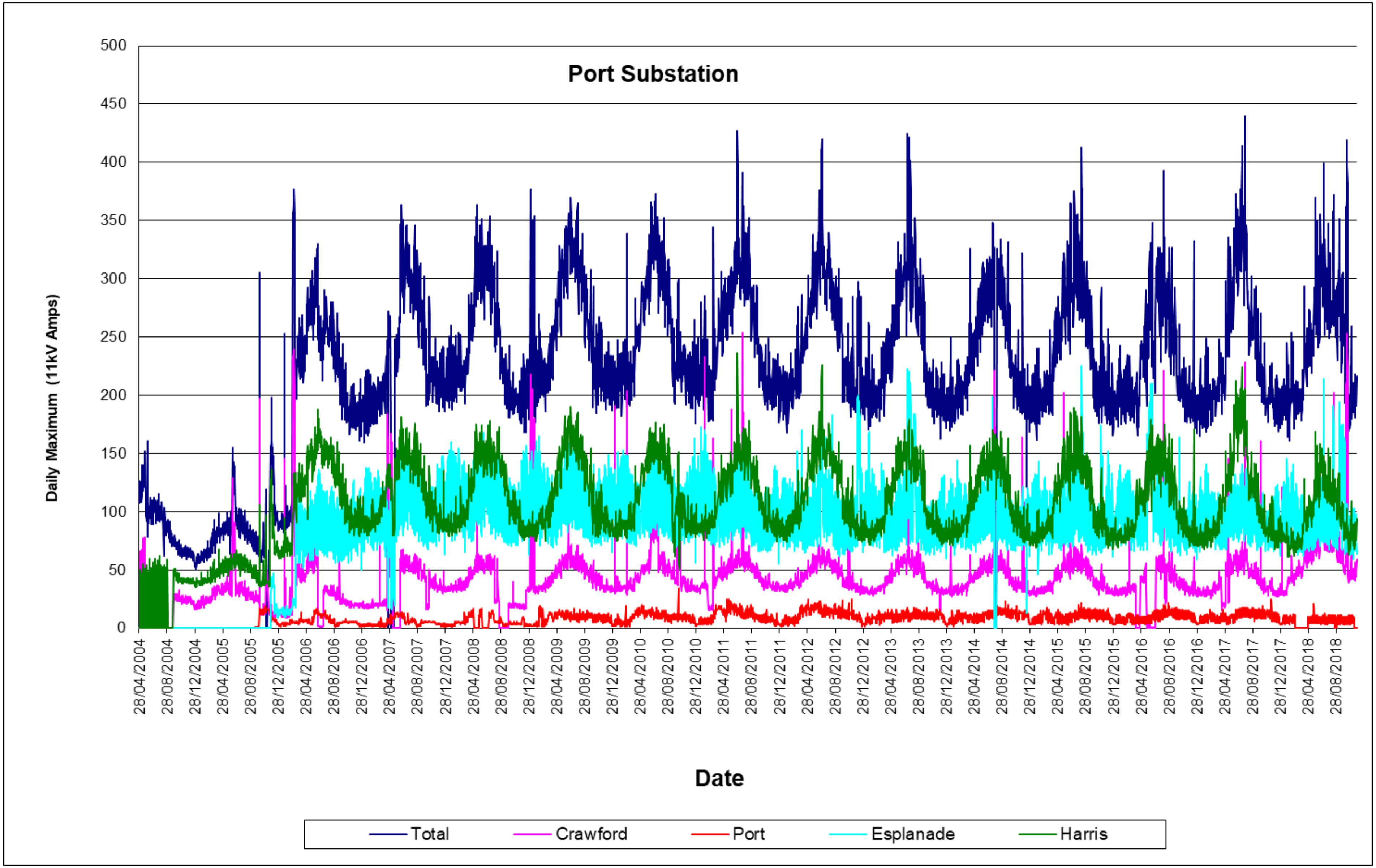

Makaraka Substation
Daily Maximum (11kV Amps)
0
100
200
300
400
500
600
Date
8/02/2002
8/06/2002
8/10/2002
8/02/2003
8/06/2003
8/10/2003
8/02/2004
8/06/2004
8/10/2004
8/02/2005
8/06/2005
8/10/2005
8/02/2006
8/06/2006
8/10/2006
8/02/2007
8/06/2007
8/10/2007
8/02/2008
8/06/2008
8/10/2008
8/02/2009
8/06/2009
8/10/2009
8/02/2010
8/06/2010
8/10/2010
8/02/2011
8/06/2011
8/10/2011
8/02/2012
8/06/2012
8/10/2012
8/02/2013
8/06/2013
8/10/2013
8/02/2014
8/06/2014
8/10/2014
8/02/2015
8/06/2015
8/10/2015
8/02/2016
8/06/2016
8/10/2016
8/02/2017
8/06/2017
8/10/2017
8/02/2018
8/06/2018
8/10/2018
Total
Campion
Nelson
Haisman
Bushmere

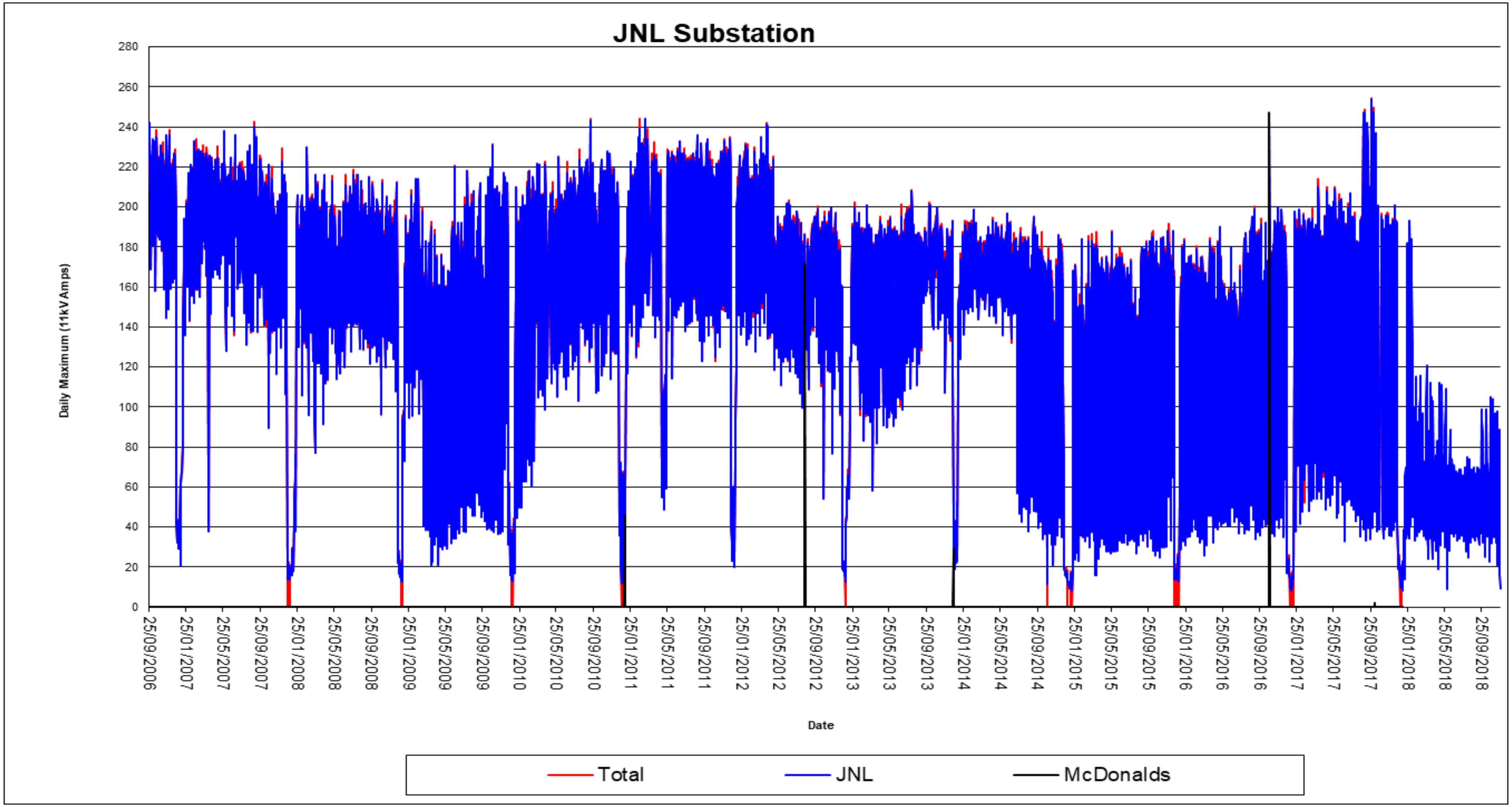

Matawhero Substation
Daily Maximum (11kV Amps)
450
400
350
300
250
200
150
100
50
0
Date
Total
Dunstan
JNLA

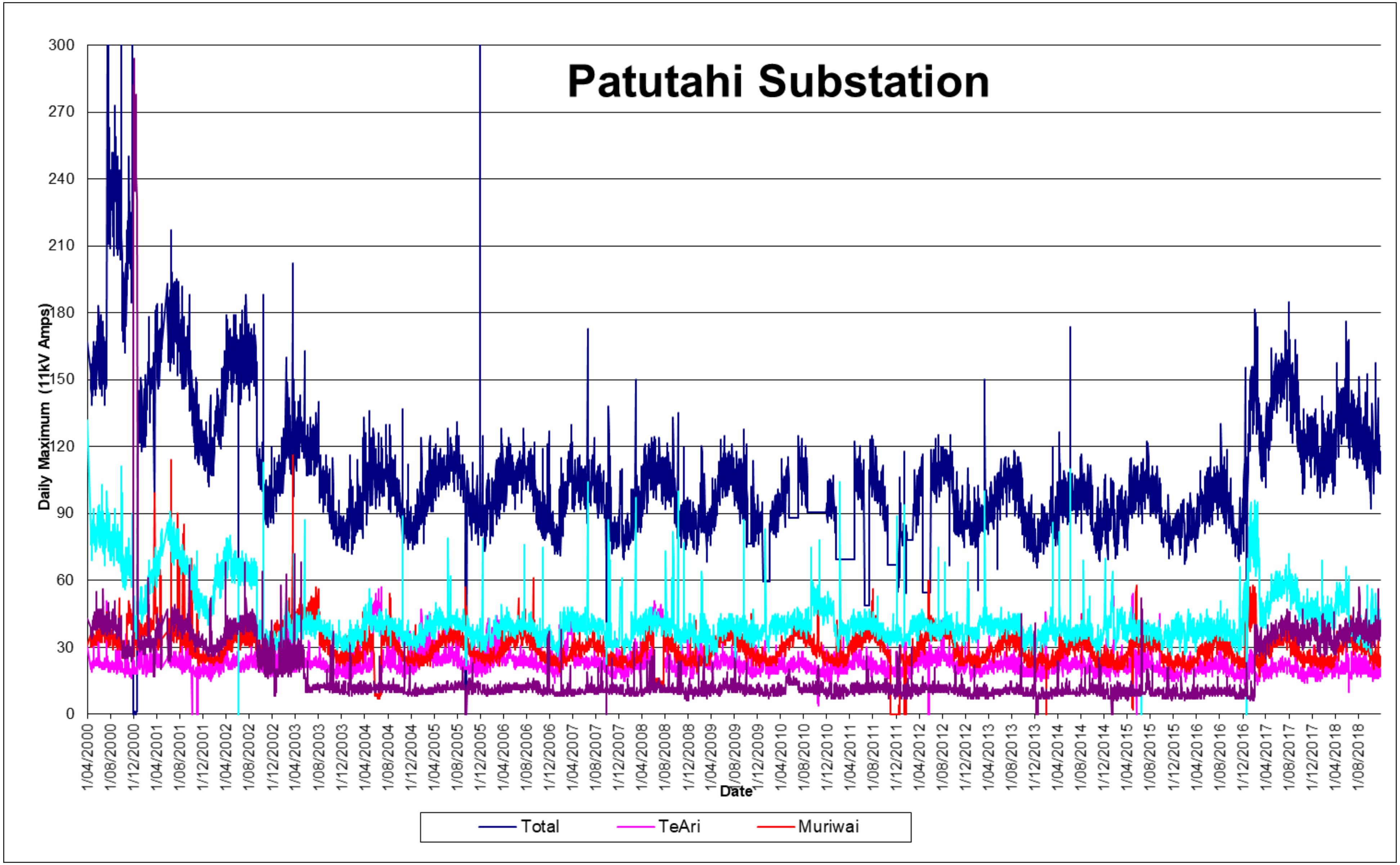

Matawhero Substation
Daily Maximum (11kV Amps)
300
250
200
150
100
50
0
Date
Dunstan
Waipoa
Manutuke
Bell

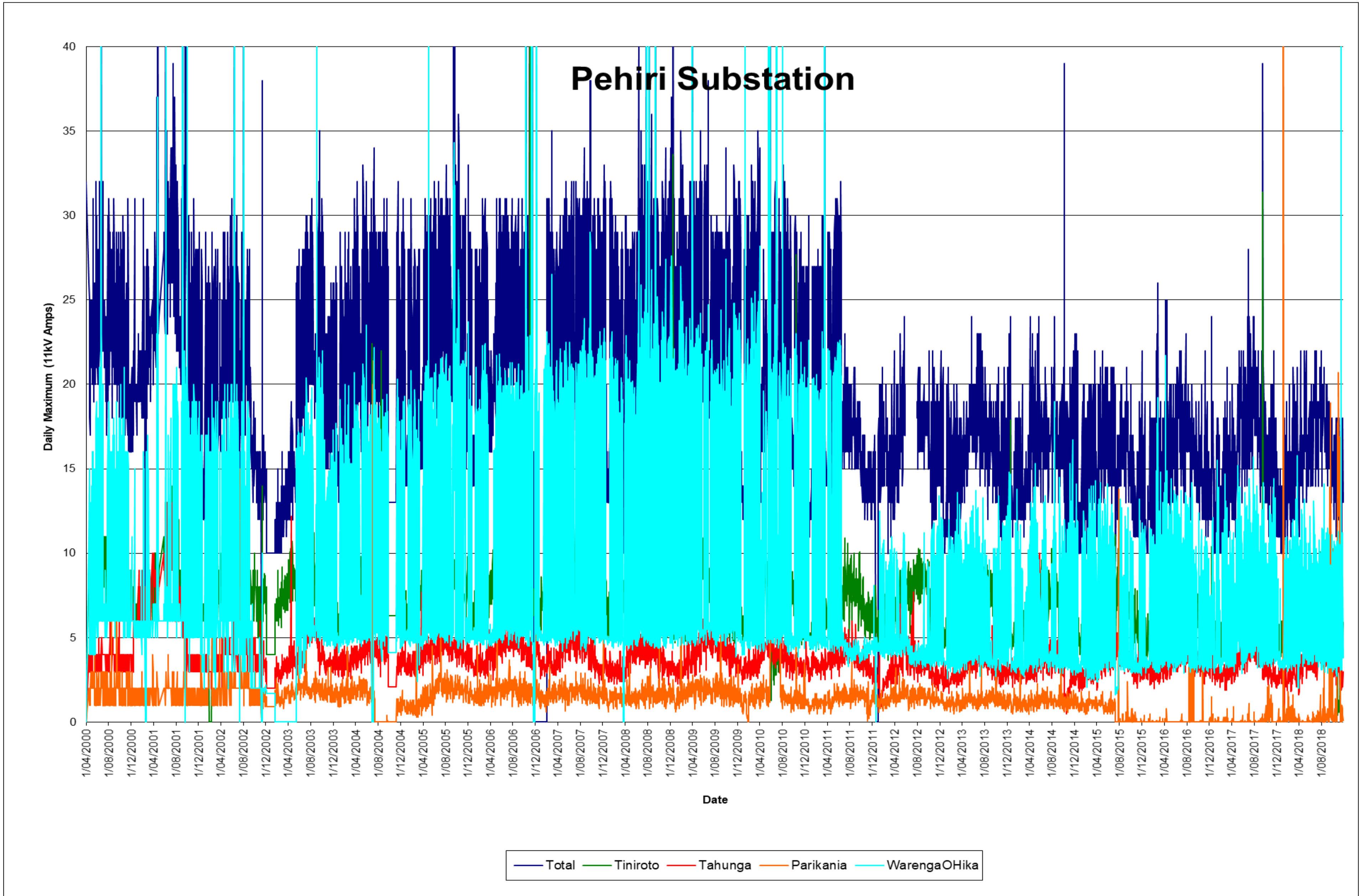

Parkinson Substation
Daily Maximum (11kV Amps)
700
600
500
400
300
200
100
0
1/04/2000
1/08/2000
1/12/2000
1/04/2001
1/08/2001
1/12/2001
1/04/2002
1/08/2002
1/12/2002
1/04/2003
1/08/2003
1/12/2003
1/04/2004
1/08/2004
1/12/2004
1/04/2005
1/08/2005
1/12/2005
1/04/2006
1/08/2006
1/12/2006
1/04/2007
1/08/2007
1/12/2007
1/04/2008
1/08/2008
1/12/2008
1/04/2009
1/08/2009
1/12/2009
1/04/2010
1/08/2010
1/12/2010
1/04/2011
1/08/2011
1/12/2011
1/04/2012
1/08/2012
1/12/2012
1/04/2013
1/08/2013
1/12/2013
1/04/2014
1/08/2014
1/12/2014
1/04/2015
1/08/2015
1/12/2015
1/04/2016
1/08/2016
1/12/2016
1/04/2017
1/08/2017
1/12/2017
1/04/2018
1/08/2018
Date
Total
Lytton Rd
Willows Rd
Chalmers

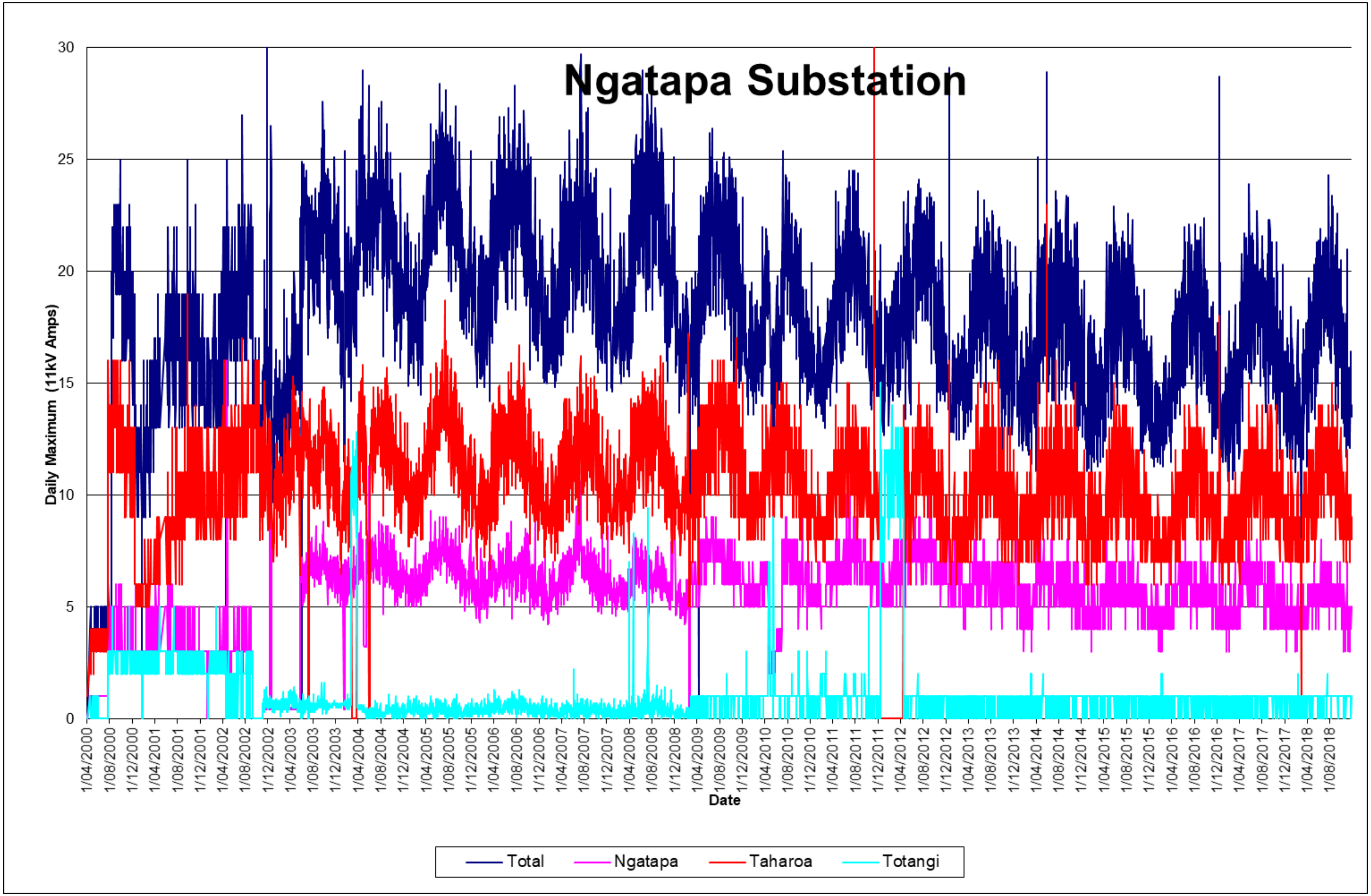

Parkinson Substation
Daily Maximum (11kV Amps)
250
200
150
100
50
0
Date
Elgin
Innes St
Cedenco
Solandis

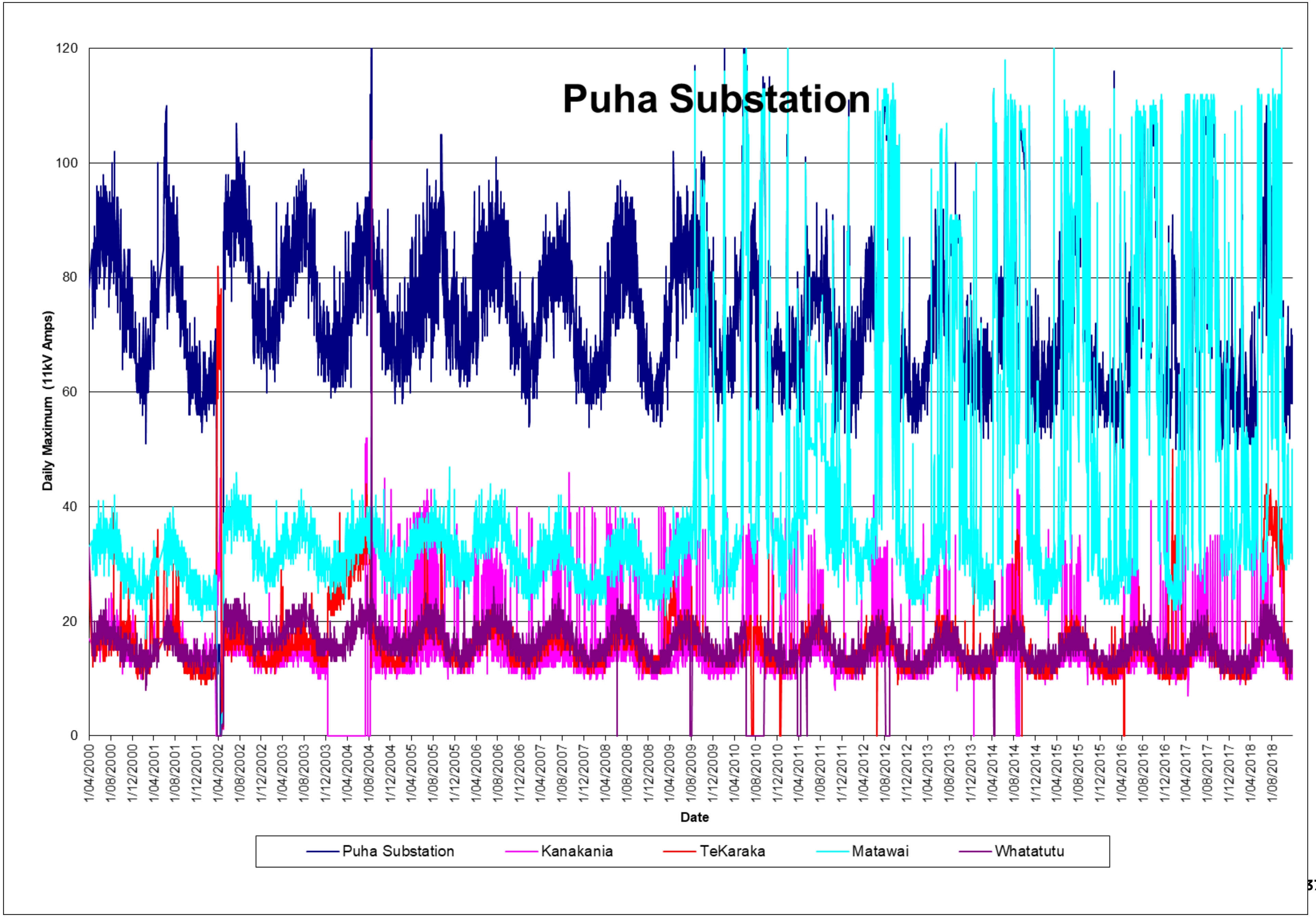

Port Substation
Daily Maximum (11kV Amps)
500
450
400
350
300
250
200
150
100
50
0
28/04/2004
28/08/2004
28/12/2004
28/04/2005
28/08/2005
28/12/2005
28/04/2006
28/08/2006
28/12/2006
28/04/2007
28/08/2007
28/12/2007
28/04/2008
28/08/2008
28/12/2008
28/04/2009
28/08/2009
28/12/2009
28/04/2010
28/08/2010
28/12/2010
28/04/2011
28/08/2011
28/12/2011
28/04/2012
28/08/2012
28/12/2012
28/04/2013
28/08/2013
28/12/2013
28/04/2014
28/08/2014
28/12/2014
28/04/2015
28/08/2015
28/12/2015
28/04/2016
28/08/2016
28/12/2016
28/04/2017
28/08/2017
28/12/2017
28/04/2018
28/08/2018
Date
Total
Crawford
Port
Esplanade
Harris

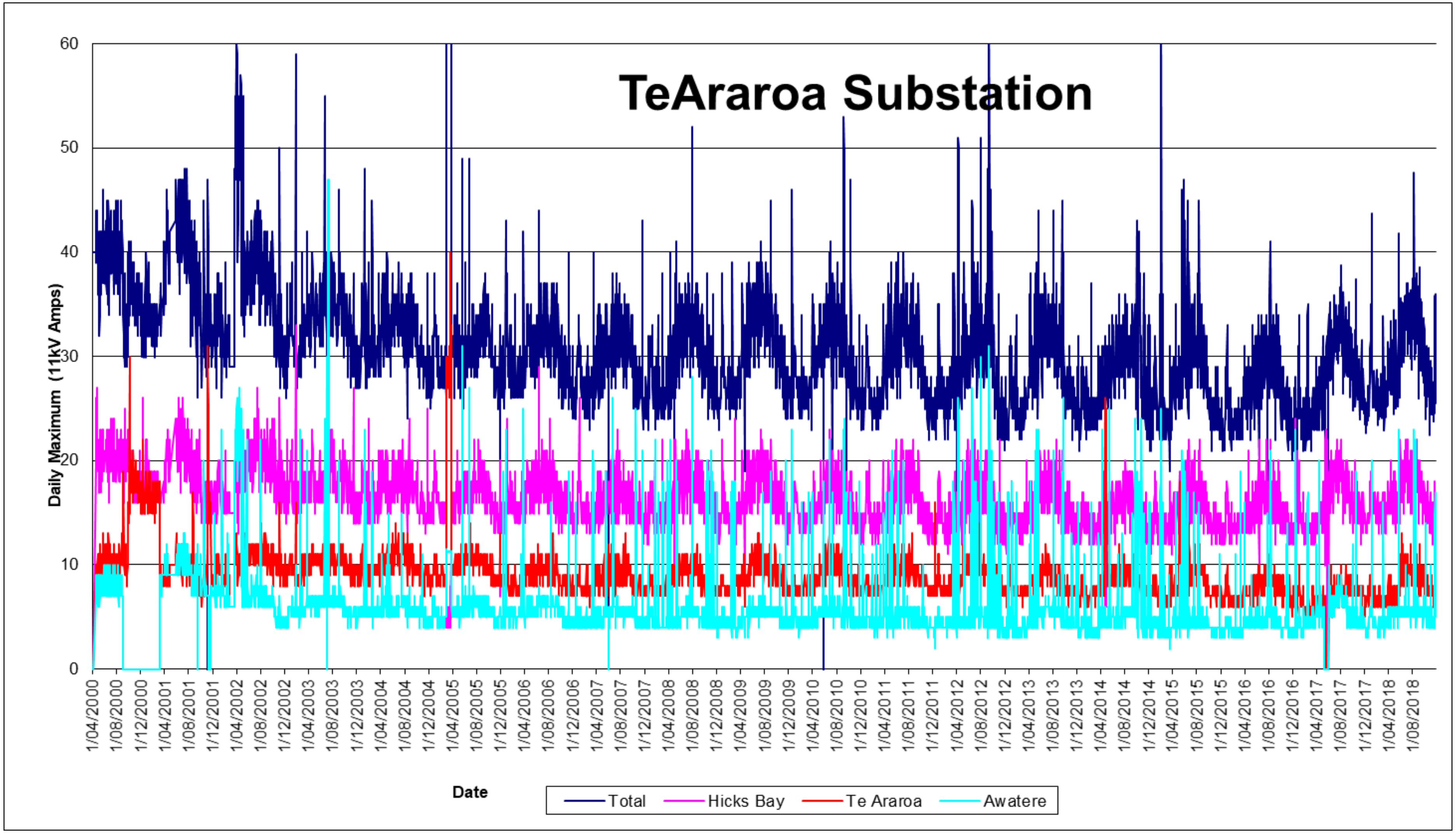

JNL Substation
Daily Maximum (11kV Amps)
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
25/09/2006
25/01/2007
25/05/2007
25/09/2007
25/01/2008
25/05/2008
25/09/2008
25/01/2009
25/05/2009
25/09/2009
25/01/2010
25/05/2010
25/09/2010
25/01/2011
25/05/2011
25/09/2011
25/01/2012
25/05/2012
25/09/2012
25/01/2013
25/05/2013
25/09/2013
25/01/2014
25/05/2014
25/09/2014
25/01/2015
25/05/2015
25/09/2015
25/01/2016
25/05/2016
25/09/2016
25/01/2017
25/05/2017
25/09/2017
25/01/2018
25/05/2018
25/09/2018
Date
Total
JNL
McDonalds


Patutahi Substation
Daily Maximum (11kV Amps)
300
270
240
210
180
150
120
90
60
30
0
1/04/2000
1/08/2000
1/12/2000
1/04/2001
1/08/2001
1/12/2001
1/04/2002
1/08/2002
1/12/2002
1/04/2003
1/08/2003
1/12/2003
1/04/2004
1/08/2004
1/12/2004
1/04/2005
1/08/2005
1/12/2005
1/04/2006
1/08/2006
1/12/2006
1/04/2007
1/08/2007
1/12/2007
1/04/2008
1/08/2008
1/12/2008
1/04/2009
1/08/2009
1/12/2009
1/04/2010
1/08/2010
1/12/2010
1/04/2011
1/08/2011
1/12/2011
1/04/2012
1/08/2012
1/12/2012
1/04/2013
1/08/2013
1/12/2013
1/04/2014
1/08/2014
1/12/2014
1/04/2015
1/08/2015
1/12/2015
1/04/2016
1/08/2016
1/12/2016
1/04/2017
1/08/2017
1/12/2017
1/04/2018
1/08/2018
Date
Total
TeAri
Muriwai

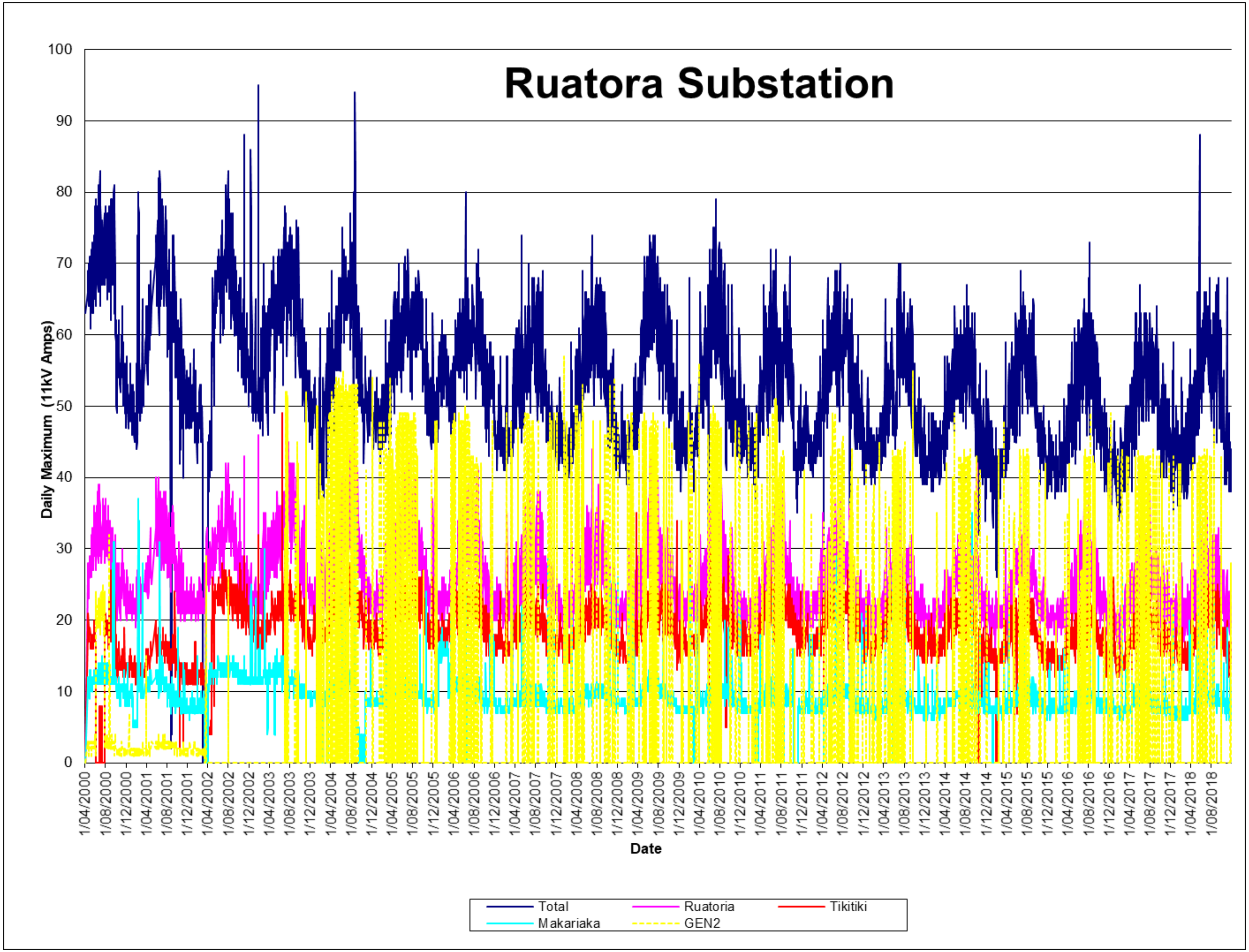

Pehiri Substation
Daily Maximum (11kV Amps)
0
5
10
15
20
25
30
35
40
Date
Total
Tiniroto
Tahunga
Parikania
WarengaOHika

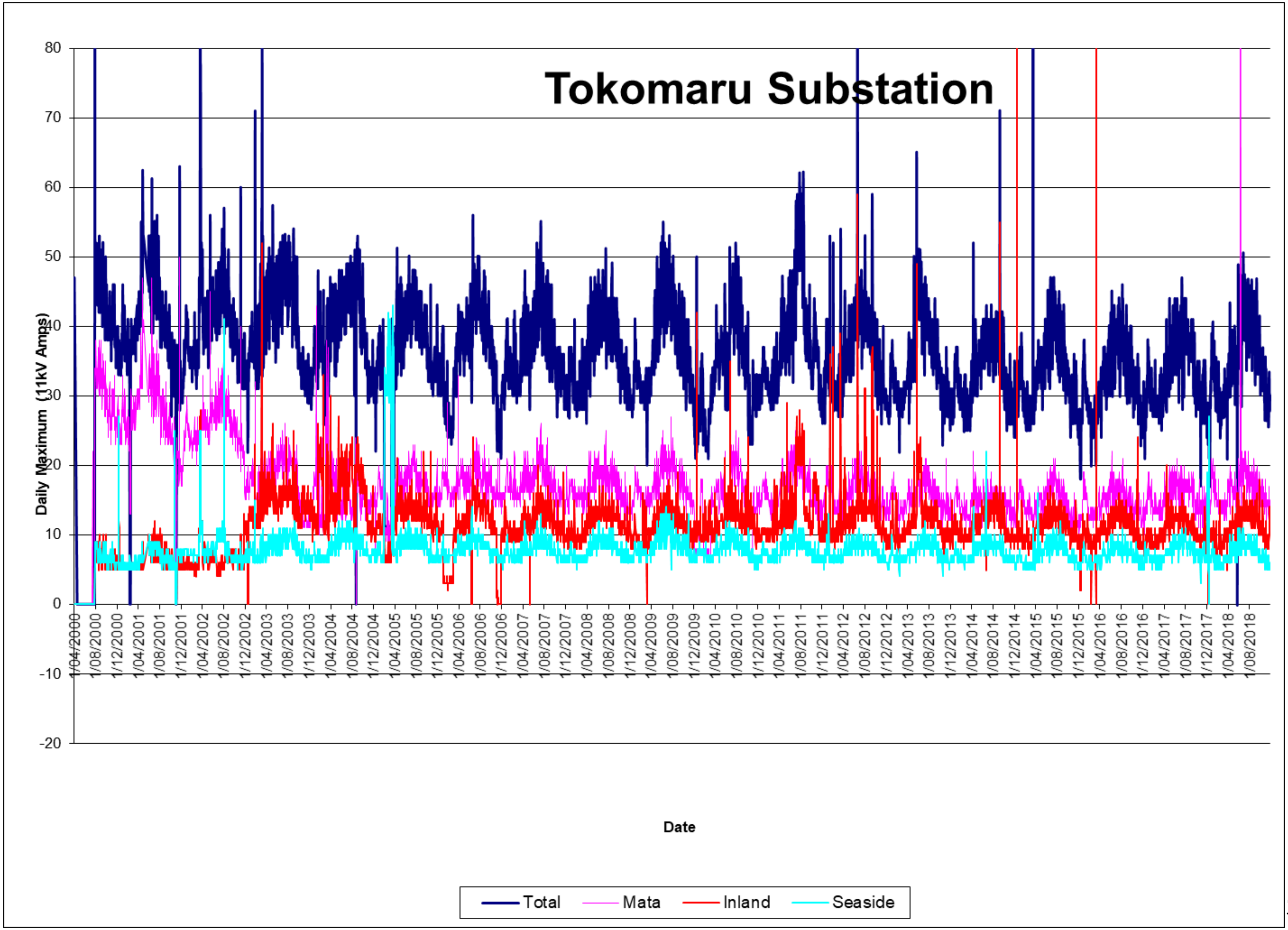

Ngatapa Substation
Daily Maximum (11kV Amps)
0
5
10
15
20
25
30
1/04/2000
1/08/2000
1/12/2000
1/04/2001
1/08/2001
1/12/2001
1/04/2002
1/08/2002
1/12/2002
1/04/2003
1/08/2003
1/12/2003
1/04/2004
1/08/2004
1/12/2004
1/04/2005
1/08/2005
1/12/2005
1/04/2006
1/08/2006
1/12/2006
1/04/2007
1/08/2007
1/12/2007
1/04/2008
1/08/2008
1/12/2008
1/04/2009
1/08/2009
1/12/2009
1/04/2010
1/08/2010
1/12/2010
1/04/2011
1/08/2011
1/12/2011
1/04/2012
1/08/2012
1/12/2012
1/04/2013
1/08/2013
1/12/2013
1/04/2014
1/08/2014
1/12/2014
1/04/2015
1/08/2015
1/12/2015
1/04/2016
1/08/2016
1/12/2016
1/04/2017
1/08/2017
1/12/2017
1/04/2018
1/08/2018
Date
Total
Ngatapa
Taharoa
Totangi


Puha Substation
Daily Maximum (11kV Amps)
Date
Puha Substation
Kanakania
TeKaraka
Matawai
Whatatutu

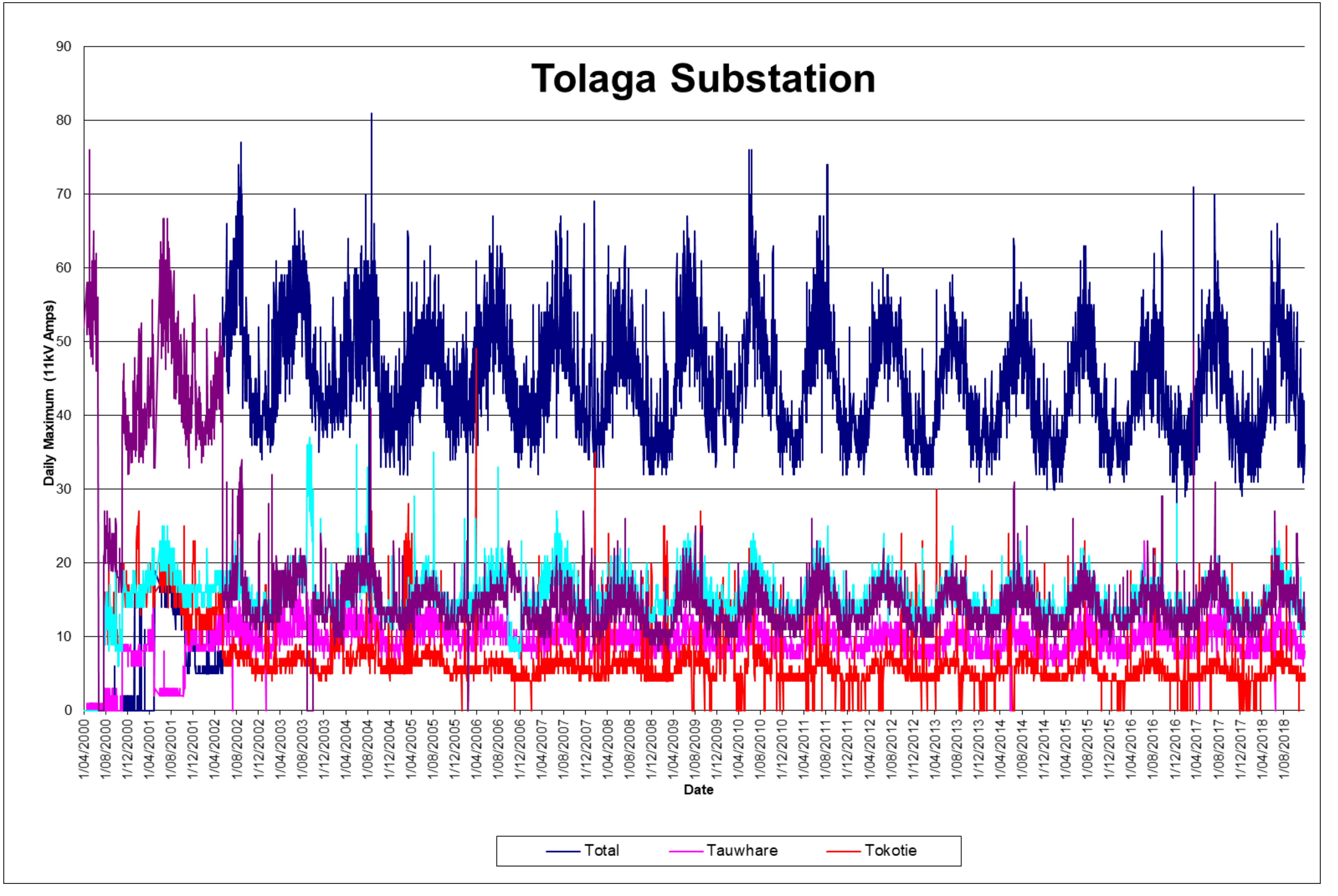


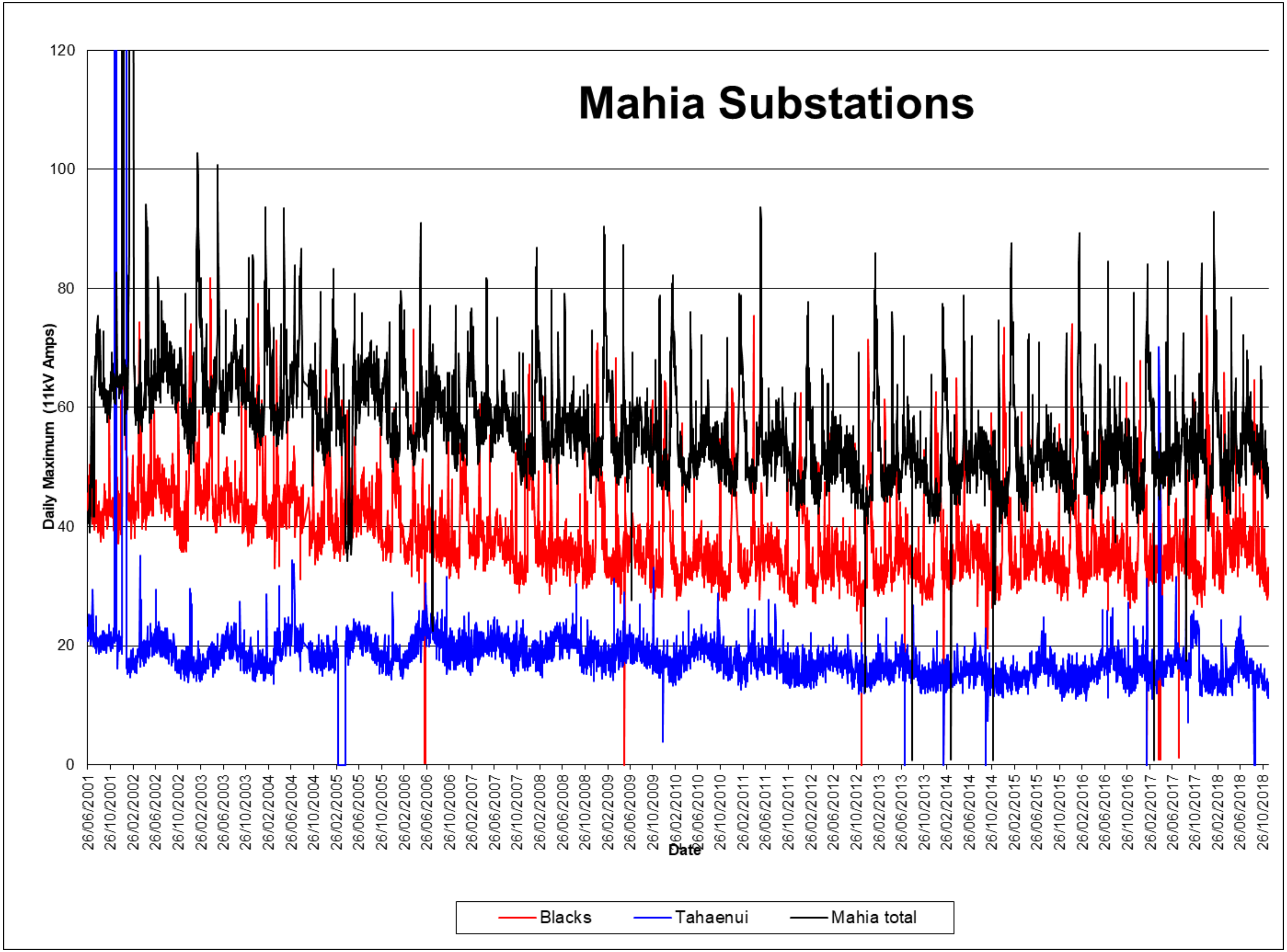
TeAraroa Substation
Daily Maximum (11kV Amps)
60
50
40
30
20
10
0
Date
Total
Hicks Bay
Te Araroa
Awatere

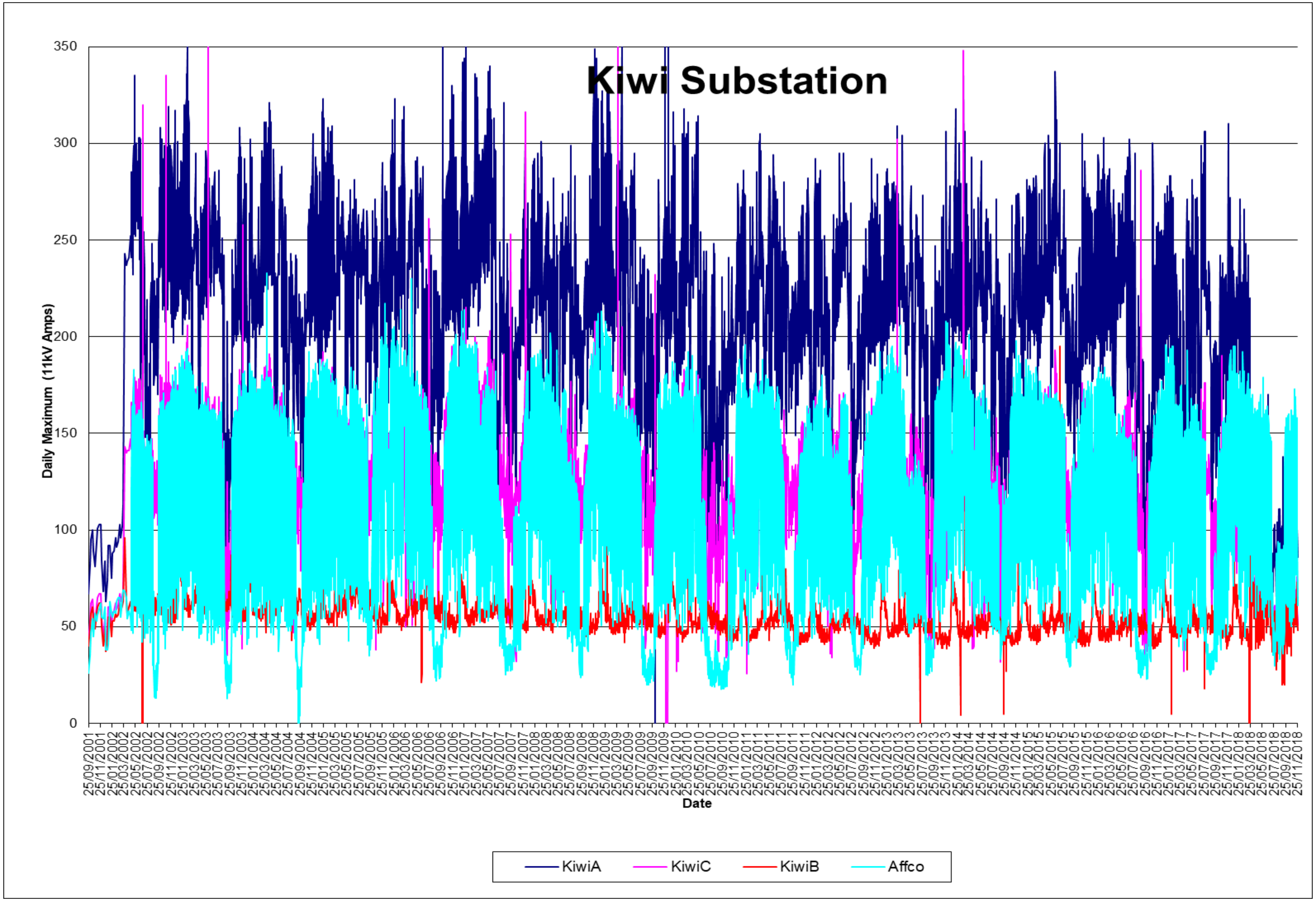

Ruatora Substation
Daily Maximum (11kV Amps)
Date
Total
Ruatoria
Tikitiki
Makariaka
GEN2

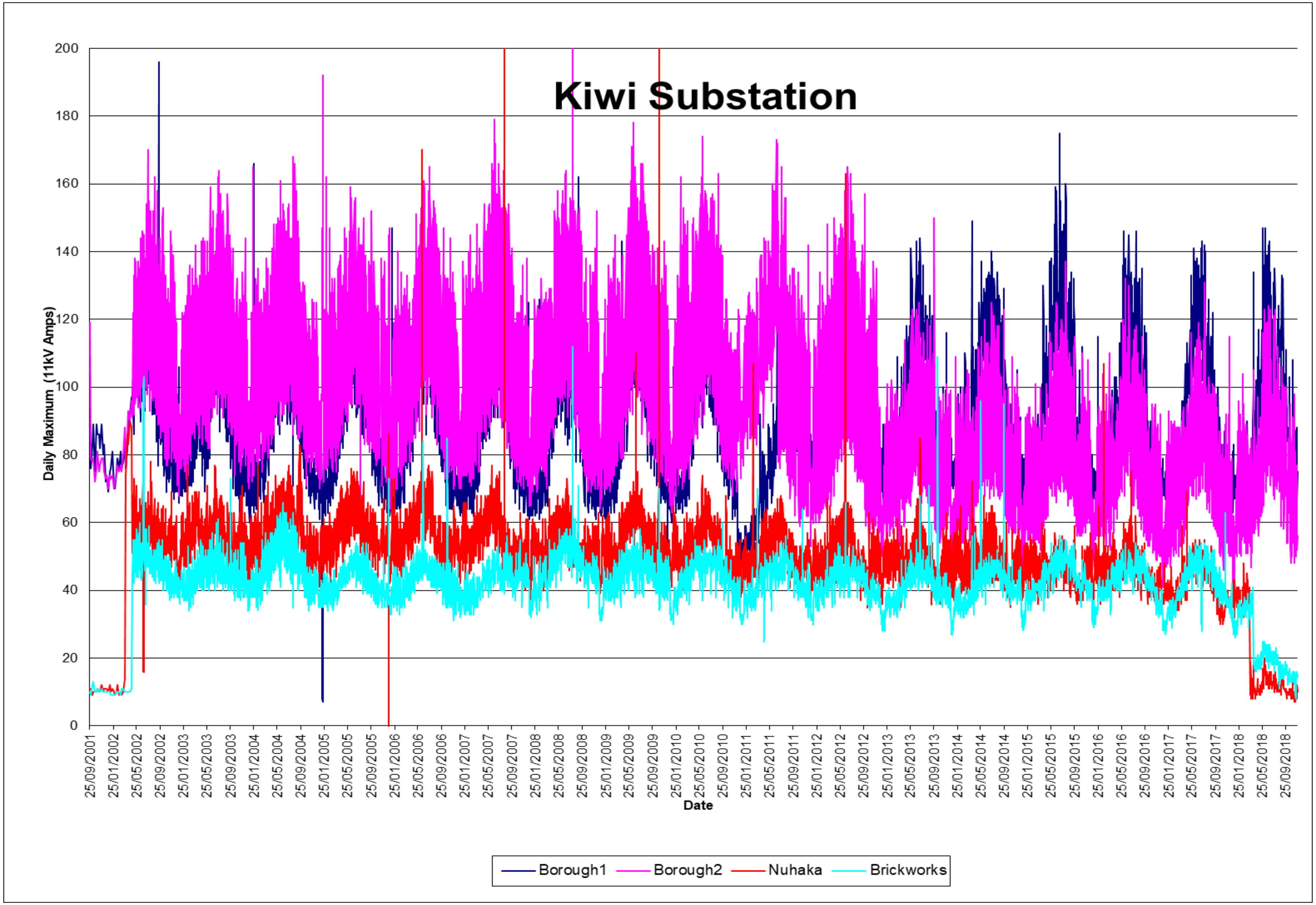


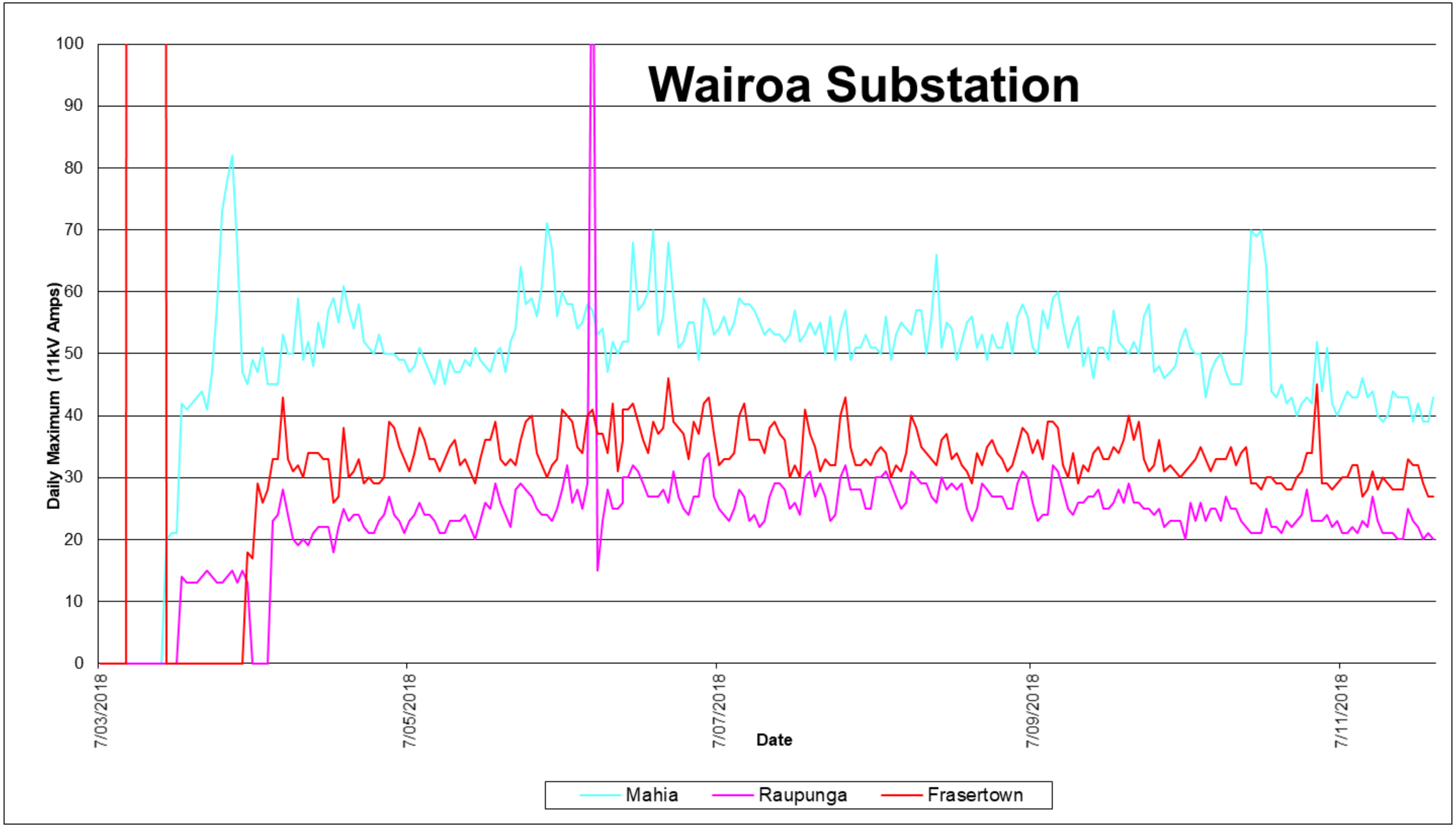
Tokomaru Substation
Daily Maximum (11kV Amps)
Date
Total
Mata
Inland
Seaside
80
70
60
50
40
30
20
10
0
-10
-20


Tolaga Substation
Daily Maximum (11kV Amps)
90
80
70
60
50
40
30
20
10
0
Date
1/04/2000
1/08/2000
1/12/2000
1/04/2001
1/08/2001
1/12/2001
1/04/2002
1/08/2002
1/12/2002
1/04/2003
1/08/2003
1/12/2003
1/04/2004
1/08/2004
1/12/2004
1/04/2005
1/08/2005
1/12/2005
1/04/2006
1/08/2006
1/12/2006
1/04/2007
1/08/2007
1/12/2007
1/04/2008
1/08/2008
1/12/2008
1/04/2009
1/08/2009
1/12/2009
1/04/2010
1/08/2010
1/12/2010
1/04/2011
1/08/2011
1/12/2011
1/04/2012
1/08/2012
1/12/2012
1/04/2013
1/08/2013
1/12/2013
1/04/2014
1/08/2014
1/12/2014
1/04/2015
1/08/2015
1/12/2015
1/04/2016
1/08/2016
1/12/2016
1/04/2017
1/08/2017
1/12/2017
1/04/2018
1/08/2018
Total
Tauwhare
Tokotie


Mahia Substations
Daily Maximum (11kV Amps)
120
100
80
60
40
20
0
Date
Blacks
Tahaenui
Mahia total


Kiwi Substation
Daily Maximum (11kV Amps)
350
300
250
200
150
100
50
0
Date
KiwiA
KiwiC
KiwiB
Affco


Kiwi Substation
Daily Maximum (11kV Amps)
200
180
160
140
120
100
80
60
40
20
0
25/09/2001
25/01/2002
25/05/2002
25/09/2002
25/01/2003
25/05/2003
25/09/2003
25/01/2004
25/05/2004
25/09/2004
25/01/2005
25/05/2005
25/09/2005
25/01/2006
25/05/2006
25/09/2006
25/01/2007
25/05/2007
25/09/2007
25/01/2008
25/05/2008
25/09/2008
25/01/2009
25/05/2009
25/09/2009
25/01/2010
25/05/2010
25/09/2010
25/01/2011
25/05/2011
25/09/2011
25/01/2012
25/05/2012
25/09/2012
25/01/2013
25/05/2013
25/09/2013
25/01/2014
25/05/2014
25/09/2014
25/01/2015
25/05/2015
25/09/2015
25/01/2016
25/05/2016
25/09/2016
25/01/2017
25/05/2017
25/09/2017
25/01/2018
25/05/2018
25/09/2018
Date
Borough1
Borough2
Nuhaka
Brickworks


Wairoa Substation
Daily Maximum (11kV Amps)
100
90
80
70
60
50
40
30
20
10
0
7/03/2018
7/05/2018
7/07/2018
7/09/2018
7/11/2018
Date
Mahia
Raupunga
Frasertown

# A2. Schedule 11a Report on Forecast Capital Expenditure

*Company Name* Eastland Network Limited
*AMP Planning Period* 1 April 2019 – 31 March 2029

## SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

Z:\Network\AMP\AMP VER19 Due 1 April 2019\[Asset Expenditure BexBS 2019-20 .xlsx]11a Capex

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* | | Inflation adj | 1.0000 | 1.0000 | 1.0200 | 1.0404 | 1.0612 | 1.0824 | 1.1041 | 1.1262 | 1.1487 | 1.1717 | 1.1951 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 March 19 | 31 March 20 | 31 March 21 | 31 March 22 | 31 March 23 | 31 March 24 | 31 March 25 | 31 March 26 | 31 March 27 | 31 March 28 | 31 March 29 |
| 9 | **11a(i): Expenditure on Assets Forecast** | | **$000 (in nominal dollars)** | | | | | | | | | | |
| 10 | Consumer connection | | 112 | 112 | 114 | 116 | 119 | 121 | 123 | 126 | 128 | 131 | 133 |
| 11 | System growth | | 1,386 | 939 | 1,296 | 1,525 | 1,193 | 1,259 | 1,826 | 1,372 | 1,969 | 2,205 | 1,397 |
| 12 | Asset replacement and renewal | | 8,853 | 7,589 | 7,672 | 7,808 | 7,629 | 7,917 | 7,681 | 7,649 | 7,770 | 7,855 | 7,892 |
| 13 | Asset relocations | | 50 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 59 | 60 |
| 14 | Reliability, safety and environment: | | | | | | | | | | | | |
| 15 | Quality of supply | | 117 | 122 | 99 | 174 | 59 | 121 | 123 | 239 | 26 | 26 | 67 |
| 16 | Legislative and regulatory | | - | - | 171 | 174 | - | - | - | - | - | - | - |
| 17 | Other reliability, safety and environment | | 341 | 341 | 348 | 355 | - | - | 364 | 372 | 379 | 387 | - |
| 18 | **Total reliability, safety and environment** | | 458 | 463 | 618 | 703 | 59 | 121 | 488 | 611 | 405 | 413 | 67 |
| 19 | **Expenditure on network assets** | | 10,859 | 9,153 | 9,750 | 10,204 | 9,052 | 9,471 | 10,173 | 9,814 | 10,330 | 10,662 | 9,549 |
| 20 | Non-network assets | | 839 | 501 | 163 | 166 | 117 | 119 | 121 | 124 | 126 | 129 | 131 |
| 21 | **Expenditure on assets** | | 11,698 | 9,654 | 9,914 | 10,371 | 9,169 | 9,590 | 10,295 | 9,938 | 10,456 | 10,791 | 9,680 |
| 22 | | | | | | | | | | | | | |
| 23 | *plus* Cost of financing | | | | | | | | | | | | |
| 24 | *less* Value of capital contributions | | 50 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 59 | - |
| 25 | *plus* Value of vested assets | | 200 | 200 | 204 | 208 | 212 | 216 | 221 | 225 | 230 | 234 | - |
| 26 | | | | | | | | | | | | | |
| 27 | **Capital expenditure forecast** | | 11,848 | 9,804 | 10,067 | 10,527 | 9,328 | 9,753 | 10,460 | 10,107 | 10,628 | 10,967 | 9,680 |
| 28 | | Capitalisation Rate | | | | | | | | | | | |
| 29 | Value of commissioned assets | 70% | 12,122 | 10,417 | 9,988 | 10,389 | 9,688 | 9,625 | 10,248 | 10,213 | 10,472 | 10,865 | 10,066 |
| 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 March 19 | 31 March 20 | 31 March 21 | 31 March 22 | 31 March 23 | 31 March 24 | 31 March 25 | 31 March 26 | 31 March 27 | 31 March 28 | 31 March 29 |
| 32 | | | **$000 (in constant prices)** | | | | | | | | | | |
| 33 | Consumer connection | | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 |
| 34 | System growth | | 1,386 | 939 | 1,270 | 1,466 | 1,124 | 1,163 | 1,654 | 1,219 | 1,714 | 1,882 | 1,169 |
| 35 | Asset replacement and renewal | | 8,853 | 7,589 | 7,521 | 7,505 | 7,189 | 7,314 | 6,957 | 6,792 | 6,764 | 6,704 | 6,604 |
| 36 | Asset relocations | | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| 37 | Reliability, safety and environment: | | | | | | | | | | | | |
| 38 | Quality of supply | | 117 | 122 | 97 | 168 | 56 | 112 | 112 | 212 | 22 | 22 | 56 |
| 39 | Legislative and regulatory | | - | - | 168 | 168 | - | - | - | - | - | - | - |
| 40 | Other reliability, safety and environment | | 341 | 341 | 341 | 341 | - | - | 330 | 330 | 330 | 330 | - |
| 41 | **Total reliability, safety and environment** | | 458 | 463 | 606 | 676 | 56 | 112 | 442 | 542 | 352 | 352 | 56 |
| 42 | **Expenditure on network assets** | | 10,859 | 9,153 | 9,559 | 9,808 | 8,530 | 8,750 | 9,214 | 8,714 | 8,993 | 9,100 | 7,990 |
| 43 | Non-network assets | | 839 | 501 | 160 | 160 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| 44 | **Expenditure on assets** | | 11,698 | 9,654 | 9,719 | 9,968 | 8,640 | 8,860 | 9,324 | 8,824 | 9,103 | 9,210 | 8,100 |
| 45 | | | | | | | | | | | | | |

| No. | | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 | CY+6 | CY+7 | CY+8 | CY+9 | CY+10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | | | | | | | | | | | | |
| 46 | **Subcomponents of expenditure on assets (where known)** | | | | | | | | | | | |
| 47 | Energy efficiency and demand side management, reduction of energy losses | | | | | | | | | | | |
| 48 | Overhead to underground conversion | | | | | | | | | | | |
| 49 | Research and development | | | | | | | | | | | |
| 57 | | *Current Year CY* | *CY+1* | *CY+2* | *CY+3* | *CY+4* | *CY+5* | *CY+6* | *CY+7* | *CY+8* | *CY+9* | *CY+10* |
| 58 | for year ended | **31 March 19** | **31 March 20** | **31 March 21** | **31 March 22** | **31 March 23** | **31 March 24** | **31 March 25** | **31 March 26** | **31 March 27** | **31 March 28** | **31 March 29** |
| 59 | **Difference between nominal and constant price forecasts** | **$000** | | | | | | | | | | |
| 60 | Consumer connection | - | - | 2 | 5 | 7 | 9 | 12 | 14 | 17 | 19 | 22 |
| 61 | System growth | - | - | 25 | 59 | 69 | 96 | 172 | 154 | 255 | 323 | 228 |
| 62 | Asset replacement and renewal | - | - | 150 | 303 | 440 | 603 | 724 | 857 | 1,006 | 1,151 | 1,288 |
| 63 | Asset relocations | - | - | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 10 |
| 64 | Reliability, safety and environment: | | | | | | | | | | | |
| 65 | Quality of supply | - | - | 2 | 7 | 3 | 9 | 12 | 27 | 3 | 4 | 11 |
| 66 | Legislative and regulatory | - | - | 3 | 7 | - | - | - | - | - | - | - |
| 67 | Other reliability, safety and environment | - | - | 7 | 14 | - | - | 34 | 42 | 49 | 57 | - |
| 68 | **Total reliability, safety and environment** | - | - | 12 | 27 | 3 | 9 | 46 | 68 | 52 | 60 | 11 |
| 69 | **Expenditure on network assets** | - | - | 191 | 396 | 522 | 721 | 959 | 1,099 | 1,337 | 1,562 | 1,559 |
| 70 | Non-network assets | - | - | 3 | 6 | 7 | 9 | 11 | 14 | 16 | 19 | 21 |
| 71 | **Expenditure on assets** | - | - | 194 | 403 | 529 | 730 | 970 | 1,113 | 1,353 | 1,581 | 1,580 |
| 72 | | | | | | | | | | | | |

| No. | | | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|---|---|
| 73 | | | *Current Year CY* | *CY+1* | *CY+2* | *CY+3* | *CY+4* | *CY+5* |
| | | for year ended | **31 March 19** | **31 March 20** | **31 March 21** | **31 March 22** | **31 March 23** | **31 March 24** |
| 74 | **11a(ii): Consumer Connection** | | | | | | | |
| 75 | | *Consumer types defined by EDB** | **$000 (in constant prices)** | | | | | |
| 76 | | Residential | 56 | 56 | 56 | 56 | 56 | 56 |
| 77 | | Commercial | - | - | - | - | - | - |
| 78 | | Industrial | 56 | 56 | 56 | 56 | 56 | 56 |
| 81 | | **include additional rows if needed* | | | | | | |
| 82 | | **Consumer connection expenditure** | 112 | 112 | 112 | 112 | 112 | 112 |
| 83 | *less* | Capital contributions funding consumer connection | 50 | 50 | 50 | 50 | 50 | 50 |
| 84 | | **Consumer connection less capital contributions** | 162 | 162 | 162 | 162 | 162 | 162 |
| 85 | **11a(iii): System Growth** | | | | | | | |
| 86 | | Subtransmission | 503 | 55 | 550 | 550 | - | - |
| 87 | | Zone substations | - | - | - | - | 275 | 275 |
| 88 | | Distribution and LV lines | 155 | 155 | 155 | 155 | 155 | 155 |
| 89 | | Distribution and LV cables | 474 | 474 | 311 | 506 | 439 | 199 |
| 90 | | Distribution substations and transformers | 255 | 255 | 255 | 255 | 255 | 255 |
| 91 | | Distribution switchgear | - | - | - | - | - | - |
| 92 | | Other network assets | - | - | - | - | - | 279 |
| 93 | | **System growth expenditure** | 1,386 | 939 | 1,270 | 1,466 | 1,124 | 1,163 |
| 94 | *less* | Capital contributions funding system growth | - | - | - | - | - | - |
| 95 | | **System growth less capital contributions** | 1,386 | 939 | 1,270 | 1,466 | 1,124 | 1,163 |

| Row | | | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|---|---|
| 104 | | for year ended | 31 March 19 | 31 March 20 | 31 March 21 | 31 March 22 | 31 March 23 | 31 March 24 |
| 105 | **11a(iv): Asset Replacement and Renewal** | | **$000 (in constant prices)** | | | | | |
| 106 | | Subtransmission | 1,401 | 1,267 | 1,372 | 1,272 | 1,272 | 1,381 |
| 107 | | Zone substations | 2,561 | 1,095 | 839 | 1,148 | 451 | 556 |
| 108 | | Distribution and LV lines | 3,592 | 3,985 | 3,985 | 3,875 | 4,167 | 4,167 |
| 109 | | Distribution and LV cables | 222 | 222 | 222 | 222 | 222 | 222 |
| 110 | | Distribution substations and transformers | 413 | 413 | 413 | 413 | 413 | 413 |
| 111 | | Distribution switchgear | 508 | 452 | 508 | 452 | 508 | 452 |
| 112 | | Other network assets | 156 | 155 | 182 | 122 | 156 | 122 |
| 113 | | **Asset replacement and renewal expenditure** | 8,853 | 7,589 | 7,521 | 7,505 | 7,189 | 7,314 |
| 114 | *less* | Capital contributions funding asset replacement and renewal | - | - | - | - | - | - |
| 115 | | **Asset replacement and renewal less capital contributions** | 8,853 | 7,589 | 7,521 | 7,505 | 7,189 | 7,314 |
| 116 | **11a(v):Asset Relocations** | | | | | | | |
| 117 | | *Project or programme** | | | | | | |
| 118 | | Asset Relocation Unplanned/Unknown | 50 | 50 | 50 | 50 | 50 | 50 |
| 123 | | **include additional rows if needed* | | | | | | |
| 124 | | All other asset relocations projects or programmes | | | | | | |
| 125 | | **Asset relocations expenditure** | 50 | 50 | 50 | 50 | 50 | 50 |
| 126 | *less* | Capital contributions funding asset relocations | - | - | - | - | - | - |
| 127 | | **Asset relocations less capital contributions** | 50 | 50 | 50 | 50 | 50 | 50 |
| 128 | | | | | | | | |
| 129 | **11a(vi):Quality of Supply** | | | | | | | |
| 130 | | *Project or programme** | | | | | | |
| 131 | | 11kV cable Port feeder link | - | - | - | - | - | - |
| 132 | | Kiwi TX bunding & SEPA unit | - | - | 75 | - | - | - |
| 133 | | Building/Switchyard Security Upgrade (2016/17 defer Kaiti) | 56 | 11 | 11 | 11 | 11 | 11 |
| | | 11kV Field Recloser Automation Plan - additions | - | 56 | - | 56 | - | 56 |
| | | SCADA Master Station Development | 11 | 11 | 11 | 11 | 11 | 11 |
| | | SCADA Rural Automation -development | - | - | - | 34 | 34 | 34 |
| | | SCADA Long Term Development Additional Sites | - | - | - | 56 | - | - |
| | | Alternate Massey Rd Control Room (defer from 2018/19) | 50 | 44 | - | - | - | - |
| 134 | | Establish 2x Genset sites (Raupunga & Ruakituri)(defer 2016/17) | 0 | - | - | - | - | - |
| 135 | | Trailer mounted 30KVA Generator | - | - | - | - | - | - |
| 136 | | **include additional rows if needed* | | | | | | |
| 137 | | All other quality of supply projects or programmes | | | | | | |
| 138 | | **Quality of supply expenditure** | 117 | 122 | 97 | 168 | 56 | 112 |
| 139 | *less* | Capital contributions funding quality of supply | - | - | - | - | - | - |
| 140 | | **Quality of supply less capital contributions** | 117 | 122 | 97 | 168 | 56 | 112 |
| 141 | | | | | | | | |
| 142 | **11a(vii): Legislative and Regulatory** | | | | | | | |
| 143 | | *Project or programme** | | | | | | |
| 144 | | AUFLS Relay install | - | - | 168 | 168 | - | - |
| 149 | | **include additional rows if needed* | | | | | | |
| 150 | | All other legislative and regulatory projects or programmes | | | | | | |
| 151 | | **Legislative and regulatory expenditure** | - | - | 168 | 168 | - | - |
| 152 | *less* | Capital contributions funding legislative and regulatory | - | - | - | - | - | - |
| 153 | | **Legislative and regulatory less capital contributions** | - | - | 168 | 168 | - | - |

| Row | | for year ended | Current Year CY 31 March 19 | CY+1 31 March 20 | CY+2 31 March 21 | CY+3 31 March 22 | CY+4 31 March 23 | CY+5 31 March 24 |
|---|---|---|---|---|---|---|---|---|
| 161 | | | | | | | | |
| 162 | | | | | | | | |
| 163 | **11a(viii): Other Reliability, Safety and Environment** | | | | | | | |
| 164 | *Project or programme** | | $000 (in constant prices) | | | | | |
| 165 | Wairoa GXP 11kV Feeder Rationalisation/Reinstatement (defer fron 2016/17) | | - | - | - | - | - | - |
| 166 | Service Fuse Boxes & Meter Bds to Replace Galv Meter Box (Asbestos), 100pa from 2017- Safety | | 341 | 341 | 341 | 341 | - | - |
| | Replace 11kV SWGR Matawhero,Kaiti, Kiwi & Parkinson | | - | - | - | - | - | - |
| 170 | **include additional rows if needed* | | | | | | | |
| 171 | All other reliability, safety and environment projects or programmes | | | | | | | |
| 172 | **Other reliability, safety and environment expenditure** | | 341 | 341 | 341 | 341 | - | - |
| 173 | *less* Capital contributions funding other reliability, safety and environment | | - | - | - | - | - | - |
| 174 | **Other reliability, safety and environment less capital contributions** | | 341 | 341 | 341 | 341 | - | - |
| 175 | | | | | | | | |
| 176 | | | | | | | | |
| 177 | | | | | | | | |

| Row | | CY 31 March 19 | CY+1 31 March 20 | CY+2 31 March 21 | CY+3 31 March 22 | CY+4 31 March 23 | CY+5 31 March 24 |
|---|---|---|---|---|---|---|---|
| 178 | **11a(ix): Non-Network Assets** | | | | | | |
| 179 | **Routine expenditure** | | | | | | |
| 180 | *Project or programme** | | | | | | |
| 181 | Test Instrument & Safety Equipment,(inc Lone worker 19/20 additional/upgrade) | 16 | 16 | 10 | 10 | 10 | 10 |
| 182 | Vehicle Replacement @ $60k each (Ntk) | 60 | 60 | 60 | 60 | 60 | 60 |
| 183 | Vehicle Replacement @ $60k each (Eastech) + 1x Trailers 2018/19 & 2019/20 @ $3k Ea | 63 | - | - | - | - | - |
| 184 | EPV 5yr Cert @ $20k (19/20 x2) | - | - | - | - | - | - |
| | General asset replacement (Eastech) | 20 | - | - | - | - | - |
| 185 | General asset replacement (Ntk) | 20 | 20 | 20 | 20 | 20 | 20 |
| | General building capex (ENL office, Eastech, Wairoa Depot) | 10 | 20 | 20 | 20 | 20 | 20 |
| 186 | **include additional rows if needed* | | | | | | |
| 187 | All other routine expenditure projects or programmes | | | | | | |
| 188 | **Routine expenditure** | 189 | 116 | 110 | 110 | 110 | 110 |
| 189 | **Atypical expenditure** | | | | | | |
| 190 | *Project or programme** | | | | | | |
| 191 | GIS Thin Client Softwaret | 50 | 50 | - | - | - | - |
| 192 | Plan Plotter/Printer replacement | - | 15 | - | - | - | - |
| 193 | Property Capital Projects (ENL Carnarvon St office refurb) | 350 | 150 | - | - | - | - |
| 194 | Property Capital Projects (Carnarvon St security fence upgrade) | - | 20 | - | - | - | - |
| | Property Capital Projects (Eastech office refurb) | - | 30 | - | - | - | - |
| | Property Capital Projects (Wairoa office & w/shop refurb) | 100 | - | 50 | 50 | - | - |
| | Solar PV Trial (Carnarvon & 1x Wairoa defer from 2016/17) | - | 55 | - | - | - | - |
| | Home EV Charger trial (half cost with Energy Solutions) | - | 15 | - | - | - | - |
| | Property Capital Projects (ENL Carnarvon St earthquake strengthening) | 150 | 50 | - | - | - | - |
| 196 | **include additional rows if needed* | | | | | | |
| 197 | All other atypical projects or programmes | | | | | | |
| 198 | **Atypical expenditure** | 650 | 385 | 50 | 50 | - | - |
| 199 | | | | | | | |
| 200 | **Non-network assets expenditure** | 839 | 501 | 160 | 160 | 110 | 110 |

# A3. Schedule 11b Report on Forecast Operational Expenditure

Company Name: Eastland Network Limited
AMP Planning Period: 1 April 2019 – 31 March 2029

## SCHEDULE 11b: REPORT ON FORECAST OPERATIONAL EXPENDITURE

Z:\Network\AMP\AMP VER19 Due 1 April 2019\[Asset Expenditure BexBS 2019-20 .xlsx]11b Opex

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 | | Inflation adj | 1.0000 | 1.0000 | 1.0200 | 1.0404 | 1.0612 | 1.0824 | 1.1041 | 1.1262 | 1.1487 | 1.1717 | 1.1951 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 March 19** | **31 March 20** | **31 March 21** | **31 March 22** | **31 March 23** | **31 March 24** | **31 March 25** | **31 March 26** | **31 March 27** | **31 March 28** | **31 March 29** |
| 9 | Operational Expenditure Forecast | | **$000 (in nominal dollars)** | | | | | | | | | | |
| 10 | Service interruptions and emergencies | | 1,356 | 1,364 | 1,392 | 1,420 | 1,448 | 1,477 | 1,506 | 1,537 | 1,567 | 1,599 | 1,631 |
| 11 | Vegetation management | | 1,015 | 1,015 | 1,035 | 1,056 | 1,077 | 1,099 | 1,121 | 1,143 | 1,166 | 1,189 | 1,213 |
| 12 | Routine & Corrective Maint & Inspection | | 1,510 | 1,520 | 1,704 | 1,602 | 1,650 | 1,645 | 1,771 | 1,881 | 1,763 | 1,822 | 1,816 |
| 13 | Asset replacement and renewal | | 2,263 | 1,907 | 1,843 | 1,880 | 1,917 | 1,955 | 1,995 | 2,034 | 2,075 | 2,117 | 2,159 |
| 14 | **Network Opex** | | 6,144 | 5,806 | 5,974 | 5,957 | 6,093 | 6,176 | 6,393 | 6,596 | 6,571 | 6,727 | 6,819 |
| 15 | System operations and network support | | 2,908 | 1,269 | 2,079 | 2,097 | 2,263 | 2,286 | 2,285 | 2,382 | 2,401 | 2,437 | 2,607 |
| 16 | Business support | | 832 | 4,007 | 4,088 | 4,169 | 4,253 | 4,338 | 4,425 | 4,513 | 4,603 | 4,695 | 4,789 |
| 17 | **Non-network opex** | | 3,740 | 5,276 | 6,167 | 6,267 | 6,515 | 6,624 | 6,710 | 6,895 | 7,004 | 7,133 | 7,396 |
| 18 | **Operational expenditure** | | 9,884 | 11,082 | 12,141 | 12,224 | 12,608 | 12,800 | 13,103 | 13,491 | 13,576 | 13,859 | 14,215 |
| 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 March 19** | **31 March 20** | **31 March 21** | **31 March 22** | **31 March 23** | **31 March 24** | **31 March 25** | **31 March 26** | **31 March 27** | **31 March 28** | **31 March 29** |
| 21 | | | **$000 (in constant prices)** | | | | | | | | | | |
| 22 | Service interruptions and emergencies | | 1,356 | 1,364 | 1,364 | 1,364 | 1,364 | 1,364 | 1,364 | 1,364 | 1,364 | 1,364 | 1,364 |
| 23 | Vegetation management | | 1,015 | 1,015 | 1,015 | 1,015 | 1,015 | 1,015 | 1,015 | 1,015 | 1,015 | 1,015 | 1,015 |
| 24 | Routine & Corrective Maint & Inspection | | 1,510 | 1,520 | 1,671 | 1,540 | 1,555 | 1,520 | 1,604 | 1,671 | 1,535 | 1,555 | 1,520 |
| 25 | Asset replacement and renewal | | 2,263 | 1,907 | 1,807 | 1,807 | 1,807 | 1,807 | 1,807 | 1,807 | 1,807 | 1,807 | 1,807 |
| 26 | **Network Opex** | | 6,144 | 5,806 | 5,857 | 5,726 | 5,741 | 5,706 | 5,790 | 5,857 | 5,721 | 5,741 | 5,706 |
| 27 | System operations and network support | | 2,908 | 1,269 | 2,038 | 2,016 | 2,132 | 2,112 | 2,070 | 2,115 | 2,090 | 2,080 | 2,181 |
| 28 | Business support | | 832 | 4,007 | 4,007 | 4,007 | 4,007 | 4,007 | 4,007 | 4,007 | 4,007 | 4,007 | 4,007 |
| 29 | **Non-network opex** | | 3,740 | 5,276 | 6,046 | 6,023 | 6,140 | 6,120 | 6,077 | 6,123 | 6,097 | 6,088 | 6,189 |
| 30 | **Operational expenditure** | | 9,884 | 11,082 | 11,903 | 11,749 | 11,881 | 11,825 | 11,868 | 11,979 | 11,818 | 11,829 | 11,894 |
| 31 | Subcomponents of operational expenditure (where known) | | | | | | | | | | | | |
| 32 | Energy efficiency and demand side management, reduction of | | | | | | | | | | | | |
| 33 | energy losses | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | |
| 36 | Insurance | | 255 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 |
| 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 March 19** | **31 March 20** | **31 March 21** | **31 March 22** | **31 March 23** | **31 March 24** | **31 March 25** | **31 March 26** | **31 March 27** | **31 March 28** | **31 March 29** |
| 41 | Difference between nominal and real forecasts | | **$000** | | | | | | | | | | |
| 42 | Service interruptions and emergencies | | - | - | 27 | 55 | 84 | 112 | 142 | 172 | 203 | 234 | 266 |
| 43 | Vegetation management | | - | - | 20 | 41 | 62 | 84 | 106 | 128 | 151 | 174 | 198 |
| 44 | Routine and corrective maintenance and inspection | | - | - | 33 | 62 | 95 | 125 | 167 | 211 | 228 | 267 | 296 |
| 45 | Asset replacement and renewal | | - | - | 36 | 73 | 111 | 149 | 188 | 228 | 269 | 310 | 352 |
| 46 | **Network Opex** | | - | - | 117 | 231 | 351 | 470 | 603 | 739 | 851 | 986 | 1,113 |
| 47 | System operations and network support | | - | - | 41 | 81 | 130 | 174 | 215 | 267 | 311 | 357 | 426 |
| 48 | Business support | | - | - | 80 | 162 | 245 | 330 | 417 | 506 | 596 | 688 | 782 |
| 49 | **Non-network opex** | | - | - | 121 | 243 | 376 | 504 | 633 | 772 | 907 | 1,045 | 1,207 |
| 50 | **Operational expenditure** | | - | - | 238 | 475 | 727 | 975 | 1,235 | 1,511 | 1,757 | 2,031 | 2,320 |

# A4. Schedule 12a Report on Asset Condition

*Company Name* **Eastland Network Limited**

*AMP Planning Period* **1 April 2019 – 31 March 2029**

## 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* | | | | | | | | | | | |
| *9* | **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** |
| *10* | All | Overhead Line | Concrete poles / steel structure | No. | - | 3.00% | 58.00% | 39.00% | - | 1 | 1.00% |
| *11* | All | Overhead Line | Wood poles | No. | 3.00% | 21.00% | 61.00% | 15.00% | - | 1 | 21.00% |
| *12* | All | Overhead Line | Other pole types | No. | - | - | - | - | - | 4 | - |
| *13* | HV | Subtransmission Line | Subtransmission OH up to 66kV conductor | km | 13.00% | 29.00% | 56.00% | 2.00% | - | 1 | 1.00% |
| *14* | HV | Subtransmission Line | Subtransmission OH 110kV+ conductor | km | 34.00% | 43.00% | 23.00% | - | - | 1 | - |
| *15* | HV | Subtransmission Cable | Subtransmission UG up to 66kV (XLPE) | km | - | - | 100.00% | - | - | 1 | - |
| *16* | HV | Subtransmission Cable | Subtransmission UG up to 66kV (Oil pressurised) | km | - | - | - | - | - | 4 | - |
| *17* | HV | Subtransmission Cable | Subtransmission UG up to 66kV (Gas pressurised) | km | - | - | - | - | - | 4 | - |
| *18* | HV | Subtransmission Cable | Subtransmission UG up to 66kV (PILC) | km | - | - | - | - | - | 4 | - |
| *19* | HV | Subtransmission Cable | Subtransmission UG 110kV+ (XLPE) | km | - | - | - | - | - | 4 | - |
| *20* | HV | Subtransmission Cable | Subtransmission UG 110kV+ (Oil pressurised) | km | - | - | - | - | - | 4 | - |
| *21* | HV | Subtransmission Cable | Subtransmission UG 110kV+ (Gas Pressurised) | km | - | - | - | - | - | 4 | - |
| *22* | HV | Subtransmission Cable | Subtransmission UG 110kV+ (PILC) | km | - | - | - | - | - | 4 | - |
| *23* | HV | Subtransmission Cable | Subtransmission submarine cable | km | - | - | - | - | - | 4 | - |
| *24* | HV | Zone substation Buildings | Zone substations up to 66kV | No. | - | - | 67.00% | 33.00% | - | 1 | - |
| *25* | HV | Zone substation Buildings | Zone substations 110kV+ | No. | - | - | 14.00% | 86.00% | - | 1 | - |
| *26* | HV | Zone substation switchgear | 22/33kV CB (Indoor) | No. | - | - | - | - | - | 4 | - |
| *27* | HV | Zone substation switchgear | 22/33kV CB (Outdoor) | No. | - | - | 100.00% | - | - | 1 | - |
| *28* | HV | Zone substation switchgear | 33kV Switch (Ground Mounted) | No. | - | - | - | - | - | 4 | - |
| *29* | HV | Zone substation switchgear | 33kV Switch (Pole Mounted) | No. | - | - | - | - | - | 4 | - |
| *30* | HV | Zone substation switchgear | 33kV RMU | No. | - | - | - | - | - | 4 | - |
| *31* | HV | Zone substation switchgear | 50/66/110kV CB (Indoor) | No. | - | - | - | - | - | 4 | - |
| *32* | HV | Zone substation switchgear | 50/66/110kV CB (Outdoor) | No. | 2.00% | 33.00% | 65.00% | - | - | 1 | 10.00% |
| *33* | HV | Zone substation switchgear | 3.3/6.6/11/22kV CB (ground mounted) | No. | 1.00% | 30.00% | 69.00% | - | - | 1 | 20.00% |
| *34* | HV | Zone substation switchgear | 3.3/6.6/11/22kV CB (pole mounted) | No. | - | - | 100.00% | - | - | 1 | - |

| 42 | | | | | Asset condition at start of planning period (percentage of units by grade) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | | | | | | | | | | | |
| 44 | 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 |
| 45 | HV | Zone Substation Transformer | Zone Substation Transformers | No. | 8.00% | 30.00% | 50.00% | 12.00% | - | 1 | 10.00% |
| 46 | HV | Distribution Line | Distribution OH Open Wire Conductor | km | 4.00% | 29.00% | 61.00% | 6.00% | - | 1 | 20.00% |
| 47 | HV | Distribution Line | Distribution OH Aerial Cable Conductor | km | - | - | - | - | - | 4 | - |
| 48 | HV | Distribution Line | SWER conductor | km | - | - | 100.00% | - | - | 1 | - |
| 49 | HV | Distribution Cable | Distribution UG XLPE or PVC | km | 1.00% | 2.00% | 74.00% | 23.00% | - | 1 | - |
| 50 | HV | Distribution Cable | Distribution UG PILC | km | - | 9.00% | 82.00% | 9.00% | - | 1 | - |
| 51 | HV | Distribution Cable | Distribution Submarine Cable | km | - | - | - | - | - | 4 | - |
| 52 | HV | Distribution switchgear | 3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers | No. | - | 21.00% | 79.00% | - | - | 1 | 21.00% |
| 53 | HV | Distribution switchgear | 3.3/6.6/11/22kV CB (Indoor) | No. | - | 21.00% | 79.00% | - | - | 1 | - |
| 54 | HV | Distribution switchgear | 3.3/6.6/11/22kV Switches and fuses (pole mounted) | No. | - | 4.00% | 60.00% | 36.00% | - | 1 | 7.00% |
| 55 | HV | Distribution switchgear | 3.3/6.6/11/22kV Switch (ground mounted) - except RMU | No. | - | 3.00% | 97.00% | - | - | 1 | - |
| 56 | HV | Distribution switchgear | 3.3/6.6/11/22kV RMU | No. | 19.00% | 19.00% | 62.00% | - | - | 1 | 36.00% |
| 57 | HV | Distribution Transformer | Pole Mounted Transformer | No. | - | - | 60.00% | 40.00% | - | 1 | 8.00% |
| 58 | HV | Distribution Transformer | Ground Mounted Transformer | No. | - | 14.00% | 86.00% | - | - | 1 | 6.00% |
| 59 | HV | Distribution Transformer | Voltage regulators | No. | - | 50.00% | 50.00% | - | - | 1 | - |
| 60 | HV | Distribution Substations | Ground Mounted Substation Housing | No. | - | 14.00% | 86.00% | - | - | 1 | 6.00% |
| 61 | LV | LV Line | LV OH Conductor | km | 5.00% | 11.00% | 76.00% | 8.00% | - | 1 | 1.00% |
| 62 | LV | LV Cable | LV UG Cable | km | 1.00% | 40.00% | 51.00% | 8.00% | - | 1 | - |
| 63 | LV | LV Streetlighting | LV OH/UG Streetlight circuit | km | - | - | 44.00% | 56.00% | - | 1 | - |
| 64 | LV | Connections | OH/UG consumer service connections | No. | - | - | 72.00% | 28.00% | - | 1 | - |
| 65 | All | Protection | Protection relays (electromechanical, solid state and numeric) | No. | - | 5.00% | 95.00% | - | - | 1 | 10.00% |
| 66 | All | SCADA and communications | SCADA and communications equipment operating as a single system | Lot | 5.00% | 12.00% | 83.00% | - | - | 1 | 25.00% |
| 67 | All | Capacitor Banks | Capacitors including controls | No. | - | - | 100.00% | - | - | 1 | - |
| 68 | All | Load Control | Centralised plant | Lot | - | 100.00% | - | - | - | 1 | 50.00% |
| 69 | All | Load Control | Relays | No. | - | - | 61.00% | 39.00% | - | 1 | - |
| 70 | All | Civils | Cable Tunnels | km | - | - | - | - | - | 4 | - |

# A5. Schedule 12b Report on Forecast Capacity

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 – 31 March 2029** |

## 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 | TeAraroa | 1 | - | N-1 Switched | 1 | - | - | - | Transformer | Constraint supported by Generation AMP 4.2.2.4 |
| 10 | Ruatoria | 1 | - | N-1 Switched | 1 | - | - | - | Transformer | Constraint supported by Generation AMP 4.2.2.4 |
| 11 | Tokomaru | 1 | - | N-1 Switched | 2 | - | - | - | Transformer | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| 12 | Tolaga | 1 | - | N-1 Switched | 1 | - | - | - | Transformer | Constraint supported by Generation AMP 4.2.2.4 |
| 13 | Kaiti | 7 | - | N-1 Switched | 8 | - | - | - | Transformer | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| 14 | Port | 8 | - | N-1 Switched | 8 | - | - | - | Transformer | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| | Gisborne | 48 | 60 | N-1 | - | 80% | 60 | 75% | No constraint within +5 years | |
| 15 | Carnarvon | 15 | 13 | N-1 | 8 | 118% | 13 | 90% | No constraint within +5 years | Current Peak caused when load transferred to site during contengency |
| 16 | Parkinson | 10 | 13 | N-1 | 8 | 81% | 13 | 37% | No constraint within +5 years | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| 17 | Makaraka | 7 | - | N-1 Switched | 8 | - | - | - | Transformer | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| 18 | Patutahi | 4 | - | N-1 Switched | 5 | - | - | - | Transformer | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| 19 | Pehiri | 1 | - | N-1 Switched | 2 | - | - | - | Transformer | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| 20 | Ngatapa | 0 | - | N-1 Switched | 2 | - | - | - | Transformer | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| 21 | Puha | 2 | - | N-1 Switched | 3 | - | - | - | Transformer | Constraint supported by Generation AMP 4.2.2.4 |
| 22 | JNL | 5 | - | N-1 Switched | 8 | - | - | - | Transformer | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| 23 | Matawhero | 4 | 5 | N-1 | 8 | 72% | 5 | 70% | No constraint within +5 years | Current Peak caused when load transferred to site during contengency |
| 24 | Tuai | 1 | 5 | N | - | 12% | - | - | Transformer | Portable Generation Used for extended repair times AMP 4.2.2.4 |
| | Kiwi | 5 | 7 | N | - | 74% | | | Transformer | Generation Infeed |
| 25 | Wairoa | 7 | 10 | N-1 | - | 69% | 10 | 102% | No constraint within +5 years | Constraint Suported by Generation AMP 4.2.2.4 |
| 26 | Blacks pad | 1 | - | N-1 Switched | 1 | - | - | - | Transformer | Constraint supported by Generation AMP 4.2.2.4 |
| 27 | Tahaenui | 1 | - | N-1 Switched | 1 | - | - | - | Transformer | Constraint Suported by adjacent Substations AMP 4.2.2.4 |
| 28 | Waihi | 5 | 7 | N | - | 74% | - | - | Transformer | Generation Infeed |

29 [1] *Extend forecast capacity table as necessary to disclose all capacity by each zone substation*

30 **12b(ii): Transformer Capacity**

| sch ref | | (MVA) |
|---|---|---|
| 32 | Distribution transformer capacity (EDB owned) | 215 |
| 33 | Distribution transformer capacity (Non-EDB owned) | 47 |
| 34 | **Total distribution transformer capacity** | 262 |
| 35 | | |
| 36 | **Zone substation transformer capacity** | 330 |

# A6. Schedule 12c Report on Forecast Network Demand

*Company Name* **Eastland Network Limited**

*AMP Planning Period* **1 April 2019 – 31 March 2029**

## 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 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** |
| 11 | *Consumer types defined by EDB** | | | | | | |
| 12 | Domestic | 19,356 | 19,394 | 19,432 | 19,470 | 19,510 | 19,900 |
| 13 | Non Domestic | 6,047 | 6,059 | 6,071 | 6,082 | 6,095 | 6,217 |
| 14 | Non Domestic Large | 45 | 45 | 45 | 45 | 45 | 45 |
| 15 | Non Domestic Industrial | 4 | 4 | 4 | 4 | 4 | 4 |
| 16 | [EDB consumer type] | | | | | | |
| 17 | **Connections total** | 25,452 | 25,502 | 25,552 | 25,601 | 25,654 | 26,167 |
| 18 | **include additional rows if needed* | | | | | | |
| 19 | **Distributed generation** | | | | | | |
| 20 | Number of connections | 227 | 477 | 727 | 927 | 1,127 | 1,352 |
| 21 | Installed connection capacity of distributed generation (MVA) | 15 | 16 | 16 | 16 | 16 | 16 |
| 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 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** |
| 25 | GXP demand | 55 | 57 | 59 | 61 | 62 | 63 |
| 26 | *plus* Distributed generation output at HV and above | 5 | 5 | 6 | 6 | 6 | 6 |
| 27 | **Maximum coincident system demand** | 60 | 62 | 65 | 67 | 68 | 69 |
| 28 | *less* Net transfers to (from) other EDBs at HV and above | | | | | | |
| 29 | **Demand on system for supply to consumers' connection points** | 60 | 62 | 65 | 67 | 68 | 69 |
| 30 | **Electricity volumes carried (GWh)** | | | | | | |
| 31 | Electricity supplied from GXPs | 293 | 294 | 295 | 296 | 298 | 300 |
| 32 | *less* Electricity exports to GXPs | - | - | - | - | | |
| 33 | *plus* Electricity supplied from distributed generation | 16 | 17 | 17 | 17 | 17 | 17 |
| 34 | *less* Net electricity supplied to (from) other EDBs | - | - | - | - | | |
| 35 | **Electricity entering system for supply to ICPs** | 310 | 311 | 312 | 313 | 314 | 317 |
| 36 | *less* Total energy delivered to ICPs | 280 | 281 | 282 | 283 | 284 | 285 |
| 37 | **Losses** | 30 | 30 | 30 | 30 | 30 | 32 |
| 38 | | | | | | | |
| 39 | **Load factor** | 58.92% | 57.19% | 54.71% | 53.24% | 52.78% | 52.41% |
| 40 | **Loss ratio** | 9.62% | 9.59% | 9.57% | 9.60% | 9.54% | 10.04% |

# A7. Schedule 12d Report on Forecast Interruptions and Duration

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 – 31 March 2029** |
| *Network / Sub-network Name* | **Total** |

## 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* |
|---|---|---|---|---|---|---|---|
| *8* | | | | | | | |
| *9* | for year ended | **31 Mar 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** |
| *10* | **SAIDI** | | | | | | |
| *11* | Class B (planned interruptions on the network) | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 |
| *12* | Class C (unplanned interruptions on the network) | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 | 232.0 |
| *13* | **SAIFI** | | | | | | |
| *14* | Class B (planned interruptions on the network) | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 |
| *15* | Class C (unplanned interruptions on the network) | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 – 31 March 2029** |
| *Network / Sub-network Name* | **Gisborne** |

## 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

| *sch ref* | | *Current Year CY* | *CY+1* | *CY+2* | *CY+3* | *CY+4* | *CY+5* |
|---|---|---|---|---|---|---|---|
| *8* | | | | | | | |
| *9* | for year ended | **31 Mar 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** |
| *10* | **SAIDI** | | | | | | |
| *11* | Class B (planned interruptions on the network) | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 |
| *12* | Class C (unplanned interruptions on the network) | 170.0 | 170.0 | 170.0 | 170.0 | 170.0 | 170.0 |
| *13* | **SAIFI** | | | | | | |
| *14* | Class B (planned interruptions on the network) | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 |
| *15* | Class C (unplanned interruptions on the network) | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 – 31 March 2029** |
| *Network / Sub-network Name* | **Wairoa** |

## 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

| *sch ref* | | *Current Year CY* | *CY+1* | *CY+2* | *CY+3* | *CY+4* | *CY+5* |
|---|---|---|---|---|---|---|---|
| *8* | | | | | | | |
| *9* | for year ended | **31 Mar 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** |
| *10* | **SAIDI** | | | | | | |
| *11* | Class B (planned interruptions on the network) | 28.0 | 28.0 | 28.0 | 28.0 | 28.0 | 28.0 |
| *12* | Class C (unplanned interruptions on the network) | 302.0 | 302.0 | 302.0 | 302.0 | 302.0 | 302.0 |
| *13* | **SAIFI** | | | | | | |
| *14* | Class B (planned interruptions on the network) | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| *15* | Class C (unplanned interruptions on the network) | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 |

# A8. Schedule 13 Report on Asset Management Maturity

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

**SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY**

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 3 | Asset management policy | To what extent has an asset management policy been documented, authorised and communicated? | 2 | AMP Section 8.4 Performance and Improvement, SMS 5.3, and Eastland Group Policies. | Asset Manager review. | Widely used AM practice standards require an organisation to document, authorise and communicate its asset management policy (eg, as required in PAS 55 para 4.2 i). A key pre-requisite of any robust policy is that the organisation's top management must be seen to endorse and fully support it. Also vital to the effective implementation of the policy, is to tell the appropriate people of its content and their obligations under it. Where an organisation outsources some of its asset-related activities, then these people and their organisations must equally be made aware of the policy's content. Also, there may be other stakeholders, such as regulatory authorities and shareholders who should be made aware of it. | Top management. The management team that has overall responsibility for asset management. | The organisation's asset management policy, its organisational strategic plan, documents indicating how the asset management policy was based upon the needs of the organisation and evidence of communication. |
| 10 | Asset management strategy | What has the organisation done to ensure that its asset management strategy is consistent with other appropriate organisational policies and strategies, and the needs of stakeholders? | 2 | Industry Participation EEA, IPENZ. Forum and Confrence attendance. Supplier relationships. Quality System procedures for Continuous Improvement, Review and Performance monitoring. SMS 5.3, Documented in Annual Amps , Key Strategic indicators and plans within Eastland Group Strategic Plan | Asset Manager review. | 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 | AMP Section 5 Lifecycle management, ENL4 Section 3 -7 and 8 describe activity elements for life cycle,SMS 5.3 | Asset Manager review. | Good asset stewardship is the hallmark of an organisation compliant with widely used AM standards. A key component of this is the need to take account of the lifecycle of the assets, asset types and asset systems. (For example, this requirement is recognised in 4.3.1 d) of PAS 55). This question explores what an organisation has done to take lifecycle into account in its asset management strategy. | Top management. People in the organisation with expert knowledge of the assets, asset types, asset systems and their associated life-cycles. The management team that has overall responsibility for asset management. Those responsible for developing and adopting methods and processes used in asset management | The organisation's documented asset management strategy and supporting working documents. |
| 26 | Asset management plan(s) | How does the organisation establish and document its asset management plan(s) across the life cycle activities of its assets and asset systems? | 2.5 | Maintenance, Condition assessment and performance records incorporated into plans. Annual AMP produced -Director sign off - External Review | Asset Manager review. | 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* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

## 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.<br><br>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.<br>OR<br>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.<br><br>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.<br>OR<br>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.<br><br>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.<br><br>The assessor is advised to note in the Evidence section why this is the case and the evidence seen. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

## 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? | 1.5 | Publicly Disclosed via web site, Sent to regulator annually, Submitted to board annually, Copy on front counter main office, Plans comunicated via standards, work programs and asset management activities, SMS 5.8 | Asset Manager review. | Plans will be ineffective unless they are communicated to all those, including contracted suppliers and those who undertake enabling function(s). The plan(s) need to be communicated in a way that is relevant to those who need to use them. | The management team with overall responsibility for the asset management system. Delivery functions and suppliers. | Distribution lists for plan(s). Documents derived from plan(s) which detail the receivers role in plan delivery. Evidence of communication. |
| 29 | Asset management plan(s) | How are designated responsibilities for delivery of asset plan actions documented? | 2.5 | Publicly Disclosed via web site, Sent to regulator annually, Submitted to board annually, Copy on front counter main office, Plans comunicated via standards, work programs and asset management activities,SMS 2.4 and 5.4 | Asset Manager review. | 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)?<br><br>(Note this is about resources and enabling support) | 2 | The quality system documents policies, processes, procedures and design standards to achieve the outcomes identified in the annual AMP, Asset and Financial performance indicators demonstrate compliance with efficiency targets over time | Asset Manager review. | 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 | AMP Section 6 Managing risk,ENL16 Emergency Prepardness, ENL2 Network control operational procedures, ENL10 Network safety management system, Civil Defence and Lifelines participation, External audit as part of safety management system Regulations. SMS 4.5. Regular participitation an actual events | Asset Manager review. | 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* | Eastland Network Limited |
| *AMP Planning Period* | 1 April 2019 - 31 March 2029 |
| *Asset Management Standard Applied* | PAS 55 |

**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).<br>OR<br>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.<br><br>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.<br><br>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)?<br><br>(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.<br><br>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.<br><br>The assessor is advised to note in the Evidence section why this is the case and the evidence seen. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

## 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 | AMP section 1.5, Roles and Responsibilities are incorporated into position descriptions and performance incentive plans. SMS 2.4 and 5.4 | Asset Manager review. | 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 | Annual Strategic and Business Planning considers Resourcing, Incident and event reviews provide a mechanism for identifying gaps. The AMP identifies shortfalls in resourcing. SMS 5.4 | Asset Manager review. | 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? | 2.5 | AMP section 1.5, Roles and Responsibilities are incorporated into position descriptions. Board reporting of key asset management indicators is undertaken.Internal and External Auditing programs SMS 5.4 | Asset Manager review. | 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? | 3 | Activities associated with asset information, planning, design undertaken inhouse, ENL4 Section 7 Outsourced contracting, consulting and review managed via contract documentation including scope and specification. Audit and review processes in place. | Asset Manager review. | 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. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

## 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.<br><br>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.<br><br>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.<br><br>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.<br><br>The assessor is advised to note in the Evidence section why this is the case and the evidence seen. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

## 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 | ENL1 Setcion 4 Compentency/Authorisation procedures in place . Scholarship programme in place , Induction procedures in place, SMS 5.2 and 5.7. | Asset Manager review. | There is a need for an organisation to demonstrate that it has considered what resources are required to develop and implement its asset management system. There is also a need for the organisation to demonstrate that it has assessed what development plan(s) are required to provide its human resources with the skills and competencies to develop and implement its asset management systems. The timescales over which the plan(s) are relevant should be commensurate with the planning horizons within the asset management strategy considers e.g. if the asset management strategy considers 5, 10 and 15 year time scales then the human resources development plan(s) should align with these. Resources include both 'in house' and external resources who undertake asset management activities. | Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers. | Evidence of analysis of future work load plan(s) in terms of human resources. Document(s) containing analysis of the organisation's own direct resources and contractors resource capability over suitable timescales. Evidence, such as minutes of meetings, that suitable management forums are monitoring human resource development plan(s). Training plan(s), personal development plan(s), contract and service level agreements. |
| 49 | Training, awareness and competence | How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies? | 2.5 | ENL1 Section 4 Individual Compentency assessment process with skills and training matrix. Job descriptions, Performance review process, Contractor Management and Auditing Process.SMS 5.7 | Asset Manager review. | 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 | ENL1 Section 4 Individual Compe | Asset Manager review. | 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. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

**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.<br><br>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.<br><br>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.<br><br>The assessor is advised to note in the Evidence section why this is the case and the evidence seen. |

| | |
|---|---|
| Company Name | Eastland Network Limited |
| AMP Planning Period | 1 April 2019 - 31 March 2029 |
| Asset Management Standard Applied | PAS 55 |

**SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)**

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 53 | Communication, participation and consultation | How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers? | 2.5 | Annual Reporting processes, Monthly Reporting Processes, Weekly Meeting process, Monthly Contractor Meeting Process. Processes for Datacapture and provision of asset information in place. Design and Maintenance Standards communicated via contracts., SMS 5.9 | Asset Manager review. | Widely used AM practice standards require that pertinent asset management information is effectively communicated to and from employees and other stakeholders including contracted service providers. Pertinent information refers to information required in order to effectively and efficiently comply with and deliver asset management strategy, plan(s) and objectives. This will include for example the communication of the asset management policy, asset performance information, and planning information as appropriate to contractors. | Top management and senior management representative(s), employee's representative(s), employee's trade union representative(s); contracted service provider management and employee representative(s); representative(s) from the organisation's Health, Safety and Environmental team. Key stakeholder representative(s). | Asset management policy statement prominently displayed on notice boards, intranet and internet; use of organisation's website for displaying asset performance data; evidence of formal briefings to employees, stakeholders and contracted service providers; evidence of inclusion of asset management issues in team meetings and contracted service provider contract meetings; newsletters, etc. |
| 59 | Asset Management System documentation | What documentation has the organisation established to describe the main elements of its asset management system and interactions between them? | 2 | AMP 1.6 Describes the processes and systems in place. Quality system documentation describes procedures for data capture and reporting. SMS 5.2 | Asset Manager review. | Widely used AM practice standards require an organisation maintain up to date documentation that ensures that its asset management systems (ie, the systems the organisation has in place to meet the standards) can be understood, communicated and operated. (eg, s 4.5 of PAS 55 requires the maintenance of up to date documentation of the asset management system requirements specified throughout s 4 of PAS 55). | The management team that has overall responsibility for asset management. Managers engaged in asset management activities. | The documented information describing the main elements of the asset management system (process(es)) and their interaction. |
| 62 | Information management | What has the organisation done to determine what its asset management information system(s) should contain in order to support its asset management system? | 2 | Regulatory requirements for Performance, Asset management, Public safety Management, Health and Safety and Design Paramaters mandate the requirements. Internal and External Reviews or Aduits identify data processes and review suitability/accuracy. Continuious improvement processes enable improvement over time. Strategic goals balance the information costs with derived benifits. | Asset Manager review. | 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.<br><br>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 | ENL7 Information Procedures, ENL 14 ENL maintenance Procedures, ENL8 Standard Forms, ENL's safety management system covers review of data and controls from design standards to defect reporting and corrective action consistent with Asset management requirements. The Quality | Asset Manager review. | The response to the questions is progressive. A higher scale cannot be awarded without achieving the requirements of the lower scale.<br><br>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. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

## 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.<br><br>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.<br><br>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.<br><br>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.<br><br>The assessor is advised to note in the Evidence section why this is the case and the evidence seen. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

**SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)**

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 64 | Information management | How has the organisation's ensured its asset management information system is relevant to its needs? | 2 | Procedures documented in Quality System. Internal Reviews and where appropriate, Internal/External Audits documented. SMS 4.6 | Asset Manager review. | 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? | 2.5 | Asset Risk assesment audited under regulation for public safety management system. SMS 4.0 | Asset Manager review. | 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? | 2 | AMP 6.0 Business Risk sumarised and Action plan prioritised by risk reduction outcomes.ENL10 Network safety Management system procedures. QM8 Emergency management documentation related to risk controls. ENL4 section 11 Emergency procedures. ENL4 section 13 Risk management assessments | Asset Manager review. | 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 | Legal Compliance procedures audited under regulation for public safety management system. SMS 4.6g | Asset Manager review. | 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 |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

**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.<br><br>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.<br><br>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.<br><br>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.<br><br>The assessor is advised to note in the Evidence section why this is the case and the evidence seen. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

**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 | AMP Section 5 Lifecycle management, ENL4 Section 3 -7 and 8 describe activity elements for life cycle. ENL9 contails design standards, Audited underregulation for safety management system. | Asset Manager review. | Life cycle activities are about the implementation of asset management plan(s) i.e. they are the "doing" phase. They need to be done effectively and well in order for asset management to have any practical meaning. As a consequence, widely used standards (eg, PAS 55 s 4.5.1) require organisations to have in place appropriate process(es) and procedure(s) for the implementation of asset management plan(s) and control of lifecycle activities. This question explores those aspects relevant to asset creation. | Asset managers, design staff, construction staff and project managers from other impacted areas of the business, e.g. Procurement | Documented process(es) and procedure(s) which are relevant to demonstrating the effective management and control of life cycle activities during asset creation, acquisition, enhancement including design, modification, procurement, construction and commissioning. |
| 91 | Life Cycle Activities | How does the organisation ensure that process(es) and/or procedure(s) for the implementation of asset management plan(s) and control of activities during maintenance (and inspection) of assets are sufficient to ensure activities are carried out under specified conditions, are consistent with asset management strategy and control cost, risk and performance? | 2.5 | AMP Section 5 Lifecycle management, ENL4 Section 3 -7 and 8 describe activity elements for life cycle. AMP section 3 Performance Monitoring, Audited under regulation for public safety management system. SMS 6.0 | Asset Manager review. | 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? | 1.5 | AMP Section 3 Performance, AMP Section 4 Development Plans. ENL7 Information Procedures. Amp Section 7 Financial Forcasts, AMP Section 8 Performance and Improvement SMS 2.11 and 6.0 | Asset Manager review. | Widely used AM standards require that organisations establish implement and maintain procedure(s) to monitor and measure the performance and/or condition of assets and asset systems. They further set out requirements in some detail for reactive and proactive monitoring, and leading/lagging performance indicators together with the monitoring or results to provide input to corrective actions and continual improvement. There is an expectation that performance and condition monitoring will provide input to improving asset management strategy, objectives and plan(s). | A broad cross-section of the people involved in the organisation's asset-related activities from data input to decision-makers, i.e. an end-to end assessment. This should include contactors and other relevant third parties as appropriate. | Functional policy and/or strategy documents for performance or condition monitoring and measurement. The organisation's performance monitoring frameworks, balanced scorecards etc. Evidence of the reviews of any appropriate performance indicators and the action lists resulting from these reviews. Reports and trend analysis using performance and condition information. Evidence of the use of performance and condition information shaping improvements and supporting asset management strategy, objectives and plan(s). |
| 99 | Investigation of asset-related failures, incidents and nonconformities | How does the organisation ensure responsibility and the authority for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances is clear, unambiguous, understood and communicated? | 2 | Incident Reporting, Real time monitoring, Investigation Procedures. Monthly Board Reporting. Audited under regulation for public safety management , SMS 5.10 | Asset Manager review. | 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. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

**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.<br><br>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.<br><br>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.<br><br>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.<br><br>The assessor is advised to note in the Evidence section why this is the case and the evidence seen. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

**SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)**

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 105 | Audit | What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))? | 2.5 | Procedures documented in Quality System. Internal Reviews and where appropriate, Internal/External Audits documented. | Asset Manager review. | This question seeks to explore what the organisation has done to comply with the standard practice AM audit requirements (eg, the associated requirements of PAS 55 s 4.6.4 and its linkages to s 4.7). | The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit teams, together with key staff responsible for asset management. For example, Asset Management Director, Engineering Director. People with responsibility for carrying out risk assessments | The organisation's asset-related audit procedure(s). The organisation's methodology(s) by which it determined the scope and frequency of the audits and the criteria by which it identified the appropriate audit personnel. Audit schedules, reports etc. Evidence of the procedure(s) by which the audit results are presented, together with any subsequent communications. The risk assessment schedule or risk registers. |
| 109 | Corrective & Preventative action | How does the organisation instigate appropriate corrective and/or preventive actions to eliminate or prevent the causes of identified poor performance and non conformance? | 2 | Procedures documented in Quality System. Internal Reviews and where appropriate, Internal/External Audits documented.SMS 5.10 | Asset Manager review. | 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? | 1.5 | AMP Section 8 Performance and Improvement, SMS 5.3 | Asset Manager review. | 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? | 2.5 | Industry Participation EEA, IPENZ. Forum and Confrence attendance. Supplier relationships. Quality System procedures for Continuous Improvement, Review and Performance monitoring. SMS 5.3 | Asset Manager review. | 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. |

| | |
|---|---|
| *Company Name* | **Eastland Network Limited** |
| *AMP Planning Period* | **1 April 2019 - 31 March 2029** |
| *Asset Management Standard Applied* | **PAS 55** |

**SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)**

| Question No. | Function | Question | Maturity Level 0 | Maturity Level 1 | Maturity Level 2 | Maturity Level 3 | Maturity Level 4 |
|---|---|---|---|---|---|---|---|
| 105 | Audit | What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))? | The organisation has not recognised the need to establish procedure(s) for the audit of its asset management system. | The organisation understands the need for audit procedure(s) and is determining the appropriate scope, frequency and methodology(s). | The organisation is establishing its audit procedure(s) but they do not yet cover all the appropriate asset-related activities. | The organisation can demonstrate that its audit procedure(s) cover all the appropriate asset-related activities and the associated reporting of audit results. Audits are to an appropriate level of detail and consistently managed. | The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard.<br><br>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.<br><br>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.<br><br>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.<br><br>The assessor is advised to note in the Evidence section why this is the case and the evidence seen. |

## A9. Schedule 14a Mandatory Explanatory Notes on Forecast Information

Company Name Eastland Network Limitedfor Year Ended April 2019 – 31 March 2029

This Schedule requires EDBs to provide explanatory notes to reports prepared in accordance with clause 2.6.6.
This Schedule is mandatory—EDBs must provide the explanatory comment specified below, in accordance with clause 2.7.2. This information is not part of the audited disclosure information, and so is not subject to the assurance requirements specified in section 2.8.
*Commentary on difference between nominal and constant price capital expenditure forecasts (Schedule 11a)*
In the box below, comment on the difference between nominal and constant price capital expenditure for the current disclosure year and 10 year planning period, as disclosed in Schedule 11a.

**Box 1: Commentary on difference between nominal and constant price capital expenditure forecasts**

The difference between nominal and constant price capital expenditure forecasts is due to the following CPI forecasts.
2019/20 0.0%
2020/21 2.0%
2021/22 2.0%
2023/24 – 2028/29 2.0%

*Commentary on difference between nominal and constant price operational expenditure forecasts (Schedule 11b)*
In the box below, comment on the difference between nominal and constant price operational expenditure for the current disclosure year and 10 year planning period, as disclosed in Schedule 11b.

**Box 2: Commentary on difference between nominal and constant price operational expenditure forecasts**
The difference between nominal and constant price operational expenditure forecasts is due to the following CPI forecasts.
2019/20 0.0%
2020/21 2.0%
2021/22 2.0%
2023/24 – 2028/29 2.0%

# A10. Director certification

## CERTIFICATE FOR YEAR-BEGINNING DISCLOSURES

### Asset Management Plan

Clause 2.9.1

We, Tony Gray and Kieran Devine, being directors of Eastland Network Limited certify that, having made all reasonable enquiry, to the best of our knowledge-

a) the following attached information of Eastland Network Limited prepared for the purposes of clause 2.6.1, 2.6.3, 2.6.6 and 2.7.2 of the Electricity Distribution Information Determination 2012 in all material respects complies with that determination.

b) The prospective financial or non-financial information included in the attached information has been measured on a basis consistent with regulatory requirements or recognised industry standards.

c) The forecasts in Schedules 11a, 11b, 12a, 12b, 12c and 12d are based on objective and reasonable assumptions which both align with Eastland Network Limited's corporate vision and strategy and are documented in retained records.

Dated this day of March 2019

MATANUKU KIHIRINI MAHUIKA

*Director Name*

*Director Signature*

KIERAN JOHN DEVINE

*Director Name*

*Director Signature*